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ATTITUDES AND BEHAVIOUR OF CONSUMERS TO MEAT

IN PALMERSTON NORTH, NEW ZEALAND

1979 - 1985

A thesis presented in partial fulfillment
of the requirements for the Degree of
Doctor of Philosophy in Product Development
at Massey University

Brian Herbert Patrick Wilkinson

1985

ABSTRACT

Consumer attitudes and behaviour towards meat products were studied as a basis for meat product development. Meat consumer studies have traditionally taken two distinctive approaches. Economists have tended to use demand analysis, concentrating on the effects of price, income, and family structure on the consumption of 'beef' or 'lamb' or other aggregated commodity. Market researchers have tended to concentrate on consumer requirements and attitudes, frequently ignoring price and income. The present study examined meat consumer behaviour from both perspectives and made a detailed study of some of the techniques using 15 meats and 41 meat cuts.

In consumer preferences, the use of a Semi-structured Linear Scale with the most-preferred and least-preferred meats anchored at either end of the scale and the remaining meats arranged along the scale at distances that reflected the consumers' preferences was equally effective at determining interval scale distances between meats as the traditional methods of measuring preferences, the Thurstone Case V Interval Scale. Also for Multidimensional Scaling, substitutability measurements were the most appropriate data measurements as the resulting solutions were stable, whilst the preference solutions tended to degenerate into unidimensional solutions. The study also showed that less predictable solutions resulted from MDS if substitutability measurements were made on meat cuts rather than at a species level. Fenker's and Krusdal et al.'s methods produced very similar ideal point solutions which were slightly different to solutions from a newly-developed method. The latter had the advantage of being able to identify the dimension most sensitive to changes in preference and to indicate whether an ideal point or vector model was the most appropriate method of determining new product opportunities in an MDS space.

Factor Analysis showed that it was possible to identify three main Factors underlying consumers' attitudes to meat in general. They included: a 'meat quality on buying' Factor; a 'meat quality on eating' Factor and a 'meat quality on cooking and serving' Factor. However, the study showed that the structure of the Factors changed depending on whether attitudes to meat in general, to specific cuts from each species

of meat, or individual cuts of meat were being examined. The use of Q-Factor Analysis to categorise meats on the basis of consumer attitudes showed that it was possible to categorise meats into 9 Hypothetical Product groupings based on the consumers' attitudes to the products. The groupings were shown to be based on the similarity of the attitude profiles of the cuts, cuts with similar profiles being grouped in the same Hypothetical Product.

Three quantitative regression models were developed for 41 meat cuts. The models showed that the situation was not quite as complex as other studies had indicated. Per capita consumption of meat was shown to depend on the price, preference and prestige ratings of a meat cut, i.e. a typical demand model. The model accounted for 61% of the variance in the dependent variable, substantially higher than other studies. Meat cut preference was shown to depend on the acceptability of the flavour, juiciness and presence of bone in the cut. The model typified a Fishbein/Rosenberg attitude model and accounted for 91% of the variance in the dependent variable.

The proportion of households buying model accounted for over 93% of the variance in the dependent variable and typified a demand model. All the predictor variables in the model were consumer attitudes. The model indicated that the proportion of households that would purchase a cut was dependent on the tenderness, value for money and perceived price of a cut.

The models indicated what had to be done to improve existing meat products and the areas that should be concentrated on for successful new meat product development.

ACKNOWLEDGEMENTS

The research contained in this thesis was supported by the financial assistance of the Massey University Food Technology Research Centre.

I should like to thank Dr. Mary Earle, who took over as main supervisor when Dr. Allan Anderson left Massey University, for creating the opportunity to start this thesis, and for her encouragement and support, and most of all for her patience and unselfish allocation of time, particularly during these latter stages of the thesis when she had so many other commitments.

I should also like to thank Dr. Allan Anderson for all the fruitful discussions at the conceptual stage of the research programme and his thoughts at critical times during the execution of the thesis, and also his continued support throughout the six very long years.

I would also like to express my appreciation to the many people who assisted in a variety of ways. In particular my thanks go to:

Mr. Chris Freyberg and the staff of the Computer Unit at Massey University for the computing facilities and programming advice;

The Library staff at Massey University for their willing assistance in locating and obtaining reference material;

Professor Richards and the Food Technology Department for the use of facilities and for their support throughout;

Mr. Bing Soo, for his help with the coding and part of the analysis of the 1985 survey results, and also to the people who helped decode the three very long 1979 questionnaires;

Mr. Robert Beausire, for the suggestions which were incorporated into the 1985 survey form;

Mrs. Elizabeth Baxter who typed this thesis so magnificently. Only she knows what a mammoth task it was. My sincere thanks for coping with such a large task at the eleventh hour.

A special vote of thanks must go to the 300 respondents who gave up so much of their time to complete the four very long questionnaires.

Finally to my wife Helen and two boys, Ben and Tim, who had to live with a very cranky lodger for this last year. Thank you for your patience and understanding.

Brian Wilkinson,
Palmerston North,
New Zealand.
September, 1985.

PREFACE

Food product development is the procedure by which raw materials are selected, combined and then processed to produce a product that is acceptable to the final consumer. Twenty-five to thirty years ago, the number of food products on the shelves of supermarkets and corner dairy stores was small in comparison to the huge array of products that are available today. Consequently, in the past, it was possible to use a less systematic approach to product development than is the case today when the failure of a new product to meet its intended objectives can spell ruin for some firms or at best a down-turn in company profits for one or two years. It was common to see firms relying on intuition and experience in their development of new products. However, in today's world, where the risks of failure can be extremely damaging to a firm, more systematic and quantitative techniques have to be used to ensure a higher probability of success than one in forty (Booz and Allen, 1984). The Booz and Allen report stressed the need for a systematic product development programme for a company. The steps outlined in the report included:

* Development of a company strategy for new product development;
* Systematic product idea generation;
* Quantitative screening of product ideas;
* Initial feasibility analysis of the project;
* Development of product concepts;
* Consumer evaluation of the product concepts;
* Systematic and quantitative product formulation procedures;
* Consumer testing of products through development phases;
* Feasibility analysis of product and assessment of probability of success;
* Market testing of product;
* Evaluation of economics before decision for launch.

A number of quantitative techniques have been developed to aid the researcher in the various areas outlined above; these include:

* Market and product gap analylsis using MDS to identify new product opportunities;

* Market evaluation based on Bayesian decision tree analysis or cost benefit analysis;
* Formulation based on linear and non-linear programming;
* Mixture designs and other experimental design techniques to aid with formulation and process design;
* Business analysis including market forecasts, market surveys and buyer simulation models.

The introduction of these techniques has been largely in a haphazard fashion. The Food Technology Department at Massey University has been carrying out a research programme with the specific aim of developing systematic and quantitative techniques for new food product design and development. The design of nutritional products for consumers in developing countries has been used as the basis for this programme. An overview of the programme is given by Edwardson, Anderson, Chittaporn, Ngaramsak and Earle (1985).

Edwardson provided an objective procedure for the selection of raw materials to be used in low cost nutritional products for the Philippines. The major problem encountered by Edwardson was the incompatibility of raw materials selected by linear programming based on nutritional criteria. It was only possible to produce an acceptable product from these raw materials through extensive processing and addition of flavouring ingredients.

Anderson (1975) complemented and extended Edwardson's work by devising a procedure whereby raw material selection was made on the basis of their predicted acceptability in Thai dishes. Anderson used similarity measurements which were then analysed by non-metric Multidimensional Scaling to derive the metric acceptability scale values for the 40 raw materials and the ideal point. These values were used to derive a linear function relating raw materials to food dish acceptability. This function was used in a linear programming model together with nutritional constraints to provide a systematic method of raw material selection for nutritious and acceptable Thai food dishes. The raw materials selected by the model showed a marked improvement over those chosen by the linear programme subject to only nutritional constraints. However, there were still problems with the selection of the raw materials as ingredients

for the new food products as the developed dishes did not have as high an acceptability rating as was expected from the model.

It was clear from Edwardson's and Anderson's work that further research was needed in the area of exactly defining the consumers' requirements for new food products and what raw materials they considered to be acceptable for inclusion in the new products, if the linear programming model was to be more effective in the development of acceptable new food products. Anderson had used an indirect method to obtain the acceptability ratings for the raw material ingredients rather than one of the traditional methods of ascertaining consumer requirements, such as the Semantic Differential. The question was then posed "Which of the two approaches, i.e. the indirect method of Anderson or the more traditional approach, is the most appropriate for the measurement of consumer requirements, given that the indirect methods can sometimes pick up important product attributes which may otherwise be missed by the traditional methods, particularly if the attributes happen to be symbolic or psychological?"

The object of this study was to compare the more traditional methods of obtaining consumer requirements and preferences, such as the Semantic Differential and the Thurstone Case V Interval preference scale, with the newer and less direct methods, such as non-metric Multidimensional Scaling and arrive at some conclusions regarding the advantages and disadvantages of the two approaches and also some recommendations as to the best approach for new product development studies if the linear programming model was to be more successful for the development of new products.

CONTENTS

Page

Abstract

Acknowledgements

Preface

1 CONSUMER RESEARCH AND MEAT PRODUCT DEVELOPMENT 1

1.1 Reasons for Product Development in the Meat Industry 2

1.1.1 Does the Product Life-Cycle Theory Apply to Meats? 3

1.1.2 Effect of Technology on the Meat Industry 6

1.1.3 Need for Growth in the Meat Industry 7

1.2 The Design of a Successful Product 10

1.3 The Consumer in Product Development 13

1.4 Consumer Attitudes towards Meats 14

1.5 The Consumer Surveys 15

1.5.1 Types of Meat 16

1.6 Aims of the Present Study 17

PART ONE CHANGES IN THE RETAILING AND CONSUMPTION OF MEAT 20

2 CHANGES IN MEAT RETAIL OUTLETS IN PALMERSTON NORTH 21

2.1 Introduction 21

2.2 Consumer Survey Method 22

2.2.1 First Consumer Survey, November 1979 22

2.2.2 Second Consumer Survey, January 1985 24

2.2.3 Method of Analysis 25

2.3 Changes in the Retail Outlets for Fresh Meat in Palmerston North from 1974 to 1985 25

2.4 Changes in the Retail Outlets for Processed Meats in Palmerston North from 1974 to 1985 27

2.5 The Effect of Socio-Economic Factors on the Choice of Retail Outlets for Buying Meats 30

2.6 Conclusions 31

3 THE CONSUMPTION OF DIFFERENT MEATS IN PALMERSTON NORTH 32

3.1 Meat Consumption in New Zealand from 1950 to 1979 32

CONTENTS (continued)

Page

3.2 The Consumer Surveys in Palmerston North 34
3.3 Per Capita Consumption of Meat in Palmerston North in 1979 35
3.4 Consumption of Beef Cuts in Palmerston North in 1979 40
3.5 Consumption of Sheep Meat Cuts in Palmerston North in 1979 42
3.6 Consumption of Pig Meat Cuts in Palmerston North in 1979 46
3.7 Consumption of Offal in Palmerston North in 1979 48
3.8 Consumption of Sausage Products in Palmerston North in 1979 50
3.9 Consumption of Chicken, Shellfish and Fish in Palmerston North in 1979 53
3.10 Discussion on Meat Consumption in Palmerston North in 1979 54
3.10.1 Proportion of Households Consuming Different Meats 54
3.10.2 Hierarchy of Meats in Palmerston North in 1979 56
3.11 Changes in Meat Consumption over the Period 1979-1985 as Observed by Respondents in Palmerston North 59
3.12 Comparison of Per Capita Consumption Levels for 1979-1985 61
3.13 Comparison of Hierarchical Ratings for Meat Cuts from 1979-1985 62
3.14 Discussion 65
3.15 Conclusions 68

PART TWO THE EFFECT OF SOCIO-ECONOMIC VARIABLES ON THE CONSUMPTION OF MEATS 70

4 THE INFLUENCE OF SOCIO-ECONOMIC VARIABLES ON THE CONSUMPTION OF MEAT IN PALMERSTON NORTH 71
4.1 Introduction 71
4.2 The Surveys 72
4.2.1 Determination of Per Capita per Annum Meat Consumption 73
4.2.2 The 1979 Survey Sample 74
4.2.3 The 1985 Survey Sample 76
4.2.4 Analysis Method 77

CONTENTS (continued)

Page

4.3 Effect of Household Composition on Meat Consumption in 1979 and 1985 Surveys 78
4.3.1 Total People in Household (1979 Survey) 78
4.3.2 Children under 2 (1979 Survey) 79
4.3.3 Families with Children between 2 and 10 (1979 Survey) 79
4.3.4 Households with Children over the Age of 10 (1979 Survey) 80
4.3.5 Summary of 1985 Findings on the Effect of Household Composition on Meat Consumption 81
4.4 Effect of Age of Respondent on Meat Consumption in 1979 and 1985 Surveys 82
4.4.1 Summary of 1985 Survey Findings on the Effect of Age of Respondent on Meat Consumption 84
4.5 Family Life Cycle as it Applies to Meat Consumption 84
4.6 Effect of Occupation and Income of the Principal Income Earner on Per Capita Consumption of Meat in 1979 and 1985 Surveys 86
4.7 Discussion 87
4.7.1 Criticism of the 1979 and 1985 Studies 89
4.7.2 Recommendations for Future Studies 90
4.8 Conclusions 90

5 PER CAPITA CONSUMPTION OF MEAT BY LOW, MEDIUM AND HIGH MEAT CONSUMERS IN 1979 IN PALMERSTON NORTH 92
5.1 Introduction 92
5.2 The Survey 93
5.2.1 Analytical Method 93
5.3 Meat Consumption Patterns of Low, Medium and High Meat Consumers in Palmerston North in 1979 94
5.4 Comparison of Per Capita Consumption of Meat by Low, Medium and High Consumers of Beef, Sheep Meat and Pig Meat 99
5.5 Discussion 101
5.6 Conclusions 102

CONTENTS (continued)

	Page
6 REASONS FOR CHANGES IN MEAT CONSUMPTION FROM 1979 TO 1985	103
6.1 Introduction	103
6.2 Survey	105
6.2.1 Analytical Method	105
6.3 Reasons for Decline in Per Capita Consumption of Meat	106
6.4 Changes in Food Consumption Pattern with Increasing Income	108
6.5 Changes in Food Consumption by Low, Medium and High Meat Consumers	109
6.6 Discussion	110
6.7 Conclusions	113
PART THREE A STUDY ON THE USE OF MULTIDIMENSIONAL SCALING ON CONSUMER ATTITUDES TO MEAT	115
7 A COMPARISON OF SCALING METHODS IN STUDYING CONSUMER MEAT PREFERENCES	116
7.1 Introduction	116
7.1.1 Thurstone's Law of Comparative Judgements	118
7.1.2 Semi-structured Linear Scale	120
7.1.3 Multidimensional Scaling	121
7.2 Research Procedure	125
7.2.1 The Sample	127
7.2.2 The Questionnaire	127
7.2.3 The Interviews	130
7.2.4 The Analysis	130
7.2.4.1 Thurstone Analysis	130
7.2.4.2 Semi-structured linear scale	131
7.2.4.3 Multidimensional scaling method	131
7.3 Comparison of Preference Testing Methods	134
7.3.1 Analysis of General Meat Preference Paired Comparison	134
7.3.2 Thurstone's General Method Data	139
7.3.3 Semi-structured Linear Preference Scale	144

CONTENTS (continued)

Page

7.3.4 Comparison of the Thurstone Case V, Thurstone General and Semi-structured Linear Scales 147
7.3.4.1 Derived ranks for the 15 meats 147
7.3.4.2 Comparison of scales 149
7.3.4.3 Discussion of comparison of scales 150
7.4 Multidimensional Scaling Analysis of Preference Data for 15 Meats 153
7.4.1 Matrices 153
7.4.2 MDS Spaces for Fifteen Meats 153
7.4.3 Effects of Re-arranging Matrices 159
7.4.4 Evidence for One Dimensional Solution 161
7.4.5 Re-analysis of 'Percentage Preference' Data Set 162
7.4.6 Recovery of Original Preference Rank Order - Comparison of Methods of Collecting Data 167
7.5 Cluster Analysis of Preference Proximity Data for 15 Meats 168
7.5.1 Summary of 15 Meat Preferences Analysis 169
7.6 Preference for 41 Cuts of Meat 169
7.7 MDS Analysis of Preference Data for 41 Meat Cuts 172
7.8 Conclusions 176
7.8.1 Techniques 176
7.8.2 Meats 178

8 SUBSTITUTABILITY OF MEATS AND MEAT CUTS 179
8.1 Introduction 180
8.1.1 Direct Data 180
8.1.2 Indirect Data 182
8.1.3 Summary 183
8.1.4 Cluster Analysis 184
8.2 Research Procedure 185
8.2.1 The Sample 185
8.2.2 The Questionnaire 186
8.2.3 The Interviews 187
8.2.4 The Analysis 187
8.3 Substitutability of the 15 Meats 188
8.4 41 Meat Cut Substitutability Analysis 191

CONTENTS (continued)

Page

8.5 Comparison of the Meat Cut Substitutabilities Configuration with the Meat Species Configuration 200
8.6 Substitutabilities Analysis of Cuts from Specific Species of Animals 202
8.6.1 Discussion 211
8.7 Cluster Analysis 214
8.8 Recommendations for Future Work 217
8.9 Conclusions 219

9 COMPARISON OF SIMILARITIES FROM PREFERENCE AND SUBSTITUTABILITY 222
9.1 Research Procedure 222
9.2 Preference Data for the 15 Meats 223
9.2.1 Similarities Derived from Thurstone Case V Data for the 15 Meats 223
9.2.2 Similarities of the 15 Meats Derived from the Thurstone General Data 226
9.2.3 Similarities of the 15 Meats Derived from the Semi-structured Linear Preference Scale 226
9.2.4 Comparison of the 3-dimensional Preference Similarity Configurations for the 15 Meats Obtained from Thurstone Case V, Thurstone's General Method and the Semi-structured Linear Scale Data 231
9.3 Comparison of the 3-dimensional Configuration of the 15 Meats Derived from Substitutability Measurements and Similarity Measurements based on Preference 233
9.4 Comparison of the Substitutability and Preference Similarity 3-dimensional Configurations for each of the Meat Cut Sub-groups 235
9.5 Discussion of Results 237
9.5.1 Similarity MDS Spaces Derived from Preference Measurements 237
9.5.2 Stability of Substitutability Measurements 238
9.5.3 Comparison of Preference Similarity MDS Solutions with the Substitutability MDS Solution for the 15 Meats 238

CONTENTS (continued)

Page

9.5.4 Comparison of Preference Similarity with Substitutability Solutions for Individual Meat Groupings 239
9.6 Conclusions 240

10 'IDEAL' MODELS TO IDENTIFY PRODUCT OPPORTUNITIES 241
10.1 Preference Models 241
10.1.1 Dominance Model 243
10.1.2 Non-compensatory Models 243
10.1.2.1 Lexicographic models 243
10.1.2.2 Conjunctive model 244
10.1.2.3 The Disjunctive model 244
10.1.3 Compensatory Models 244
10.1.3.1 The Vector model 244
10.1.3.2 Ideal Point model 246
10.1.3.3 Conjoint Measurement model or part-worth model 248
10.1.4 Comparison of Compensatory Models 248
10.1.5 Choice of Preference Models 249
10.2 Research Procedure 251
10.2.1 Fenker's Method of Locating the Population Ideal Point for the 15 Meats 251
10.2.2 Kruskal, Young & Seery's Method of Locating Ideal Points for Individual Respondent's for 15 Meats 253
10.2.3 Author's Method of Locating a Population Ideal Point for the 15 Meats 255
10.2.4 Axis Identification of the 15 Meat and 41 Meat Cut Substitutability Space 257
10.2.5 Axis Identification for the 41 Meat Cut Substitutability Space 257
10.3 Population Ideal Point Located by Fenker's Method in the 15 Meat 3-Dimensional Substitutabilities Space 258
10.4 Population Ideal Point Located by Fenker's Method in the 41 Meat Cut 3-dimensional Substitutabilities Space 262

CONTENTS (continued)

Page

10.5 Respondents' Ideals Located by Kruskal, Young & Seery's Method in the 15 Meat Substitutability Space 267
10.6 Respondents' Ideals Located by Kruskal, Young & Seery's Method in the 41 Meat Cut Substitutability Space 271
10.7 Population Ideal Point Located by Author's Method in the 3-Dimensional Substitutabilities Space 271
10.8 Population Ideal Point Located by Author's Method in the 41 Meat Cut Substitutabilities Space 278
10.9 Discussion 278
10.9.1 Comparison of the 3 Methods for Locating Ideals in the 15 Meat Substitutabilities Space 278
10.9.2 Comparison of the 3 Methods for Locating Ideals in the 41 Meat Cut Substitutabilities Space 283
10.10 Conclusions 285
10.10.1 Methods of Locating Ideals 285
10.10.2 New Meat Product Opportunities 285

PART FOUR: THE USE OF FACTOR ANALYSIS TO EVALUATE CONSUMERS' ATTITUDES TO MEATS 287

11 FACTOR ANALYSIS OF CONSUMER ATTITUDES TO SENSORY, COOKING AND OTHER CHARACTERISTICS OF MEAT IN GENERAL 289
11.1 Introduction 289
11.1.1 Scales for Attitude Measurement 290
11.1.2 Types of Meat Studied 292
11.1.3 Methods of Factor Analysis 293
11.1.4 Number of Factors Extracted 295
11.1.5 Rotation of Factors 296
11.1.6 Salient Loadings 298
11.2 Research Procedure 299
11.2.1 The Sample 299
11.2.2 Questionnaire Design 300
11.2.2.1 The meat characteristics 300
11.2.2.2 Types of meat 303

CONTENTS (continued)

Page

11.2.3 The Analysis 304
11.3 Results 306
11.3.1 Meat Attitude Scores for Different Meat Groups 306
11.3.2 Factor Analysis of Attitudes Towards Meat in General 308
11.3.2.1 Number of Varimax rotated principal factors 308
11.3.2.2 Confirmation of factors 311
11.3.3 Factor Analysis of Attitude Data for 7 Beef Cuts 312
11.3.3.1 Number of Varimax rotated principal factors 312
11.3.3.2 Confirmation of factors 314
11.3.4 Factor Analysis of Attitude Data for 12 Sheep Meat Cuts 316
11.3.4.1 Number of Varimax rotated principal factors 316
11.3.4.2 Confirmation of factors 317
11.3.5 Factor Analysis of Attitude Data for 8 Pig Meat Cuts 319
11.3.5.1 Number of Varimax rotated principal factors 319
11.3.5.2 Confirmation of factors 323
11.3.6 Factor Analysis of Attitude Data for Offal Cuts 323
11.3.6.1 Number of Varimax rotated principal factors 323
11.3.6.2 Confirmation of factors 325
11.4 Discussion of Results 326
11.4.1 Rotational Method 326
11.4.2 Saliency of Variable Loadings 328
11.4.3 Extraction of Factors 331
11.4.4 Comparison of Varimax Rotated Factors for Meat Groupings 333
11.5 Conclusions 337

CONTENTS (continued)

Page

12 FACTOR ANALYSIS OF CONSUMER ATTITUDES TO 45 MEAT CUTS 340
12.1 Introduction 340
12.2 Research Procedure 342
12.2.1 General Factor Analysis 342
12.2.2 Factor Analysis of Typical Products Using Q-Factor Analysis 344
12.3 Q-Factor Analysis of the 45 Meat Cuts on the Basis of 'Meat Buying' Attitudes 345
12.3.1 Q-Factor Analysis 345
12.3.2 Structure of Varimax Rotated 'Meat Buying' Factor of each of the 9 Meats Selected to Represent the 9 Hypothetical Products 347
12.3.3 Mean 'Meat Quality on Buying' Attitude Scores for the 9 Meats Representing the 9 Hypothetical Products 349
12.4 Q-Factor Analysis of the 45 Meat Cuts on the Basis of 'Meat Eating' Attitudes 352
12.4.1 Q-Factor Analysis 352
12.4.2 Structure of Varimax Rotated 'Meat Eating' Factor of each of the 9 Meats Selected to Represent the 9 Hypothetical Products 354
12.4.3 Mean 'Meat Quality on Eating' Attitude Scores for the 9 Meats Representing the 9 Hypothetical Products 356
12.5 Q-Factor Analysis of the 45 Meat Cuts on the Basis of 'Cooking and Serving' Attitudes 360
12.5.1 Q-Factor Analysis 360
12.5.2 Structure of Varimax Rotated 'Cooking and Serving' Factor of each of the 9 Meats Selected to Represent the 9 Hypothetical Products 363
12.5.3 Mean 'Meat Quality on Cooking and Serving' Attitude Scores for the 9 Meats Representing the 9 Hypothetical Products 365
12.5.4 Q-Factor Analysis of the 45 Meats on the Basis of the 18 Attitude Variables 368

CONTENTS (continued)

Page

12.6 Discussion of Results 371
12.6.1 Grouped Meats 371
12.6.1.1 Sheep meats 371
12.6.1.2 Sausage products 373
12.6.1.3 Offal products 375
12.6.1.4 Ham cuts 376
12.6.2 Wandering Products 376
12.6.2.1 Pig meats 376
12.6.2.2 The other meat products 379
12.6.3 General Considerations 380
12.7 Discussion on Q-Factor Analysis 381
12.8 Conclusions 382
12.8.1 Q-Factor Analysis 382
12.8.2 Meat Cuts 382

13 ATTITUDES TOWARDS MEAT CUTS OF LOW, MEDIUM AND HIGH MEAT CONSUMERS AND DIFFERENT SOCIO-ECONOMIC GROUPS 384
13.1 Introduction 384
13.2 Survey Procedure 386
13.2.1 Analytical Procedure 386
13.3 Results 387
13.3.1 High, Medium and Low Total Meat Consumers' Attitudes to 7 Beef Cuts 387
13.3.2 High, Medium and Low Total Meat Consumers' Attitudes to 4 Lamb Cuts 390
13.3.3 High, Medium and Low Total Meat Consumers' Attitudes to 4 Hogget Cuts 392
13.3.4 High, Medium and Low Total Meat Consumers' Attitudes to 4 Mutton Cuts 394
13.3.5 High, Medium and Low Total Meat Consumers' Attitudes to 4 Selected Pig Meat Products 394
13.3.6 High, Medium and Low Total Meat Consumers' Attitudes to fish, Shellfish and Chicken 398

CONTENTS (continued)

Page

13.3.7 High, Medium and Low Total Meat Consumers' Attitudes to Beef Tongue, Beef Tripe, Lambs' Kidney and Lambs' Liver 401
13.3.8 High, Medium and Low Total Meat Consumers' Attitudes to 4 Sausage Products 404
13.4 Beef, Sheep and Pig Meat Eating Attidues to All the 45 Meat Cuts 406
13.4.1 High, Medium and Low Beef Consumers' Attitudes to all the 45 Meat Cuts 406
13.4.2 High, Medium and Low Sheep Meat Consumers' Attitudes to all the 45 Meat Cuts 407
13.4.3 High, Medium and Low Pig Meat Consumers' Attitudes to all the 45 Meat Cuts 407
13.5 Attitudes to meat cuts of Socio-Economic Groups 407
13.5.1 Attitudes of High, Medium and Low Income Groups to all the 45 Meat Cuts 407
13.5.2 Attitudes of the Under-30's and Over-30's to all the 45 Meat Cuts 408
13.6 Discussion of Results 408
13.6.1 Indicator Group 410
13.6.2 Market Success of New Products 411
13.7 Conclusions 413

PART FIVE: 415

14 CONSUMER BEHAVIOUR MODELS FOR MEAT CONSUMPTION AND PREFEREMCE AND PROPORTION OF HOUSEHOLDS CONSUMING MEAT IN PALMERSTON NORTH 416
14.1 Consumer Demand Models 417
14.1.1 The Economic Demand Model 417
14.1.2 The product Characteristics Demand Model 418
14.1.3 Expectancy-Value Demand Models 419
14.1.4 Choice Alternative Model 420
14.2 Relevance of Consumer Behaviour Models to Meat Consumption 421

CONTENTS (continued)

Page

14.3 Selection of Procedure for Model Building in Present Study 422
14.3.1 Choice of Variables 422
14.3.2 Method of Modelling 423
14.4 Experimental Procedure 425
14.4.1 Data Used 425
14.4.2 Multiple Regression Method 425
14.4.3 Statistical Criteria for Selection of Variables to be Entered into the Regression Equation 426
14.5 Model to Predict Per Capita Consumption of the Meat Cuts 427
14.5.1 Model 427
14.5.2 Discussion 428
14.6 Model to Predict the Proportion of Households that will Consume Each Meat Cut 430
14.6.1 Model 430
14.6.2 Discussion 431
14.7 Model to Predict Consumers' Meat Cut Preferences in Palmerston North 432
14.7.1 Model 432
14.7.2 Discussion 434
14.8 Characterisation of the Three Dimensions Obtained from the MDS Analysis of the 41 Meat Cut Substitutability Space 436
14.8.1 Characterisation of Dimension 1 436
14.8.2 Characterisation of Dimension 2 437
14.8.3 Characterisation of Dimension 3 439
14.8.4 Discussion of Axis Identification 440
14.9 Discussion 442
14.9.1 The Importance of Price 442
14.9.2 The Importance of Prestige 444
14.9.3 The Importance of Flavour 445
14.9.4 The Importance of Juiciness 446
14.9.5 The Importance of Bone 446
14.9.6 The Importance of Tenderness 447
14.9.7 The Importance of Expense and Value for Money 447

CONTENTS (continued)

Page

14.10 Relevance of Models to High, Medium and Low Consumers of Meat 448
14.11 Meat Product Development 450
14.11.1 Improvement of an Existing Product 451
14.11.2 New Meat Product from Mutton 453
14.12 Conclusions 454
14.12.1 Techniques 454
14.12.2 Meat Product Concepts 456

15 THE STUDY IN PERSPECTIVE 458
15.1 Factors Affecting Consumption of Meat 458
15.1.1 Income 458
15.1.2 Age of Respondent 459
15.1.3 Household Composition 459
15.1.4 Price 461
15.1.5 Attitudes to Meat Cuts 461
15.1.6 Preference 462
15.1.7 Other Factors 462
15.2 Factors Affecting Meat Preferences 463
15.3 Factors Affecting the Number of Households that Would Consume Each Cut of Meat 464
15.4 Comparison of Methods to Measure Preference 464
15.5 Multidimensional Scaling 465
15.5.1 Preference Measurements 465
15.5.2 Substitutability (Similarity) Measurements 466
15.5.3 Ideal Point Methods 467
15.6 Factor Analysis 469
15.6.1 Q-Factor Analysis 470
15.7 The Models 471
15.8 Recommended Method for Conducting Future Meat Product Development Consumer Studies 473
15.9 Conclusions 476

Appendices 478
Bibliography 616

LIST OF TABLES

		Page
1.1	Comparison of Danish and New Zealand Export Meat Industries	8
2.1	Trends in Retail Outlet Patronage In Palmerston North for Fresh Meat, 1974-1985	26
2.2	Trends in Retail Outlet Patronage in Palmerston North for Processed Meats, 1974-1985	28
2.3	Trends in Retail Outlet Patronage in Palmerston North for Consumer Purchases of Ham, Bacon and Smallgoods in 1979	29
3.1	Consumption of Meats over the years 1950-1979 in New Zealand	33
3.2	Meat Consumption Per Capita Per Annum in Palmerston North in 1979	36
3.3	Consumption of Sausages in Palmerston North in 1979	37
3.4	Percentage of Respondents Eating Various Meats in Palmerston North in 1979	39
3.5	Consumption of Beef Cuts by the Whole Sample and those Actually Eating the Beef Cuts in Palmerston North in 1979	40
3.6	Percentage of Respondents Eating Beef Cuts in Palmerston North in 1979	42
3.7	Consumption of Sheep Meat Cuts by the Whole Sample and those Actually Eating the Cuts in Palmerston North in 1979	43
3.8	Percentage of Respondents Eating Sheep Meat Cuts in Palmerston North in 1979	45
3.9	Consumption of Pork Cuts by the Whole Sample and those Actually Eating Pork Cuts in Palmerston North in 1979	46
3.10	Percentage of Respondents Eating Pig Meat Cuts in Palmerston North in 1979	47
3.11	Consumption of Offal Products by the Whole Sample and those Actually Eating each Type of Offal in Palmerston North in 1979	49
3.12	Percentage of Respondents Eating Offal Products in Palmerston North in 1979	50

LIST OF TABLES (continued)

Page

3.13 Consumption of Sausage Products by the Whole Sample and those Actually Eating Sausage Products in Palmerston North in 1979 51
3.14 Percentage of Respondents Eating Sausage Products in Palmerston North in 1979 52
3.15 Consumption of Chicken, Shellfish and Fish by the Whole Sample and by those Actually Eating Chicken, Shellfish and Fish in Palmerston North in 1979 53
3.16 Percentage of Respondents Eating Chicken, Shellfish and Fish in Palmerston North in 1979 54
3.17 Percentage of Households Consuming Various Meat Cuts in 1974, 1977 and 1979 55
3.18 Hierarchy of Meats on Palmerston North in 1979 58
3.19 Degree of Change in Meat Consumption Level in Palmerston North over the Period 1979-1985 59
3.20 Percentage of Respondents in Palmerston North Changing their Meat Consumption Levels over the Period 1979-1985 60
3.21 Meat Consumption Per Annum in Palmerston North, 1979-1985 62
3.22 Comparison of Hierarchical Ratings for the Meat Cuts from the 1979-1985 Surveys in Palmerston North 63

4.1 Household Structure of Survey Sample (1979 Survey) 74
4.2 Household Structure of Survey Sample (1985 Survey) 76

5.1 Basis for the Assignment of the Respondents to Various Meat Consumption Groups 94
5.2 Socio-economic Characteristics and Meat Consumption Pattern of Low, Medium and High Meat Consumers 96
5.3 Comparison of Meat Consumption by Low, Medium and High Total Meat, Beef, Sheep Meat and Pig Meat Consumers (kg/capita/annum) 100

LIST OF TABLES (continued)

		Page
6.1	Per Capita Consumption of Red Meats (1978-1982)	104
6.2	Most Important Reason for Changes to Meat Consumption Levels over the Period 1979-1984	107
6.3	Food Consumption Changes by the Respondents Given Increased Disposable Income	109
7.1	Paired Comparison of Preferences - Percentages of Respondents	135
7.2	Paired Comparison of Preferences - Z Values - Thurstone Case V	137
7.3	Paired Comparison of Preferences - Thurstone General Method	141
7.4	Rank Order of Meats Derived from use of Mean and Modal Values of the Thurstone's General Data	143
7.5	Rank, Mean, Mode and Median of the 15 Meats Obtained from the Semi-structured Linear Scale	145
7.6	Rank Order of the 15 Meats Using Different Procedures	148
7.7	Comparison of Scale Values for Three Preference Methods	149
7.8	Adjusted Scale Values for Three Preference Methods	150
7.9	Comparison of Unidimensional Rank Orders of the 15 Meats with Thurstone Case V Interval Scale Rank Order	168
7.10	Consumer Preference Rankings for the 41 Meat Cuts	171
8.1	Some Direct Methods of Collecting Dissimilarities Data	181
9.1	Comparison of 3-Dimensional Configurations using Procrustes Analysis	232
9.2	Comparison of 3-Dimensional Substitutability, Similarity and Preference Dominance Configurations for the 15 Meats	234
9.3	Comparison of 3-Dimensional Substitutabilities and Preference Similarities Configurations by Procrustes Analysis	236

LIST OF TABLES (continued)

		Page
10.1	Scale Values for the 15 Meats and the Population Ideal in the 3-Dimensional Space - Fenker's Method (1972)	258
10.2	Scale Values for the 41 Meat Cuts and the Population Ideal in the 3-Dimensional Space - Fenker's Method	266
10.3	Scale Values for the 15 Meats and the Population Ideal in the 3-Dimensional Space - Author's Method	275
10.4	Scale Values for the 41 Meat Cuts and Population Ideal in the 3-Dimensional Space - Author's Method	279
11.1	Attitude Scales Used by McFadyen *et al*. (1973)	291
11.2	Attitude Scales Used by Baron *et al*. (1981)	292
11.3	Attitude Scales Used in Present Survey	302
11.4	Mean Attitude Scores for Different Meat Groups	306
11.5	Major Factors Defined for Meat in General	309
11.6	Comparison of Rotational Methods for Meat in General	311
11.7	Major Factors Defined for Beef Cuts	313
11.8	Comparison of Rotational Methods for Beef Cuts	315
11.9	Major Factors Defined for Sheep Meat Cuts	316
11.10	Comparison of Rotational Methods for Sheep Meat Cuts	318
11.11	Major Factors Defined for Pig Meat Cuts	320
11.12	Comparison of Rotational Methods for Pig Meat Cuts	322
11.13	Major Factors Defined for Offal Cuts	324
11.14	Comparison of Rotational Methods for Offal Cuts	326
11.15	Varimax Rotated Pattern Matrix of Attitude Data for for Meat in General	330
11.16	Number of Factors Extracted from Each Data Set and Total Variance Accounted for by the Factors	332
11.17	Comparison of Varimax Rotated Factors for Meat Groupings	334
12.1	Varimax Rotated Q-Factor Matrix of 'Meat Quality on Buying' Attitudes	346
12.2	Structure of Varimax Rotated Factor 1 ('Meat Quality on Buying' Attitudes) for the 9 Groupings Identified by Q-Factor Analysis	348

LIST OF TABLES (continued)

		Page
12.3	Varimax Rotated Q-Factor Matrix of 'Meat Quality on Eating' Attitudes	353
12.4	Structure of Varimax Rotated Factor 2 ('Meat Quality on Eating' Attitudes) for the 9 Groupings Identified by Q-Factor Analysis	355
12.5	Varimax Rotated Q-Factor Matrix of 'Meat Quality on Cooking and Serving' Attitudes	361
12.6	Structure of Varimax Rotated Factor 3 ('Meat Quality on Cooking and Serving' Attitudes) for the 9 Groupings Identified by Q-Factor Analysis	364
12.7	Varimax Rotated Q-Factor Matrix of Meats on all 18 Attitudes	369
12.8	Hypothetical Product Groupings Appearing in Successive Q-Factor Analyses of all 18 Attitudes, 'Meat Quality on Buying', 'Meat Quality on Eating' and 'Meat Quality on Cooking and Serving' Attitudes	372
12.9	Products Appearing in Different Hypothetical Product Groupings	377
13.1	Basis for the Assignment of Respondents to Various Meat Consumption Groups	386
13.2	Significantly Different Attitudes between Low, Medium and High Total Meat Consumers to 7 Beef Cuts	389
13.3	Significantly Different Attitudes between Low, Medium and High Total Meat Consumers to 4 Lamb Cuts	391
13.4	Significantly Different Attitudes between Low, Medium and High Total Meat Consumers to 4 Hogget Cuts	393
13.5	Significantly Different Attitudes between Low, Medium and High Total Meat Consumers to 4 Mutton Cuts	395
13.6	Significantly Different Attitudes between Low, Medium and High Total Meat Consumers to 4 Pig Meat Cuts	396
13.7	Significantly Different Attitudes between Low, Medium and High Total Meat Consumers to 3 White Meat Cuts	399
13.8	Significantly Different Attitudes between Low, Medium and High Total Meat Consumers to 4 Offal Cuts	403

LIST OF TABLES (continued)

		Page
13.9	Significantly Different Attitudes between Low, Medium and High Total Meat Consumers to 4 Sausage Products	405
14.1	Relationship between Consumption (kg/capita/annum) of the Various Meats and Preference, Price and Attitudes	428
14.2	Relationship between Proportion of Households Consuming Each Cut and Attitudes	431
14.3	Relationship between Consumers' Preferences for the Meat Cuts and Attitudes	434
14.4	Relationship between Dimension 1 and Attitudes	436
14.5	Relationship between Dimension 2 and Attitudes	438
14.6	Relationship between Dimension 3 and Per Capita Consumption of the Meats and Attitudes	440
14.7	Comparison between Selected Cuts on Variables Included in the Three Models	443
14.8	Predicted and Actual: Per Capita Consumption; Preferences; and Proportion of Households to Meat for the Whole Population, High, Medium and Low Consumers of Meat in Palmerston North in 1979	449

LIST OF FIGURES

		Page
1.1	Per Capita Consumption of the Different Meats in New Zealand over the Period 1950-1984	4
1.2	Per Capita Consumption of 4 Selected Sausage Products in Palmerston North over the Period 1966-1983	5
1.3	Suggested Activity Flow for Market Development	11
7.1	Control Statements for KYST	133
7.2	Preference Scale for the 15 Meats Obtained from the Thurstone Case V Interval Data	138
7.3	Preference Scale for the 15 Meats Obtained from the Thurstone General Data	140
7.4	Preference Scale for the 15 Meats Obtained from the Semi-structured Linear Scale data	146
7.5a	Comparison of the Stress versus Dimension Plots for the Thurstone Case V, Thurstone General and Semi-structured Linear Scale Dominance Data	155
7.5b	Shepard Plot for the Thurstone Case V Dominance Data	156
7.6	Comparison of the 2-Dimensional Configurations of the Thurstone Case V, Thurstone General and Semi-structured Linear Scale Dominance Data	157
7.7	2-Dimensional Configuration of the 15 Meats using the Thurstone Case V Percentage Data	158
7.8	2-Dimensional Configuration of the 15 Meats with Thurstone Case V Data Re-arranged in Order of Preference	160
7.9	Shepard Plot for the Percentage Data Re-analysed by Linear Regression MDS Function	163
7.10a	Stress versus Dimension Plot for the 15 Meat Percentage Difference Data	164
7.10b	Shepard Plot for the Percentage Difference Data	165
7.11	2-Dimensional Configuration of the 15 Meats Obtained from the Percentage Difference Data	166
7.12a	Stress versus Dimension Plot for the 41 Meat Cuts Preference Data	173
7.12b	Shepard Plot for the 41 Meat Cuts Preference Data	174

LIST OF FIGURES (continued)

Page

7.13 2-Dimensional Configuration of the 41 Meat Cuts using the Percentage Data 175

8.1a Stress versus Dimension Plot for the 15 Meats Substitutability Data 189

8.1b Shepard Plot for the 15 Meats Substitutabilities Data 190

8.2 a,b,c 3-Dimensional Configuration of the 15 Meats in the Substitutability Space 192

8.3a Stress versus Dimension Plot for the 41 Meat Cut Substitutability Space 195

8.3b Shepard Plot for the 41 Meat Cuts Substitutability Data 196

8.4 a,b,c 3-Dimensional Configuration of the 41 Meat Cuts in the Substitutability Space 197

8.5 2-Dimensional Comparison of the Positions Occupied by the Anchor Meats in the 15 Meats and 41 Meat Cuts Substitutabilities Spaces 201

8.6a Comparison of the 2-Dimensional Configurations of the Beef Cuts 204

8.6b Comparison of the 2-Dimensional Configurations of the Sheep Meat Cuts 205

8.6c Comparison of the 2-Dimensional Configurations of the Pig Meat Cuts 206

8.6d Comparison of the 2-Dimensional Configurations of the Sausage Products 207

8.6e Comparison of the 2-Dimensional Configurations of the Offal Cuts 208

8.6f Comparison of the 2-Dimensional Configurations of the Roasting Cuts 209

8.6g Comparison of the 2-Dimensional Configurations of the 11 Convenience Cuts 210

8.7 2-Dimensional Configuration of the New Zealand Inter-City Distances 213

8.8 Johnson's Single Linkage Hierarchical Clustering of the 41 Meat Cuts (Minimum) 215

LIST OF FIGURES (continued)

		Page
8.9	Johnson's Complete Linkage Hierarchical Clustering of the 41 Meat Cuts (Diameter)	216
9.1	Stress versus Dimension Plot for the Thurstone Case V Similarity Preference Data	224
9.2	2-Dimensional Configuration of the 15 Meats using the Thurstone Case V Similarity Preference Data	225
9.3	Stress versus Dimension Plot for the Thurstone General Similarity Preference Data	227
9.4	2-Dimensional Configuration of the 15 Meats using the Thurstone General Similarity Preference Data	228
9.5	Stress versus Dimension Plot for the Semi-structured Linear Scale Similarity Preference Data	229
9.6	2-Dimensional Configuration of the 15 Meats using the Semi-structured Linear Scale Similarity Preference Data	230
10.1	A Taxonomy of Preference Models	242
10.2	Illustration of the Vector Model in 2-Dimensional Space	245
10.3	Illustration of the Ideal Point Model in 2-Dimensional Space	247
10.4	KYST II Control Cards for the Ideal Point Location by Fenker's Method (1972)	252
10.5	KYST II Control Cards for the Ideal Points Location by Kruskal, Young & Seery's Method (1972)	254
10.6	KYST II Control Cards for the Ideal Point Location by the Author	256
10.7a,b,c	Ideal Point Located in the 15 Meats Substitutability Space by Fenker's Method	259
10.8a,b,c	Ideal Point Located in the 41 Meat Cuts Substitutability Space by Fenker's Method	263
10.9a,b.c	Ideal Points Located in the 15 Meats Substitutability Space by Kruskal *et al*.'s Method	268
10.10a,b,c	Ideal Points Located in the 41 Meat Cuts Substitutability Space by Kruskal *et al*.'s Method	270

LIST OF FIGURES (continued)

		Page
10.11	Ideal Point and Vector Located in the 15 Meats Substitutability Space by Author's Method	276
10.12	Ideal Point and Vector Located in the 41 Meat Cuts Substitutability Space by Author's Method	280
11.1	Example of the Semantic Differential Questionnaire Layout	305
11.2	Profile of the 5 Meat Groups on the 18 Attitudes	307
12.1	Profiles for 9 'Hypothetical Product' Representatives of the 'Meat Quality on Buying' Factor	350
12.2	Profiles for 3 Meat Cuts Representing 'Hypothetical Product 2' of the 'Meat Quality on Buying' Factor	351
12.3	Profiles for 9 'Hypothetical Product' Representatives of the 'Meat Quality on Eating' Factor	358
12.4	Profiles for 6 Meat Cuts Representing 'Hypothetical Product 6' on the 'Meat Quality on Buying' Factor	359
12.5	Profiles for 9 'Hypothetical Product' Representatives on the 'Meat Quality on Cooking and Serving' Factor	366
12.6	Profiles for 5 Meat Cuts Representing 'Hypothetical Product 6' on the 'Meat Quality on Cooking and Serving' Factor	367
12.7	Profile for Traditional and Continental Sausages on all 18 Attitudes	374
15.1	Recommended Procedure for New Meat Consumer Studies	475

APPENDICES

		Page
2.1a	1979 Survey Form	478
2.2a	1985 Survey Form	481
3.1	Per Capita Consumption of Meat in New Zealand	492
4.1	Breakdown of 1979 Survey Sample	493
4.2	Breakdown of 1985 Survey Sample	497
4.3	Meat Consumption Per Annum by Household Size	500
4.4	Meat Consumption of Families with Children under 2	501
4.5	Meat Consumption of Families with Children between 2-10 years of age	502
4.6	Meat Consumption of Households with Children over 10	503
4.7	Meat Consumption per annum by Age of Respondent	504
4.8	Meat Consumption per annum by Income of Principal Income Earner	505
4.9	Meat Consumption by Type of Employment of Principal Income Earner	506
5.1	Socio-economic Characteristics and Mean Consumption Pattern of Low, Medium and High Beef Consumers	507
5.2	Socio-economic Characteristics and Meat Consumption Pattern of Low, Medium and High Sheep Meat Consumers	509
5.3	Socio-economic Characteristics and Meat Consumption Pattern of Low, Medium and High Pig Meat Consumers	511
7.1	Kendall's Coefficient of Concordance (W)	513
7.2	Determination of Triads and Coefficient of Consistence	514
7.3a	Thurstone Case V (Modal Values)	518
7.3b	Thurstone Cae V (Mean Values)	519
7.4	Thurstone Case V Lower Half Dominance Matrix	520
7.5	Thurstone General Lower Half Dominance Matrix	521
7.6	Semi-structured Linear Scale Lower Half Dominance Matrix	522
7.7	Number of People in Each Cell as a Percentage of Total Number of Respodents	523
7.8	Percentage Difference Lower Half Matrix	524

APPENDICES (continued)

		Page
7.9	Matrix of Z Values for the 41 Meat Cuts	525
7.10	Lower Half Matrix of Preference Measurements for the 41 Meat Cuts	526
8.1	Substitutability of Meats Questionnaire	527
8.2	Scale Values for the 15 Meats 3-Dimensional Substitutability Space	544
8.3	Lower Half Matrix of Substitutability Measurements for the 41 Meat Cuts	545
8.4	Scale Values for the 41 Meat Cuts in the Meat Substitutability Space	546
8.5	Scale Values for the 8 Beef Cut 3-Dimensional Substitutability Space	547
8.6	Scale Values for the 8 Sheep Meat Cut 3-Dimensional Substitutability Space	549
8.7	Scale Values for the 8 Pork Cuts 3-Dimensional Substitutability Space	551
8.8	Scale Values for the 9 Sausage Products 3-Dimensional Substitutability Space	553
8.9	Scale Values for the 6 Offal Cuts 3-Dimensional Substitutability Space	555
8.10	Scale Values for the 11 Selected Convenience Cuts of Meat 3-Dimensional Substitutability Space	557
8.11	Scale Values for the 10 Roasting Cuts of Meat 3-Dimensional Substitutability Space	559
9.1	Scale Values for the 15 Meats Thurstone Case V Preference Similarity Space	561
11.1	Significance Levels for Pearson Product-moment Correlation Coefficients	562
11.2	Significance Levels for Burt Bank's Formula with n=50 and n=100	563

APPENDICES (continued)

		Page
11.3	Rotated Factor Pattern Matrices of Attitudes Data for All Meats	564
11.4	Rotated Factor Pattern Matrices of Attitude Data for 7 Beef Cuts	565
11.5	Rotated Factor Pattern Matrices of Attitude Data for 12 Sheep Meat Cuts	566
11.6	Rotated Factor Pattern Matrices of Attitude Data for 8 Pig Meat Cuts	567
11.7	Rotated Factor Pattern Matrices of Attitude Data for 5 Offal Cuts	568
12.1	Mean 'Meat Quality on Buying' Attitude Scores for 9 'Hypothetical Product' Representatives	569
12.2	Mean 'Meat Quality on Eating' Attitude Scores for 9 'Hypothetical Product' Representatives	570
12.3	Mean 'Meat Quality on Cooking and Serving' Attitude Scores for 9 'Hypothetical Product' Representatives	571
13.1	Attitudes of Low, Medium and High Meat Consumers to 7 Beef Cuts	572
13.2	Attitudes of High, Medium and Low Total Meat Consumers to 4 Lamb Cuts	573
13.3	Attitudes of High, Medium and Low Total Meat Consumers to 4 Hogget Cuts	574
13.4	Attitudes of High, Medium and Low Total Meat Consumers to 4 Mutton Cuts	575
13.5	Attitudes of High, Medium and Low Total Meat Consumers to 4 Pig Meat Cuts	576
13.6	Attitudes of High, Medium and Low Total Meat Consumers to Fish, Shellfish and Chicken	577
13.7	Attitudes of High, Medium and Low Total Meat Consumers to 4 Offal Cuts	579
13.8	Attitudes of High, Medium and Low Total Meat Consumers to 4 Sausage Products	580

CHAPTER 1

CONSUMER RESEARCH AND MEAT PRODUCT DEVELOPMENT

For a product to be successful, it requires to be:

Salient to people's needs and desires. The product must be relevant to both the functional and the non-functional requirements of the consumer.

A unique blend of appeals. It is this unique blend of appeals that enables the consumer to identify with the product so that the product takes on a personality with the aid of suitable promotion.

The new product may appeal to a specific sense, such as smell, touch, taste or sight, or it can and is more likely to appeal to a combination of senses. This combination of senses to which the product is to appeal must be experimentally determined for the effective development of the product.

The product should also have a reason for existing, i.e. it must appeal because of what it contains or what it does. For instance, a food product could appeal because of its convenience, quality of ingredients, protein content, functionality, suitability for a specific age group or because of its low calorie content.

Finally, the product must appeal through the emotions. This type of appeal can make up a very large part of the personality of the product. It results from the nature of the associations which people have about the product. For instance, the emotional characteristics of a piece of steak can be changed by the way it is cooked. By barbecuing the steak, the prestige rating, to name one variable that is affected, is heightened compared to stewed steak.

Therefore consumer research is fundamental to any product development, including the development of new meat products.

As the red meat industry has been perhaps the slowest industry to become involved in continuous product development, there is a lack of knowledge of consumer attitudes towards meat products. There is little reported information on the use of the consumer in developing new meat products. The questions often asked are: "Is there a need for product development

in the red meat industry? Is there a need for knowledge of consumer attitudes and behaviour towards meat products?"

1.1 REASONS FOR PRODUCT DEVELOPMENT IN THE MEAT INDUSTRY

King, (1973), advanced three justifications for the development of new products: the product life cycle; the demands of technological change; and the need for the company to grow.

According to the product life cycle theory, every product's life is in four main stages - introduction, growth, maturity and decline (Levitt, 1965). Whilst the theory provides an adequate description of what happens to sales of a product over its entire life and therefore essentially illustrates the changes in consumer demand for the product over the period, it does not show the causes responsible for these changes in consumer demand. Gibson (1983) cites a number of factors that are responsible for the slow acceptance of new foods: "ethnicity, regionality, religion, habit and custom". All act in the same direction, reinforcing each other to prevent the adoption of new food products. There are also a number of other factors such as education, wealth, importance of time, environment, technology, experience and safety that can operate in a manner that either counteracts or reinforces the cultural factors mentioned above. The life of a product is dependent on the complex interaction of all these variables over time. Products that become deeply rooted in the ethnicity, regionality, religion, habits and customs of a society tend to have much longer lives than those products that fail to become established in society.

King's (1973) second reason for the development of new products is related to the demands of technological change. The basic aim of food technology is to make raw materials, either in the raw state or in the final product, readily available at all times of the year at a quality that is comparable to either the freshly-harvested produce or freshly-prepared product. As technologists approach their objectives, so the number of products available in a market at any time of the year increases, i.e. the number of choices available to the consumer increases which in turn causes diversity and change from the previous pattern of food consumption. Also development in any area of technology results in

the demise of those products produced by the older technology, assuming that the new technology results in products that are clearly discernible by the consumer to be superior to similar products produced by the older technology. Technological evolution demands that a company boards the technology treadmill where success is judged by the company's ability to at least maintain or better still beat the technical ability of competing firms, while still maintaining product price at levels at which consumers will purchase the product and result in an acceptable profit to the company.

The third reason, the need for the company to grow, is, for many companies, the only really valid one. Despite the costs, problems and risks, they need new products to grow at the rate they have set for themselves. It is immaterial how these products are developed. They can be achieved by development within the company or purchase of the technology from some other company or by a number of other ways - the aim is the same, company growth.

The question is - do these reasons also indicate a need for product development in the red meat industry?

1.1.1 Does the Product Life Cycle Theory Apply to Meats?

An examination of per capita/annum meat consumption in New Zealand over the period 1950-1983 indicates trends in consumption that appear to follow the product life cycle (Figure 1.1).

The trends for mutton and lamb in particular follow the classical product life cycle, whilst the trends for beef and pig meats are not quite so well defined. Per capita mutton consumption over the period 1950-1983 fluctuated between 30-37 kg in the years 1950-1973, but has since shown a very rapid decline to 20 kg per annum by 1980. Per capita consumption of lamb on the other hand showed a steady increase in growth over the period 1950-1980 but a fall from 1980-1984 from 11 kg to 9 kg. Per capita consumption of beef appeared to be at the growth stage over the period 1950-1980 but has since shown a slight decline, whilst pork appeared to be in the stationary maturity stage and possibly just entering the decline phase in 1980, but product development and intensive promotion since then have reversed the trend.

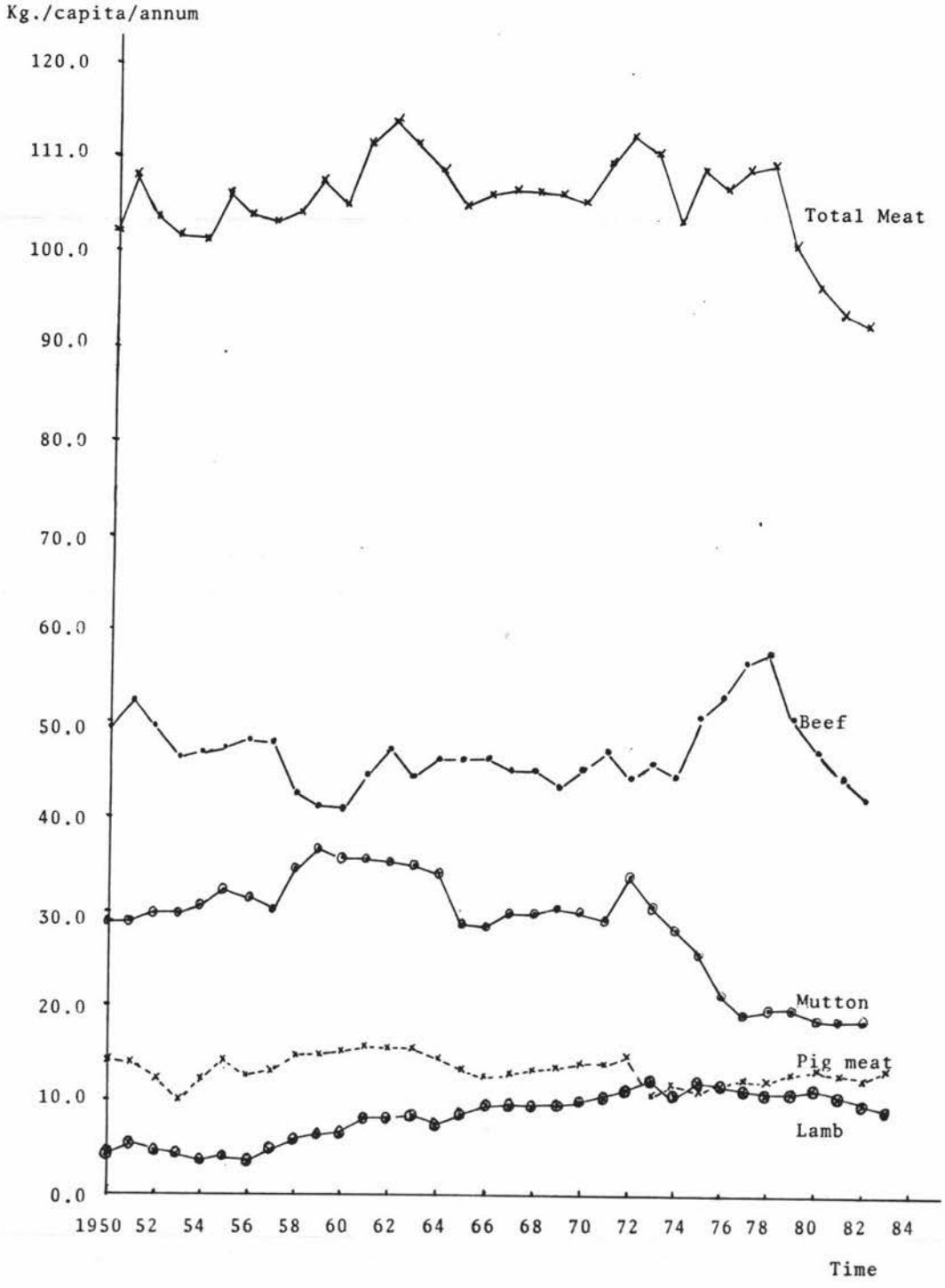

Fig. 1.1 Per Capita Consumption of the Different Meats in New Zealand over the period 1950-1984.

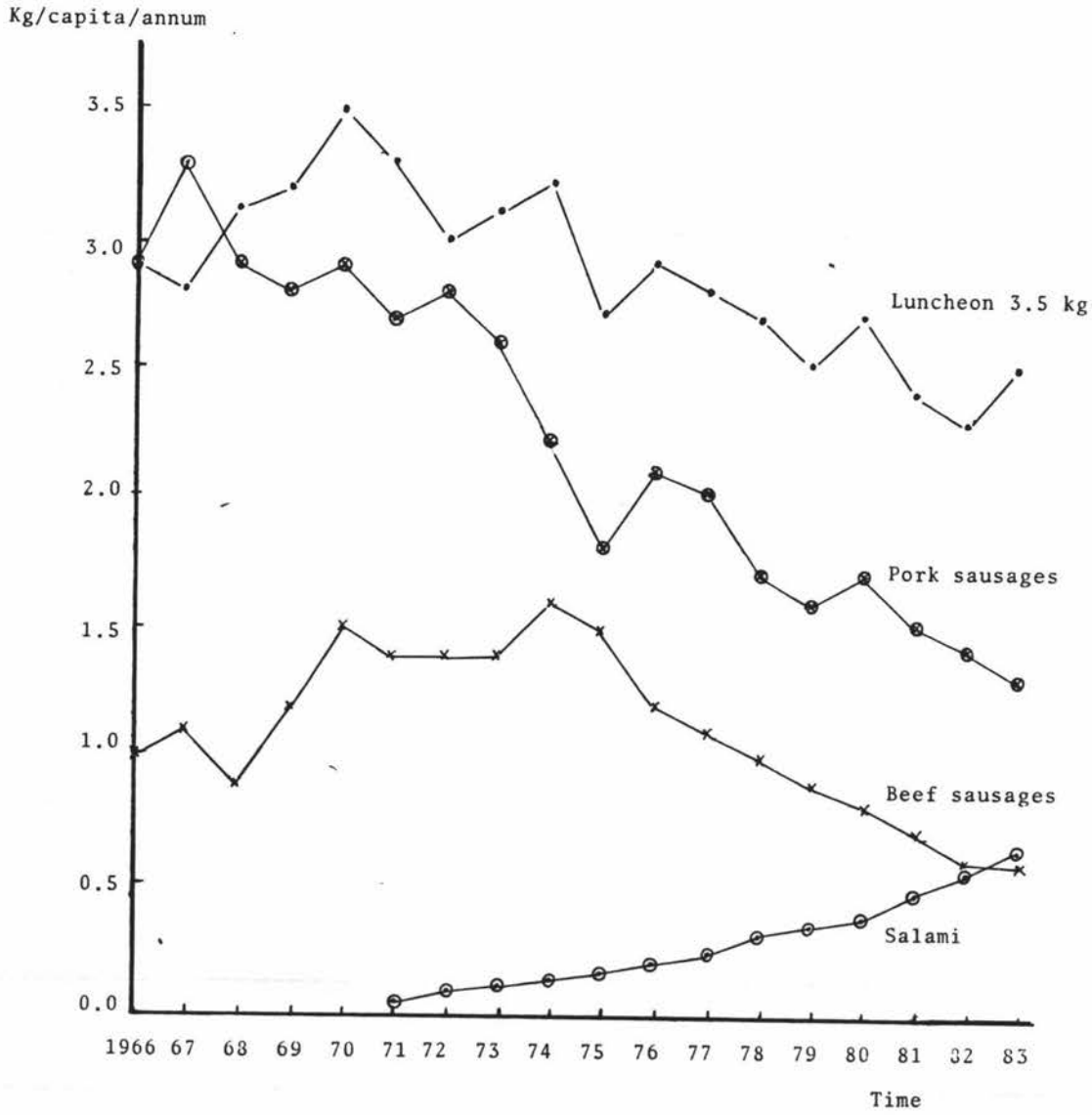

Fig. 1.2 Per Capita Consumption of 4 Selcted Sausage Products in Palmerston North over period 1966-1983

The product life cycle trend is more evident when individual meat cuts are examined. Brodie (1977) concluded from a meat survey in Christchurch, conducted 12 years after a similar survey by Yandle (1965) that there had been a marked swing to grilling steak, casserole steak, lamb, pork and mutton chops, and pork roasts in the period 1965-1977. The sales' histories of a few selected processed meat items clearly illustrate that the product life cycle concept holds for processed meat products in New Zealand (Figure 1.2).

1.1.2 Effect of Technology on the Meat Industry

The greatest impact of technology has been in the chicken industry, where production, processing and product presentation have all changed to produce a consistent, "consumer ready" product.

The New Zealand export red meat industry traditionally supplied overseas markets with frozen carcase meat. The last decade has seen a gradual shift to frozen cuts and the country now exports 25% of its lamb in cut form and 90% of its beef as boneless beef. There are problems with frozen meat in terms of consumer acceptance, colour and drip when compared with fresh meat. The Meat Industry Research Institute of New Zealand has long been involved in technological developments to improve the tenderness of the frozen meat exported from New Zealand so that it will compete more effectively with the fresh meat that is available on these export markets. Now they are studying colour and flavour changes of frozen meat during storage so that the eating quality of frozen meat can be further improved. The technology to export chilled meat is being developed because of the problems associated with frozen meat in the more lucrative markets such as the U.S.A. and Europe.

As a result of escalating labour costs, the Meat Industry Research Institute of New Zealand, in collaboration with the D.S.I.R. and the New Zealand meat companies, has developed an automatic pelting machine and this development together with developments overseas would appear to herald the dawn of the automated slaughtering plant. The carcase from such a plant is more tender because of electrical stimulation on the chain. So changes in technology are occurring in the slaughtering and cutting procedures but only starting in processing of mutton, lamb and beef in New Zealand for export. The Mathew's lamb roast, (a boneless,

rolled, roast) hopefully represents the start of many processed products based on lamb, mutton, beef, venison and other red meats.

The processed meat industry producing bacon and smallgoods for the local market has undergone significant technological changes with the introduction of new curing procedures - tumbling and massaging, and of fermented meat products technology. This has led to different types of bacon, ham and fermented sausages such as salami.

Technological developments are being forced on the New Zealand meat industry by market forces, changing consumer requirements, hygiene requirements, research findings, labour requirements and costs and these same forces will continue to generate technological change in the meat industry far into the next decade.

1.1.3 Need for Growth in the Meat Industry

The meat industry is New Zealand's largest single export earner. Meat accounted for 27% of the country's exports, with by-products increasing this to approximately 40%. However, the volume of meat exported from this country has shown little growth and the income in 1985 dollars has remained static over the five-year period 1978-1983 (Agricultural Economist, 1973).

How, then, is the meat industry in New Zealand to grow? One way is to increase total production and thereby net receipts. The like-lihood of any major increase in production in the next five years is very small in view of the competition for land, capital and other resources that the meat farmers are currently experiencing from new agriculture ventures such as horticulture. The Waikato and Bay of Plenty have seen the greatest shift from meat farming to horticulture, though most provinces have witnessed some shift in the agricultural pattern. The elimination of the supplementary minimum prices scheme for meat and wool farmers is also likely to have a major impact on the future agricultural pattern in New Zealand.

The Danish meat industry, which is about the same size as the New Zealand meat industry in terms of tonnes of meat exported, would appear to provide the direction in which the New Zealand meat industry ought to be pointed. In 1976 the Danish meat industry exported 652,000 tonnes of

product and earned US$1.29 billion. The Danish meat industry had an earnings return of $1.98/kg compared with US$0.96 for the New Zealand meat industry. The relevant earnings and quantities of meat exported by each country are presented in Table 1.1

Table 1.1. Comparison of Danish and New Zealand Meat Exporting Industries.

	Danish Meat Export Industry			New Zealand Meat Export Industry		
Year	Tonnes of meat/annum	Income US$/annum	FOB Price US$/kg	Tonnes of meat/annum	Income US$/annum	FOB Price US$/kg
1975	708,885	1,371,846	1.94	637,319	551,667	0.87
1976	651,979	1,288,361	1.98	690,300	664,975	0.96
1977	717,055	1,398,615	1.95	707,718	756,333	1.07
1978	757,104	1,761,355	2.33	720,964	964,720	1.34
1979	841,391	2,141,133	2.54	721,566	1,153,511	1.59
1980	845,104	2,298,350	2.70	723,566	1,290,383	1.78
1981	914,154	2,296,636	2.51	773,033	1.331,920	1.72
1982	918,926	2,186,069	2.38	732,787	1,229,589	1.68

Note: The weight of processed meat exported by the Danish Meat Industry dropped by 10% over the period 1975-1982 from 53.5% in 1975 to 43.3% in 1982.

Source: United Nations' Yearbook of International Trade Statistics, Volume 1, Trade by Country, 1978, 1979, 1980, 1981, 1982.

The difference between the two countries is essentially one of product range. The Danish meat industry is based on beef and pig meat; it exports chilled and frozen carcases and cuts, and also a wide range of canned goods, prepared meals, bacon, ham and continental smallgoods for export. In contrast, New Zealand exports frozen lamb and mutton carcases and cuts, a limited amount of chilled beef and lamb, most of the beef in frozen boneless form to be used by companies in the export markets for inclusion in processed meat products, and negligible quantities of processed meats. The discrepancy in earnings per tonne of

meat exported between the two countries would tend to indicate that the New Zealand meat industry could make substantial increases in earnings by producing a range of processed meat products to augment the sales of frozen and chilled carcases and cuts of meat which are currently exported, i.e. to process in New Zealand a large proportion of the meat that is currently exported for inclusion in processed meat products in overseas markets. The development of new processed meat products would appear to hold the key to the growth of the New Zealand meat industry in the next decade. An examination of the Danish meat export receipts shows that the earnings per kilogram of meat actually declined from a high of US$2.70 per kilogram in 1980 to US$2.38 in 1982. Most of the 10% decline in exports of processed meat products occurred during these three years - once again there would appear to be a message in these results for the New Zealand meat industry, namely the need to export processed meat products which could possibly be as much as 50% of all meat exports.

One can conclude that there is a need for meat product development for both the local and the export meat industries. However, before there is a great rush to develop products for the export market, developers should initially concentrate on the local market since there has been a per capita decline in red meat consumption here in New Zealand, particularly of the sheep meats. Confining the initial development to the local market would ensure that companies refine their new products to the stage that all the problems of production and marketing have been eliminated thus ensuring a greater chance of success for the new products on export markets.

The arguments for new products in the meat industry are: the export meat industry needs new products, particularly sheep meat-based products, to provide product diversification opportunities to eliminate existing problems with the export of carcase meats. Technological improvements have occurred which make new products possible. Trends in the overseas marketing of meat require a new meat product response from the New Zealand meat industry if it is to maintain its share of overseas meat markets. Finally, and most importantly, the declining trend in meat consumption in New Zealand and its major overseas markets needs to be reversed simply to restore profitability and growth to the red meat

industry. New meat product development offers one method to reverse the trend by appealing to consumers' needs for greater product variety.

1.2 THE DESIGN OF A SUCCESSFUL PRODUCT

In the design of any new product, the first problem to overcome is the selection of the product area, and the second problem is the generation of product ideas that are salient to a sufficiently large market segment and which have a unique blend of appeals to make the products distinctive. The question of relevance to the consumers' needs is most important and extensive consumer research has to be undertaken to establish these consumer requirements before the idea generation stage. How these consumer requirements are translated into products depends on company policy, the availability of skilled personnel and market opportunities. It is the interaction of these last three elements which results in the different products on the market which supposedly meet the same consumer requirements.

Four main stages can be isolated in the development of any new products, including meat products (Duncan, 1981). These four stages represent a gradual refinement of ideas to the point where the product becomes a reality, and a gradual move from uncertainty towards a reasonable predictability (Figure 1.3). Each stage represents an increasing degree of commitment by management to the product in terms of company resources.

The long-term company objectives broadly define the product areas and markets to which the products are to be aimed. Desk research is then used to look at existing technology and trends in technology, market trends, market sizes for existing products in the product area, their prices and relevant characteristics, consumer socio-economic characteristics, attitudes to existing products in the product area and aspirations for products in the area. Where the information is not available in either the company records or the literature, then the necessary research work is undertaken to obtain the information. The objective at this stage is to identify market opportunities that could be profitably explored by the company.

Fig. 1.3 Suggested Activity Flow For Market Development.

IDEA

Production related
- Use of new technology
- New use for certain raw materials and equipment

Market related
- Generated by market research

GENERAL DESCRIPTION OF PRODUCT & MARKET

Predevelopment
- Establish purpose for developing idea

INFORMATION ANALYSIS OF MARKET & COMPANY

Market trends for related products
- Growth in units over past years
- Growth in monetary value over past years
- Breakdown of sales by season
- Breakdown of sales by region
- Forecast on future market growth
- Analysis of existing market surveys

Analysis of product position
- Competition
- Comparison of user needs and existing product suitability
- Nature of competition with proposed idea, competitor reaction
- Strength of competitor assessed

Import regulations
- Tariff and non tariff barriers
- Labelling requirements
- Clearance documents
- Veterinary requirements
- Special requirements

Economic constraints
- Capital expenditure
- Return on investment

Company analysis
- Ability of company organization to develop idea
- Company policy
- Company constraints and limitations

PROPOSED PRODUCT CONCEPT

Understanding of product form, and market to which it is to be aimed.

POLICY DECISION TO
- CONTINUE
- MODIFY
- TERMINATE VENTURE

ESTABLISH CONTACT IN MARKET PLACE

Define requirements for selection of contact in market place
- Suitability of proposed product contact

Discuss concept with contact in market
- Determine their reaction

Assessment of distribution requirements
- What facilities are available

Assessment of ability of contact to market specific product

DEVELOP PROTOTYPE PRODUCT

Lab scale product 'mock-up'
- Application of physical form of product

EVALUATION

Contacts' reaction to prototype product
- understanding of requirements of reseller through to consumer
- physical and organoleptic acceptability
- suitability of product in selected market environment

Realization of difficulties
- Early modifications

TRIAL PROJECT COSTINGS

Assessment of
- production costs
- marketing costs
- company overheads

EVALUATION OF ECONOMIC VIABILITY

expected sales and profits
- flexibility in product pricing in relation to market outlet
- break even point

POLICY DECISION TO
- CONTINUE
- MODIFY
- TERMINATE VENTURE

ASSESSMENT OF CONSUMER BENEFIT

Attributes that will be of importance to the consumer
- Ways to induce product purchase and re-use
- Means by which company plans to provide this

ASSESSMENT OF MARKET SEGMENT

Attitudes of the consumer in the selected market segment
- statistics relating to their purchasing patterns

Understanding by the contact of the consumer attitudes

Development by company of a better appreciation of marketing environment

SETTING OF OBJECTIVES

Company
- short and long term policies

Financial
- sales
- market share
- return on investment

Marketing
- new product/new market
- new product/existing market
- existing product/new market
- increase market share in existing market

PRODUCT CONCEPTS FINALISED

Screening of all the previous assessed variables

PROGRAMME PLANNING

Setting of stages and scheduling of activities
- construction of flow diagrams such as job progress bar charts

Allocation of responsibilities, and authority

PILOT SCALE DEVELOPMENT OF PRODUCT

Formulation
- process development
- product cost
- organoleptic evaluation
- packaging devlopment

Equipment
- layout, plant design and alternatives

Quality assurance specifications
- product specification
- raw material specification and control
- process control
- final product inspection

Setting of product and process specifications

DEVELOP MARKETING STRATEGY

Analysis of potential product acceptance
- who would buy the product, and who would not
- where and when would they buy and use the product
- how would they use it
- why would they buy it, not buy more of it, or not buy it at all
- what could be done to encourage the use of the product

Determine product appeal
- translation of these aspects into relevant promotional effort

CHOICE OF MARKETING MIX VARIABLES TO IMPLEMENT STRATEGY

Product
- brand name
- generic name
- image

Pricing
- flexibility for negotiations at wholesale and retail level
- sensitivity of market to price levels
  - low price for high volume sales
  - high price for quality image
  - competitive price in relation to other products
  - competitive price in relation to quality perception

Place
- selection of sales outlets that have the necessary facilities, and image

Promotion
- budget allocation
- choice of media
- aiming to promotional effort
  - trade level
  - consumer level
- promotional tactics for launch as distinct from maintenance programme

SOLICITING BUYERS REACTION

Pilot scale samples presented to market contact
- ensure correct handling during transportation, and clearance of stopover points
- negotiations on pricing, branding and naming
- tentative promotion plans

CONSIDER POSSIBLE MODIFICATIONS

Relate back to objectives and product concept

REVIEW OVERALL SITUATION

Performance of venture in line with
- company objectives
- market reaction/acceptance
- profitability of venture
- production capability

POLICY DECISION TO
- CONTINUE
- MODIFY
- TERMINATE VENTURE

Financial commitment by company to continue

EQUIPMENT PURCHASE

If new technology required

FINAL PLANNING FOR PRODUCTION & MARKETING

Scheduling of production
- to allow for best use of equipment
- coincide with raw material supply
- allow for distribution arrangements

DESIGN OF RESELLER & CONSUMER TESTING

Set objectives for survey
- Design testing programme that will provide information to satisfy objectives

Organize product supply for test market

Allocate responsibility for testing programme

TEST MARKET

Ensure that the test marketing programme is adhered to

Test out distribution channels for correct product handling

ANALYSE TEST MARKET

POLICY DECISION TO
- CONTINUE
- MODIFY
- TERMINATE VENTURE

FULL SCALE PRODUCTION

Satisfactory performance to product specification

Effectiveness of Quality Assurance Programme

PRODUCT LAUNCH INTO MARKET

Co-ordinated promotional campaign with launch

MONITOR SALES

ONGOING MODIFICATIONS TO
- PRODUCTION &
- MARKETING POLICIES

Once the market opportunities have been defined, a range of product ideas is developed to meet these market opportunities and the product ideas are then evaluated on the basis of the constraints established by financial, consumer, market and technological considerations.

The few ideas that pass the screening stage then pass onto the design stage which is characterised by a single process - the refinement of the general concept to detailed product specifications for the product.

The precise definition of the product concept represents the most difficult step in the development stage. The product concept is the verbal description of the product and must embody the synthesis of appeals which the product must have, the needs that it must satisfy, the raw material composition, the processing technology and most importantly the form of the actual physical product, its shape, packaging and sensory characteristics.

The detailed product concept then becomes a brief for the product and the communications associated with the product. Both must be developed in harmony to ensure that both the product and communications highlight the unique blend of appeals to be incorporated into the product.

The development stage is essentially the transformation of the product specifications into a physical product. The physical product and communications are produced apart and then brought together as the prototype new product. Throughout the development stage both the product and the messages should be routinely evaluated to ensure the product and the message comply with the product concept. Through the development stage the product is produced on an increasingly larger scale until sufficient is produced in the factory for test marketing purposes. Increasing the scale of production ensures that the specified product can actually be produced on a larger scale. Finally after successful test marketing, the product is ready to be launched on the market.

1.3 THE CONSUMER IN PRODUCT DEVELOPMENT

There must be a series of evaluation stages throughout the development process where the product is tested against a set of consumer constraints and requirements to ensure that the product is on target and secondly to give management an opportunity to either kill the product or to modify the product before progression to the next stage of development. The market test should be the final consumer evaluation of the product before it is handed over to production, as it is the last time corrections can be made to the product and message to ensure a greater degree of success for the product.

The consumer in any satisfactory new product development programme must take the central role if the product is to be successful. New products can of course fail for any number of reasons - incorrect technology, price, marketing mix, channels of distribution, poor launch timing - but even if all the above factors are correct the product will still fail if it does not meet the specific needs and desires of the consumer and if it does not possess a unique blend of appeals.

It is very difficult to develop a new food product that will appeal to and be consumed by all consumers. Consequently, new food products are usually aimed at a specific market segment that is sufficiently large to return the desired company profits. The markets can be segmented on the basis of age, sex, income, marital status, family status, profession, geography and even physical environment. Markets can be further specified on the basis of differential attitudes, life style, interests, values and aspirations.

Companies are essentially concerned with profits which are in turn associated with sales which in turn are related to the consumers' needs for these products. Consequently, if the company wants to be successful it must have a thorough understanding of the consumers in the specific market segment at which the product is aimed. The company must know the socio-economic status of the consumers, geography, occupation, attitudes to existing products in the market, life styles, interests, values and aspirations. Furthermore the company must have a thorough understanding of the functional and non-functional aspects of the product which enables the product to meet the consumers' requirements. Moreover, the

company should have an understanding of the inter-relationships of the various factors and how these factors affect consumption of the products.

1.4 CONSUMER ATTITUDES TOWARDS MEATS

In New Zealand, virtually all the research effort has been centred on the primary sensory characteristics affecting meat consumption, i.e. the more functional aspects of meat such as texture, tenderness, flavour and colour and the effect of production and processing variables on these functional characteristics of meat. The same would be true of overseas countries as well. Some efforts have been made in New Zealand to examine the inter-relationships between consumption and socio-economic status of the consumers (Yandle, 1967; Brodie, 1977). However, with the exception of Wilkinson (1975) no published research in New Zealand has examined the inter-relationship between consumer attitudes and meat consumption and related this information to the development of new meat products.

There have been a number of studies in Britain that have examined the inter-relationships between consumer attitudes and meat consumption. These include: Baron et al. (1973), Hughes (1976), Gendall (1978) and Baron et al. (1981). McFadyen et al. (1973) and Wilkinson (1975) showed that people viewed meat at three levels; firstly on a meat commodity basis, secondly as broad categories of cuts of meats, and finally individual meat products; i.e. at each level it was possible to differentiate products on the basis of the unique appeals of each product. This pattern of unique appeals became more complex in going from the meat commodity level to the individual meat products level. This pattern of appeals for each product contained not only the more obvious functional characteristics such as colour, texture, flavour but also the psychological or non-functional appeals such as prestige of the meats.

There is a lack of knowledge of consumer attitudes for meat product development, particularly attitudes relating to sheep meat in New Zealand. There is insufficient information available at the moment in New Zealand to answer the question "Why are the sales of some meats

increasing while others are declining?" More importantly, from purely product development aspects there is insufficient information available on the important non-functional characteristics of meat products to adequately design meat products.

However, not only is there a lack of this information in New Zealand but there is also the same lack in overseas literature as well. Jeremiah (1982), for instance, in a comprehensive review of the factors influencing consumption, selection, and acceptability of meat purchases concluded by saying "that since there is so little information available within the literature regarding consumer preferences for meat and factors influencing consumption, selection and acceptability - and much of what is there is over 20 years old - that there is a need for additional research in these areas to provide more up-to-date information."

Therefore it was decided that a consumer survey should be conducted to collect and analyse the New Zealand meat consumers' attitudes, preferences and consumption behaviour towards meat cuts and a range of meat products. In view of the limitations apparent in many similar studies the above information was obtained for 45 different meat cuts and meat products, including chicken, fish and shellfish.

1.5 THE CONSUMER SURVEYS

Three surveys, conducted on consecutive weeks in November and December of 1979, using the same respondents were carried out to gather all the information. One hundred and fifty respondents started the first questionnaire, but only 92 completed all three.

In the first survey, respondents were asked questions dealing with the outlets where they purchased their meat, the frequency of purchase, the amount of a meat cut that they would consume at a single sitting and their frequency of consumption of the 45 meat cuts. They were also asked to provide attitudes to the 45 meat cuts on 18 separate attitude constructs. The final questions in the first survey dealt with a range of socio-economic variables such as: household composition, ages of household members, number of people working in the household, their

annual incomes, country of birth and if born overseas, how long they had been in New Zealand.

The second survey asked the respondents to assess firstly the similarity between 15 different meats, i.e. beef, veal, mutton, hogget, lamb, pork, ham, bacon, chicken, turkey, fish, shellfish, sausages, salami and offal, and then the similarities between 41 of the meat cuts and products that were included in the first survey. Forty-one rather than 45 were included because of the enormity of the task that had been set the respondents.

The third and final survey dealt firstly with the respondents' preferences for the 15 meats listed above. Two methods were used, i.e. the traditional paired comparison method and a modification of the semi-structured linear scale method.

This third survey also dealt with the respondents' meat preferences for the 41 meat cuts and meat products.

During the course of the study - as it took almost 5 years - it was apparent that dramatic changes were occurring to people's meat consumption behaviour in New Zealand and so a fourth survey was conducted late in 1984 to monitor the changes that people had made to their meat consumption over the period 1979-1984 and also to find out the reasons why people had made the changes that they had to their meat consumption patterns.

1.5.1 Types of Meat

It was decided, for the present study, that consumption attitudes, preferences, substitutabilities would be sought for 45 meat cuts to overcome some of the limitations of previous studies. The meats studied were:

* Beef cuts: wienersnitzel, rump steak, porterhouse steak, stewing steak, topside, beef mince and corned beef.
* Lamb cuts: lamb forequarter, lamb neck chops, lamb loin chops and leg of lamb.
* Hogget cuts: hogget forequarter, hogget neck chops, hogget loin chops and leg of hogget.

* Mutton cuts: mutton forequarter, mutton neck chops, mutton loin chops and leg of mutton.
* Pork cuts: pork chops, pork pieces and leg of pork.
* Ham cuts: sliced ham, ham steaks and leg of ham.
* Bacon cuts: middle bacon and shoulder bacon.
* Offal cuts: beef tongue, beef hearts, beef tripe, lambs' kidney and lambs' liver (lambs' fry).
* Sausage products: beef sausages, pork sausages, hamburgers, luncheon, ham & chicken, saveloys, frankfurters, black pudding, salami and garlic sausage.
* White meats: fish, shellfish and chicken.

1.6 AIMS OF THE PRESENT STUDY

The overall aim of the work was to collect and analyse the New Zealand meat consumers' attitudes, preferences and consumption behaviour towards meat so that models could be developed to predict per capita consumption of the meat cuts and products, preference ratings on the Thurstone Interval preference scale for the meat cuts and the proportion of households that would consume the cuts and products so that the more important aspects could be identified for meat product improvement and new product development.

As a large amount of detailed information was necessary to meet the above aim it was decided that consumer panels in Palmerston North would be used to obtain the information. The opportunity was taken to compare different techniques, such as Multidimensional Scaling and Factor Analysis, in using consumer panels to identify product areas and product characteristics.

Meat consumption was related to preference, substitutability of meats one for the other, and the attitudes of the consumers to the various meats that are and are not consumed.

This work also examined meats at three levels: commodity; groups of meats; and individual meat cuts to firstly substantiate earlier work and secondly to show how the three tiers information could be used to design new products.

The Thesis is in five parts:

1. Changes in the Retailing and Consumption of Meat

   The aim of this part was firstly to characterise the changes that consumers had made in their meat purchasing behaviour, and secondly to examine the changes in the meat consumption of Palmerston North households over the period 1974-1985.

2. The Effect of Socio-economic Variables on the Consumption of Meat

   The aim of this section was to examine the effect of socio-economic variables such as household size, number of children of differing ages, age of housewife, occupation of principal income earner, and country of birth on the meat consumption of various households in Palmerston North. A second aim of this section was to try and establish the reasons for the large drop in per capita consumption of meat which was observed over the period 1979-1984.

3. A Study on the Use of Multidimensional Scaling on Consumer Attitudes of Meat

   The aim of this section was to firstly ascertain the suitability and reliability of an alternative method of obtaining preference data compared with the traditional Thurstone Case V Method, and secondly to examine the suitability and applicability of preference proximity measurements and substitutability proximity measurements in Multi-dimensional Scaling.

4. Consumer Attitudes to Meat Products

   Work by Baron et al. (1973), Hughes (1976), Gendall (1978) and Baron et al. (1981) had shown that it was possible to extract a limited number of factors from consumer attitude data relating to meat. One aim of this section was to establish whether factors could be extracted for meat in general and whether these factors were common not only for meat in general, but also for sub-groupings of meats such as beef cuts, the sheep meat cuts, and also for individual meat cuts. The second aim of this section was to see

whether it was possible to group meats on the basis of consumer attitudes using the Q-Factoring technique and thus demonstrate the existence of clearly identifiable, unique appeals in meat cuts.

5. Development of Consumer Behaviour Models

The aim of this section was to summarise all the consumption information for 41 meat cuts, the preference information, the scale values for each of the dimensions from the MDS analysis of the 41 meat cut substitutabilities space, the 3 Factors obtained from the Factor Analysis of the attitude data relating to the 45 meat cuts, the proportion of households consuming each meat cut and the attitude scores for the 41 meat cuts and then by way of Multiple Regression develop models to predict per capita consumption of the 41 meat cuts, preference ratings for the meat cuts on the Thurstone Case V Interval preference scale, and the proportion of households consuming each meat cut. The more important consumer aspects would then be identified for product improvements and new product development.

PART 1

CHANGES IN THE RETAILING AND CONSUMPTION OF MEAT

Meat buying has changed a great deal during the ten years from 1974 to 1984. As a basis for the main study on the effects of consumer attitudes and socio-economic variables on meat consumption, a survey was made on, firstly, the changes in meat retail outlets in Palmerston North and secondly, the types and amounts of meat bought.

Chapter 2 describes the changes in meat retail outlets in Palmerston North between 1975 and 1985, Chapter 3 the consumption of different meats in Palmerston North.

CHAPTER 2

CHANGES IN MEAT RETAIL OUTLETS IN PALMERSTON NORTH

The aim was to examine the changes that had occurred in the types of retail outlets used by the consumers in the last ten years.

2.1 INTRODUCTION

From a marketing perspective, a knowledge of where meat is being sold to consumers and the changes that have occurred is very important. It determines where the marketing effort of the company should be directed to maintain current and future product sales. Also this knowledge is the basis for the packaging, promotion, and new meat products which are being developed by the company to meet the changing requirements of consumer demand. In the present study, it was important to see what changes had taken place in retailing as this would have a marked effect on the products designed for the New Zealand market in the future.

The change from butchers to supermarket selling of meat in the U.S.A. saw the introduction of firstly boxed beef and the pre-packaging of consumer cuts. Much of this pre-packaging is being performed by companies who traditionally supplied the supermarkets with boxed beef. In other words, the change in the method of retail selling caused the American meat processing companies to market meat like any other consumer item. Whether the boxed beef concept or its newer development of consumer packs will dominate the wholesaling of meat in New Zealand as it did in the U.S.A. will largely depend on the present and future market shares of the supermarket and butchery retail outlets.

Very little information is published in New Zealand on the market share of the various retail outlets and so it was difficult to predict what would happen in the future marketing of meat in New Zealand. Yandle (1967) and Brodie (1977) carried out meat consumer surveys in Christchurch in which they obtained the meat purchasing behaviour of respondents. Wilkinson (1974) also studied the retailing of meat in Palmerston North. Therefore further studies were carried out in Palmerston North to up-date this information.

2.2 CONSUMER SURVEY METHOD

2.2.1 First Consumer Survey, November 1979

This consumer survey consisted of three separate surveys which the respondents were expected to complete over a three-week period - a separate survey each week.

The first survey asked the respondents to provide details of where they purchased their fresh meat, ham and bacon and also smallgoods - the respondents were asked to provide the name of a shop so that their response could be checked. The first survey also asked for details of the frequency with which they purchased the various meats, which meat cuts they consumed, how much of each cut per meal and the frequency of consumption of each cut per month. Included in the first survey were questions relating to the respondents' attitudes to 45 different meat cuts and a range of questions dealing with the socio-economic status of the respondents. Pilot studies had shown that the respondents would need at least one and a half hours to complete the first questionnaire.

The second questionnaire essentially dealt with the consumers' meat preferences dealing with meat both at a commodity level and also at a specific meat-cut level. The preferences were dealt with in three separate ways so that the three methods of obtaining preference could be compared and contrasted. The early pilot studies had shown that at least eight hours would be required by the consumers to answer this questionnaire and so they were allowed to take it home to complete once they had made a start on all the questions and had no problems answering the questions.

The third questionnaire dealt with the respondents' perceptions of the substitutability of the various meat cuts one for the other and also the substitutability of the various meats one for another. This questionnaire was expected to take at least seven hours to complete according to early pilot studies.

In view of the length of the three questionnaires, coupled with their difficulty and the need to have all three questionnaires answered by each respondent it was decided that a non-representative sampling procedure would be used to select the respondents for the survey.

Preliminary studies had shown that respondents with above-average intelligence would be needed to answer the questionnaires - and that the respondents had to be highly motivated and interested in the survey to be able to give up to twenty hours of their time over a three-week period.

In view of the length of the survey and the time that would be needed to decode and transfer the information to computer coding sheets, a sample size of 150 respondents was selected rather than 300 which should have been used to provide reliable information for the section dealing with the socio-economic variables and meat consumption. 300 respondents would have provided a larger base from which to obtain socio-economic groups of 40-50 people and hence would have improved the reliability of the inter-group comparisons. Lack of finance was the major factor that determined that the final sample size could only be 150.

Consequently, one hundred and fifty women were selected from members of church groups, kindergartens, Plunket groups and two large businesses. These groups were selected firstly because each group was likely to consist of reasonably motivated people, who were willing to help with the project, and the more active members of each group were usually of above-average intelligence. The groups were selected in such a manner that an equal number of respondents was selected from each suburb of Palmerston North. No attempt was made to ensure that the sample was representative of the New Zealand population. The sample consisted of women aged between 18 to 60 years of age with most in the 20 to 50 years age bracket.

The chairperson of each organisation was contacted in the last week of October, 1979. The aims of the survey, together with the time required to complete the surveys were discussed with the chairpeople. If the chairpeople agreed to participate in the survey, they were then asked to arrange for 20 people to attend a group discussion at a suitable meeting place, usually a hall or somebody's house, at a pre-arranged time, during the last two weeks of November and the first three weeks of December. Each person was paid $4 for answering each of the three questionnaires and this money was paid to the participating organisation.

At the beginning of each group discussion, the aim of each survey was explained to the participants and then the questionnaire was handed out to them and they were asked to read it. Ten minutes were then spent on explaining the questions, what each was trying to achieve and how they should be answered. The respondents were then asked to complete the first questionnaire while remaining at the venue. Most respondents completed the first questionnaire within one-and-a-half hours. They were allowed to complete the second and third questionnaires at home.

2.2.2 Second Consumer Survey, January 1985

The second survey included many of the same questions that had been included in the first meat consumption questionnaire so that the responses to the first and second surveys could be readily compared, i.e. questions relating to retail outlets from which respondents purchased their fresh meat, ham, smallgoods, cheese and poultry. Questions relating to frequency of purchase of each meat type, quantity consumed per meal, and frequency of consumption of specific meat cuts per month were included. The questionnaire also included a smaller number of attitude questions and an expanded number of socio-economic questions. In addition to these questions, that had been included in the first survey, a large number of questions were also included in the second survey to try to identify the reasons for the major changes that consumers had made in their per capita meat consumption over the period 1979-1984. Due to the fact that socio-economic variables had not been altogether successful in isolating the causes for differences in meat consumption between households, a number of psychographic questions were also included in the second survey to see whether the differences in per capita consumption of meat between households were due in part to differences in lifestyle between households.

For financial reasons and also because of time limitations, the sample size for the second survey was restricted to 125 respondents.

The second survey was started in October 1984 and completed in January 1985. A different procedure was adopted for this second survey. One hundred and fifty respondents were randomly selected from the electoral roll and a questionnaire was mailed to these people asking them to complete the questionnaire and post it back to Massey University as soon as possible. People who had not completed the questionnaire by the end

of the second month were contacted by telephone and asked to do so. A response rate of 40%, i.e. 60 respondents, was achieved.

As sixty respondents were not enough for the survey, a further 100 respondents were randomly selected as they left the five major supermarkets in Palmerston North - 20 respondents from each supermarket. A $75 grocery prize was offered as an inducement to participate in the survey and also to ensure a speedy return of the completed questionnaires. The above approach resulted in a 65% response rate which was achieved within two weeks of the questionnaires being handed out - a far better and speedier response rate than the mail order approach.

As it was thought that there could be a bias in the results of the questionnaires handed out at the supermarkets, the mail and supermarket-distributed questionnaires were analysed separately. The responses of the two groups were very similar and so the results of the two groups were combined and analysed as a single survey. Therefore 125 respondents took part in the second survey.

The survey form is presented in Appendix 2.2a.

2.2.3 Method of Analysis

The collected data were coded and edited for computer analysis. The data for each question were initially analysed using Version 9 of Nie *et al.*'s (1979) SPSS programme. Frequency histograms, means, modes, medians, standard deviations, standard errors and ranges were calculated for each variable.

2.3 CHANGES IN THE RETAIL OUTLETS FOR FRESH MEAT IN PALMERSTON NORTH FROM 1974 TO 1985

A comparison was made between the results of the 1979 survey and the 1985 surveys and the 1974 survey of Wilkinson (1975) in Palmerston North. The results are presented in Table 2.1.

Table 2.1 Trends in Retail Outlet Patronage in Palmerston North for Fresh Meat, 1974-1985

	1974 %	1979 %	1985 %
Supermarket	14.8	24.4	47.1
Supermarket & butchery	n.a.	12.6	13.2
Butchery	45.5	28.5	15.6
Freezing works	21.4	13.4	12.9
Farmer	n.a.	5.8	1.6
Kill own	n.a.	2.5	4.8
Dairy and Grocer	n.a.	1.6	n.a.
No regular shop	18.3	11.2	4.8
	100.0	100.0	100.0

In the space of 11 years the relative market positions of the supermarkets and butcheries were reversed. In 1974 the butcher shops accounted for 45.5% of fresh meat retail outlet patronage in Palmerston North whilst the supermarkets accounted for only 14.8%. By 1979 the relative shares of both retail groups were very similar. However, in the next 5 years the supermarkets nearly doubled their market share from 24.4% to 47.1% almost solely at the expense of the butcher shops' share which dropped from 28.5% to 15.5% over the period November 1979 to January 1985.

During the period 1974 to 1985, the importance of the freezing works-owned butcher shops appeared to have decreased, from a market share of 21.4% in 1974 to 12.8% in 1985. However, there was little change over the period 1979-1985.

A very small proportion of respondents surveyed in 1985 reported purchasing their meat at "no regular shop" compared with the previous surveys which had been 18.3% in 1974 and 11.2% in 1979. So the percentage of people with no regular shop for buying meat has decreased. However, this does not mean that the other 95.2% only use the one retail outlet. A notable fact in the 1979 survey was the very high proportion

of consumers (73.6%) who always used the one retail outlet to purchase their meat. However, compared to the 1974 survey, the proportion of consumers using a particular retail outlet had actually fallen from 81.7% to 73.6% between 1974 and 1979. The proportion in 1985 was not known.

In the 1985 survey respondents were also asked to state where they mainly purchased their poultry as poultry sales grew quite rapidly over the period 1979-1985, largely at the expense of red meat. Supermarkets accounted for approximately 89% of all poultry sales, followed by poultry farms at 4.8% and butcher shops with 3.2%. The supermarkets clearly dominated poultry sales in Palmerston North.

It is possible that the supermarkets could dominate the sales of fresh red meats in the future given the very rapid increase in market share over the last 5 years in that the supermarkets would be in the same position with red meat sales that they currently enjoy with poultry sales.

2.4 CHANGES IN THE RETAIL OUTLETS FOR PROCESSED MEATS IN PALMERSTON NORTH FROM 1974 TO 1985

The changes that have occurred in the market share of the various retail outlets for ham, bacon and smallgoods are summarised in Table 2.2.

Table 2.2 Trends in Retail Outlet Patronage in Palmerston North for Processed Meats, 1974-1985

	1974 %	1979 %	1985 %
Supermarkets	40.8	58.1	70.2
Butcher shops	28.8	18.5	6.4
Dairy, grocer	7.0	7.8	4.8
Delicatessen	4.2	6.9	7.4
Freezing works' butcher shops	5.6	3.3	3.2
Farmer	n.a.	n.a.	1.6
Own cured	n.a.	4.1	3.2
No regular shop	13.6	1.3	3.2
	100.0	100.0	100.0

Over the 11 year period 1974-1985 the supermarkets' share of the processed meat market has tended to steadily increase at the expense of most other retail outlets, in particular the butcher shops whose market share dropped from 28.8% in 1974 to 18.5% in 1979 and then to 6.4% in 1985 whilst the supermarket share increased from 40.8% in 1974 to 70.2% over the same period.

The loss of market share of the butcher shops between the years 1979-1985 could have been due to the closure and sale of some of the Manawatu Consumers' Cooperative butcher shops. In the 1979 survey these shops had accounted for a sizeable share of the processed meat market.

The corner dairy stores which accounted for approximately 7% of the processed meat market during the 1970's appeared to have lost trade by 1985. The delicatessen outlets, although accounting for a small share of the retail processed meat market, appear to have steadily increased their market share over the period 1974-1985 from 4.2% in 1974 to 7.4% in 1985 - which is a slightly greater market share than the butcher shops enjoyed in 1985.

In the 1979 survey, respondents were also asked to differentiate between the retail outlets used for the purchase of bacon, ham and smallgoods, and the results are shown in Table 2.3.

Table 2.3 Trends in Retail Outlet Patronage in Palmerston North for Consumer Purchases of Ham, Bacon and Smallgoods in 1979

Type of Retail Outlet	Bacon and Ham		Smallgoods	
	Main Outlet	Second Choice Outlet	Main Outlet	Second Choice Outlet
Used only 1 outlet		72.5		80.2
Dairy	14.3		22.0	
Grocer	17.6	2.2	13.2	1.1
Delicatessen	2.2	2.2	1.1	2.2
Supermarket	46.2	7.7	36.2	7.7
Butcher	9.9	6.6	12.1	2.2
Suburban butcher	1.1	-	1.1	n.a.
City butcher	n.a.	2.2	1.1	2.2
Freezing works	6.6	4.4	5.5	2.2
Farmer	n.a.	1.1	4.4	2.2
Kill own	n.a.	1.1	1.1	n.a.
Did not reply	2.2		2.2	
	100.1	100.0	100.0	100.0

In 1979 approximately 73 per cent of the respondents said they purchased their bacon and ham from the one outlet. With second-choice retail outlets the butcher shops and supermarkets would appear to hold an almost equal share of customer patronage. The supermarkets held a commanding position in the sales of bacon and ham in 1979 accounting for 46.2% of consumer patronage, with grocery and dairy shops being the next two most important retail outlets. In contrast to fresh meat sales, the butcher shops played a very minor role in the sale of bacon and ham with a customer patronage of 11%.

The retail outlet patronage for smallgoods would appear to be again different from either fresh meat sales or bacon and ham sales. Whilst the supermarkets held a commanding retail position, it was 10% below that for bacon and ham. The corner dairy was the second most important outlet for smallgoods at 22% followed by the larger grocer shops and the butcher shops with 13% and 14% of the market share respectively. The delicatessens appeared to play a very minor role in either the sale of bacon and ham or smallgoods. A very high proportion of respondents tended to purchase their smallgoods from one outlet. This was 6-7% higher than for fresh meat or bacon and ham. Of those who used additional retail outlets to purchase their smallgoods, the supermarkets would appear to be the most important secondary outlet followed by all the others with an almost equal market share.

With the overall increase in the percentage of the households buying processed meats from supermarkets in 1985, it could be safely assumed that importance of the dairies and grocers as retail outlets for bacon, ham and smallgoods has decreased.

2.5 THE EFFECT OF SOCIO-ECONOMIC FACTORS ON THE CHOICE OF RETAIL OUTLETS FOR BUYING MEAT

The 1979 survey showed that the only significant determinant of retail outlet patronage was the age of the housewife. The under-20's tended to shop at a butcher shop for their fresh meat, but they did not have a specific butcher shop from which they purchased their meat. The respondents from the 20-29 age bracket mainly shopped at a suburban butcher shop and this could in part be due to a low mobility level as a result of the presence of very young children in their households. The 30-39 age group tended to shop at a butcher shop for their meat, and like the under-20's had no specific butcher shop from which they purchased their meat. The over-40's tended to mainly purchase their meat from supermarkets. The results of the survey were in marked contrast to those of Brodie (1977) who found that the younger respondents tended to mainly purchase their meat from supermarkets and that a larger proportion of the middle-aged group used the chain butcher shops and an even greater proportion of the older-aged group used the private butcher shops.

For bacon and smallgoods in the 1979 survey the sample size was too small to give a detailed breakdown of retail outlet patronage for the various socio-economic groupings. Instead the retail outlet used by the majority of each socio-economic grouping has been provided in Appendices 2.3a and 2.4a. In the sales of smallgoods the only socio-economic variable with any statistical significance was the age of the respondent. Supermarkets tended to be the major retail outlets used by those in the 20-29, and 30-39 age groups. The Under-20's and those in the 40-49 age brackets mainly purchased their bacon and ham from the grocer, whilst the over-50's tended to use the suburban butcher. The picture was quite different for the sale of bacon and ham where the under-20's and those in the 30-49 age brackets mainly used the supermarkets, the 20-29's the grocer and the over-50's a butcher shop. Occupation of the principal income earner was also found to be marginally significant (d=8.9%) in the choice of outlets in the sale of bacon and ham.

Unlike the 1979 survey, no socio-economic variable showed a significant relationship with retail outlet patronage in 1985. A major portion of all age groups purchased their meat from supermarkets.

2.6 CONCLUSIONS

The retail selling of meat in Palmerston North has changed dramatically from 1974 to 1985. The supermarkets have increased their consumer patronage for fresh meat from 14.8% to 47.1% of respondents. This gain has been mainly made at the expense of butcher shops whose patronage dropped from 45.5% in 1974 to 15.4% in 1985. Similarly the supermarkets have increased their consumer patronage for the processed meats (bacon, ham and smallgoods) from 40.8% in 1974 to 70.4% in 1985. The supermarkets also had a higher share of the poultry market with almost 90% of the respondents purchasing their poultry from the supermarkets.

Therefore the change in retail selling of meat which has occurred in other countries and in other parts of New Zealand [Yandle (1965) and Brodie (1977)] has also occurred in Palmerston North. The supermarket is now the main retail outlet for all meats, with the butcher shop and the freezing works-owned shops as the second but much smaller outlets.

CHAPTER 3

THE CONSUMPTION OF DIFFERENT MEATS IN PALMERSTON NORTH

The changes in household consumption of meat over the last 15 years were studied using published information and the consumer surveys completed in 1979 and 1985.

3.1 MEAT CONSUMPTION IN NEW ZEALAND FROM 1950 TO 1979

Total average meat consumption in New Zealand did not show much variation over the years 1950-1979 as can be seen in Table 3.1a in the Appendix 3.1. The total average per capita consumption over this period was 106.7 ±3.3 kg per annum. On only occasion it fell outside the 2 standard deviations, i.e. outside 100.0-115.3 kg/annum, and this was in 1962 when total meat consumption was 2.1 standard deviations above the total average meat consumption. Total per capita meat consumption in 1979 was the lowest recorded annual consumption over the 29-year period under review. The very low standard deviation of ±3.3 kg per annum or 3.1% of the total average meat consumption is testimony of the very stable overall meat intake pattern of New Zealanders.

Table 3.1 provides a breakdown of the average per capita consumption per annum of the various meats over the period 1950-1979.

Table 3.1 Consumption of Meats over the Years 1950-1979 in New Zealand

Meat	Average per capita Consumption/annum kg (bone-in)	Standard Deviation	Standard Deviation as Percentage of Total
Beef	47.25	4.01	8.5%
Veal	3.16	0.53	16.8%
Mutton	29.91	4.80	16.1%
Lamb	7.99	2.98	37.0%
Pig Meat	13.55	1.53	11.3%
Offal	4.66	0.57	12.2%
Total	106.72	3.34	3.1%

Source: N.Z. Department of Statistics: NEW ZEALAND OFFICIAL YEARBOOK, 1951-1981.

Beef showed the least variation in per capita consumption over the period 1950-1979, with a percent standard deviation of ±8.5%, whilst lamb showed the greatest variation with a percent standard deviation of ± 37.0%. The other meats to show low variations in per capita consumption were pig meats and offal. Mutton and veal showed medium variations. In the case of veal the per capita consumption per annum at 3.16 kg/annum is so low that any promotional activity such as a well-known T.V. cooking personality demonstrating a new veal dish could have a marked effect on the annual per capita consumption of veal. The mutton consumption figures include hogget consumption, and all figures include both household meat consumption and meat going to processing (both human and petfood production).

Only two meats showed marked trends in per capita consumption over the period 1950-1979, namely lamb and mutton.

Per capita consumption of lamb showed a gradual increase in consumption from 4.10 kg per capita per annum in 1950 to 12.2 kg per capita per annum in 1976 and has since showed a slight decline in the period 1976-1979 to 10.9 kg. Mutton, on the other hand, showed a gradual increase

in per capita consumption over the period 1950-1960, but has since shown a downward trend, so much so that in successive years 1977-1979 the annual per capita consumption was over two standard deviations lower than the average per capita consumption over the period 1950-1979.

Whenever the per capita consumption of one meat declined, this was compensated for by an increase in the consumption of one or more of the other meats as evidenced by the very small variation in total per capita meat consumption per annum. The relative price of one meat against the other has been shown by McShane (1973) to have a large bearing on the substitution effect. While the relative prices explain the temporary substitution by consumers of one meat for another, it does not explain the long-term trends of declining lamb and mutton consumption. There would appear to be some underlying causes responsible for this decline in consumption, which should be elucidated to establish whether the trends could be reversed.

Whilst it is important to know the trends in overall consumption of each meat type, of more importance is the knowledge of the consumption trends of specific cuts within each meat species so as to pin-point the causes for the rise or decline of one or other species of meat. One of the objectives of the present survey was to establish the consumption pattern of as many cuts of meat as possible and compare the present findings with other published research to ascertain trends in consumption of specific cuts of meat so that such trends as the decline in per capita consumption of mutton and lamb could be pin-pointed to a decline in one or more cuts of each of these two meats. If this could be done then more effective marketing and product development strategies could be developed to combat and hopefully turn back the trends of declining consumption of mutton and lamb.

3.2 THE CONSUMER SURVEYS IN PALMERSTON NORTH

The survey methods are described in Section 1.5. The 150 respondents in the 1979 survey and the 125 respondents in the 1984/85 survey all answered the question on the type of meat bought in the questionnaire (see Appendix 2.1a).

The collected data were coded and edited for computer analysis. The data for each question were initially analysed using Version 9 of Nie et al.'s (1979) SPSS programme. Frequencies, means, standard deviations, standard errors, modes, medians and ranges were calculated for each of the meat cuts.

3.3 PER CAPITA CONSUMPTION OF MEAT IN PALMERSTON NORTH IN 1979

Table 3.2 provides a detailed breakdown of the consumption of the various meats over all the sample and by those who actually consumed the cuts. Beef was served on a regular basis by 98.9% of the households compared with 78% for lamb, 62.6% for hogget. Some cuts of beef, fish, chicken and sausages were consumed by over 90% of all households on a regular basis. Ham, pork, bacon and lamb were the next group of most frequently-served meats. The least popular types of meat were hogget, mutton and offal with 62.6%, 37.4% and 68.1% respectively of households serving these meats.

Brodie (1977) found that 98% of all households in Christchurch served beef at least once every 6 months with 96% serving it at least every two weeks. He also found that 85% of all households served hogget and mutton and 63% served pork.

Table 3.2 Meat Consumption per Capita per Annum in Palmerston North in 1979

Meat	Eating Meat	Meat Consumption per Capita/annum over all Sample		
		Mean	SE	(S.D.)
	% of Households	kg/annum		
Beef	98.9	25.6	1.6	(15.5)
Lamb	78.0	9.4	1.0	(10.4)
Hogget	62.6	11.9	1.4	(13.8)
Mutton	37.4	6.1	1.08	(10.2)
Pig Meat	96.7	28.9	2.6	(24.9)
Pork	78.0	12.8	1.3	(12.8)
Ham	81.3	14.0	1.8	(17.5)
Bacon	74.7	2.0	0.3	(3.2)
Offal	68.1	3.6	0.5	(4.6)
Chicken	91.2	6.2	0.4	(3.6)
Fish (includes shellfish)	94.5	4.2	0.2	(2.61)
Sausage products	95.2	9.0	0.6	(6.0)
Total red meat	98.9	94.5	6.1	(59.2)
Total all meats*	98.9	103.8	6.6	(63.0)

*Note: 1 person was a vegetarian. Valid responses 91.

Ninety-nine percent of all households served "convenience meats" on a regular basis; these included frying steaks and chops from lamb, hogget, mutton and pork; 90.1% of the households served roasts of beef, lamb, pork, hogget or mutton. The mean consumption of all the respondents was 28.4 kg per capita per annum for convenience meats and 28.9 kg per annum for roasts.

With such meats as lamb, pork, offal, bacon, hogget and particularly mutton, where a relatively large number of households never served the meats, the per capita consumption of these meats was, not unexpectedly, much higher for the consumers of these meats than for the whole sample.

As shown in Table 3.3, a high proportion (approximately 90%) ate sausages, but only 30% ate continental sausages.

Table 3.3 Consumption of Sausages in Palmerston North in 1979

	Eating Sausages	Sausage Consumption per capita/annum Mean	SE (S.D.)
	% of Households	kg/annum	
Fresh sausages	94.5	3.8	0.4 (3.5)
Cooked sausages	90.1	4.2	0.6 (5.4)
Continental sausages	27.5	1.0	0.2 (2.4)

The standard deviations for the estimated consumption of each meat were exceedingly high and the reasons for these high deviations can be seen in Table 3.4 which provides a frequency breakdown of the consumption (kg/capita/annum) pattern for each meat. Most of the consumption distributions follow a normal curve with the exception of hogget, pork and ham where the distributions were almost bimodal with a sizeable portion 3.2% in the case of hogget and over 20% in the cases of pork and ham - who consumed over 30 kg/capita/annum of each cut.

The consumption frequency distributions for total beef, convenience meats, bacon, chicken, fish, fresh sausages and continental sausages had a positive kurtosis, i.e. they were comparatively peaked whilst the kurtosis was negative for all other meats. Practically all the distri-

butions had a negative skewness value indicating that the majority of the meat consumption tended to cluster to the left.

An examination of the total meat consumption distribution shows that almost 20% of the sample had a per capita consumption of meat per annum that was less than 60% of the national average and 41% of the sample had a meat intake which was greater than the national average. Eight percent of the sample had a per capita consumption that was 3 times the national average. The figures were so high that the households in question were contacted to confirm the figures on their survey forms.

Table 3.4 Percentage of Respondents Eating Various Meats in Palmerston North in 1979

Percentage of Respondents Eating Various Quantities of Each Meat. kg/capita/annum

	0 %	0-3.0 %	3.1-6.0 %	6.1-9.0 %	9.1-12.0 %	12.1-15.0 %	15.1-18.0 %	18.1-21.0 %	21.1-24.0 %	24.1-27.0 %	27.1-30.0 %	> 30.0 %
Steak	1.1	1.1	3.3	9.9	8.8	23.1	26.4	6.6	5.5	6.6	3.3	4.4
Lamb	22.0	2.2	3.3	12.1	15.4	17.6	13.2	4.4	4.4	3.3	0	2.2
Hogget	37.4	2.2	2.2	6.6	5.5	9.9	5.5	6.6	4.4	3.3	3.3	13.2
Mutton	62.6	1.1	3.3	5.5	3.3	3.3	1.1	6.6	2.2	4.4	3.3	3.3
Pork	22.0	2.2	6.6	11.1	13.2	9.9	4.4	2.2	2.2	2.2	3.3	20.9
Ham	18.7	15.4	12.1	8.8	9.9	2.2	2.2	0	2.2	2.2	2.2	24.2
Bacon	25.3	39.6	24.2	3.3	6.6	0	0	0	1.1	0	0	0
Chicken	8.8	4.4	9.9	20.9	47.3	4.4	4.4	0	0	0	0	0
Fish	8.8	5.5	27.5	29.7	25.3	3.3	0	0	0	0	0	0
Offal	31.9	13.2	11.0	22.0	14.3	3.3	2.2	0	1.1	1.1	0	0
Fresh Sausage	5.5	11.0	31.9	17.6	30.8	2.2	0	0	0	0	0	1.1
Cooked Sausage	9.9	13.2	8.8	36.2	19.8	3.3	6.6	1.1	1.1	0	0	1.1
Continental Sausage	72.5	12.1	6.6	4.4	3.3	0	1.1	0	0	0	0	0

	0	0.1-15	15.1-30	30.1-45	45.1-60	60.1-75	75.1-90	0.1-105	105.1-120	120.1-135	135.1-150	150.1-165	165.1-180	>
Convenience Meats	1.1	9.9	44.0	31.9	9.9	1.1	0	1.1	1.1	0	0	0	0	
Beef	1.1	14.3	52.8	23.1	5.5	1.1	0	1.1	1.1	0	0	0	0	
Sheep Meat	5.5	19.8	34.1	12.1	15.4	6.6	3.3	1.1	1.1	0	0	1.1	0	
Pig Meat	3.3	29.7	20.9	22.0	13.2	3.3	6.6	0	0	1.1	0	0	0	
Smallgoods	8.8	70.4	18.7	1.1	0	0	0	0	0	0	0	0	0	
Meat	1.1	1.1	4.4	4.4	9.9	14.3	15.4	7.7	11.0	6.6	5.5	4.4	5.5	

Valid responses 91

3.4 CONSUMPTION OF BEEF CUTS IN PALMERSTON NORTH IN 1979

A closer examination is made in Table 3.5 of the per capita per annum consumption of the various beef cuts which were included in the survey.

Table 3.5 Consumption of Beef Cuts by the Whole Sample and those Actually Eating the Beef Cuts in Palmerston North in 1979

	Eating	Beef Cut Consumption Over all Sample		Beef Cut Consumption Over Meat Eaters	
		Mean	SE (S.D.)	Mean	SE (S.D.)
	% of Households	kg/annum/capita			
Wienersnitzel	84.6	2.0	0.2 (2.1)	2.5	0.2 (2.1)
Rump Steak	73.6	3.2	0.3 (2.8)	4.4	0.3 (2.4)
Porterhouse Steak	69.2	2.3	0.2 (2.6)	3.4	0.2 (1.7)
Stewing Steak	78.0	3.2	0.2 (2.6)	4.2	0.3 (2.3)
Topside Steak	58.2	3.1	0.4 (3.8)	5.3	0.5 (3.6)
Total Steaks	98.9	14.0	0.8 (8.4)	19.8	1.5 (12.1)
Beef Mince	85.7	3.2	0.2 (2.0)	3.8	0.2 (1.6)
Corned Beef	80.2	4.4	0.5 (5.1)	5.5	0.6 (5.1)
Total Beef	98.9	25.6	1.6 (15.4)	38.8	3.8 (22.3)
Valid Responses	91				

It can be seen from Table 3.5 that whilst beef and steaks were consumed by 98.9% of all households, there was no single beef cut that approached this household consumption level. Beef mince and wienersnitzel were served by most households (approximately 85%); corned beef and stewing steak were the next most consumed meats. The more expensive frying and grilling steaks such as rump and porterhouse steak tended to be served less frequently. Topside, traditionally used as a roasting meat, was only consumed by 58.2% of all households. Wienersnitzel which is equally as expensive as porterhouse steak tended to be consumed by more households because it is a very thinly sliced meat and hence provides more serves per unit weight than either rump or porterhouse steak.

With the exception of wienersnitzel, porterhouse steak and corned beef, the mean per capita per annum consumption of the remaining beef cuts was very similar at 3.1-3.2 kg. However, the comparatively high per capita consumption of topside and corned beef, particularly of those actually consuming each cut, suggests that people tend to eat more of a meat if it is available. With steaks a unit quantity is served to each individual and that limits the amount of meat each person will eat at the meal. However, with roasts and large cuts such as corned beef, which are usually purchased in 1-3 kg sizes, sufficient meat usually exists after the first serving to be served either as seconds or for lunches and/or further main meals.

The distribution of per capita consumption of the various cuts of beef by the households participating in the survey is presented in Table 3.6. The wienersnitzel and topside distributions were highly skewed to the 0.1-3.0 kg per capita per annum level with over 40% of all households in this group. However, with topside and corned beef almost 9% of the households reported consumption levels for these two meats in excess of 15 kg per capita per annum. With the other cuts of beef the consumption levels tended to be grouped around consumption levels of 3-6 kg per capita per annum.

Table 3.6 Percentage of Respondents Eating Beef Cuts in Palmerston North in 1979

Meat	kg/capita/annum 0 %	0.1-3.0 %	3.1-6.0 %	6.1-9.0 %	9.1-12.0 %	12.1-15.0 %	>15.0 %
Wienersnitzel	15.4	18.7	56.1	3.3	5.5	0.0	1.1
Rump steak	26.4	1.1	39.6	12.1	11.0	3.3	6.6
Porterhouse steak	30.8	16.5	30.8	14.3	6.6	1.1	0.0
Stewing steak	22.0	7.7	33.0	20.8	14.3	3.3	0.0
Topside	41.8	2.2	20.9	12.1	14.3	6.6	2.2
Beef mince	14.3	1.1	7.7	59.4	15.4	2.2	0.0
Corned beef	19.8	12.1	2.2	30.8	23.1	3.3	8.8

Valid responses = 91

3.5 CONSUMPTION OF SHEEP MEAT CUTS IN PALMERSTON NORTH IN 1979

From Table 3.7 it can be seen that 94.5% of households served some sheep meat cut.

Table 3.7 Consumption of Sheep Meat Cuts by the Whole Sample and Those Actually Eating the Cuts in Palmerston North in 1979

	Eating	Sheep Meat Consumption/capita/annum Over All Sample		Over Meat Eaters	
		Mean	SE (S.D.)	Mean	SE (S.D.)
	% Households	kg/annum/capita			
Lamb					
Forequarter	47.3	2.0	0.2 (2.6)	4.4	0.3 (1.9)
Neck chops	36.3	1.4	0.2 (2.0)	3.8	0.3 (1.6)
Loin chops	59.3	2.2	0.2 (2.2)	3.8	0.2 (1.7)
Leg	63.7	3.7	0.7 (6.7)	5.8	1.0 (7.6)
Total Lamb	78.0	9.4	1.0 (10.4)	17.8	1.8 (12.8)
Hogget					
Forequarter	35.2	2.9	0.52 (4.9)	8.3	0.9 (5.1)
Neck chops	29.7	1.4	0.2 (2.6)	4.8	0.5 (2.7)
Loin chops	47.3	2.0	0.3 (2.8)	4.4	0.4 (2.7)
Leg	52.7	5.4	0.8 (7.2)	10.4	1.0 (6.9)
Total Hogget	62.6	11.9	1.4 (13.8)	27.9	2.8 (17.4)
Mutton					
Forequarter	15.4	1.2	0.4 (3.4)	7.7	1.4 (5.1)
Neck chops	17.6	0.8	0.2 (2.2)	4.9	0.7 (2.8)
Loin chops	22.0	1.2	0.3 (2.6)	5.3	0.7 (3.5)
Leg	26.4	2.8	0.6 (11.8)	11.0	1.3 (6.5)
Total Mutton	37.4	6.1	1.08 (10.2)	28.9	4.1 (14.9)
Total Sheep Meat	94.5	29.9	0.4 (26.0)	74.6	8.7 (45.1)

Valid responses = 91

As was pointed out earlier, more households (78%) served lamb than hogget (62.6%) and only 37.4% of households served any cut of mutton. Neck chops were clearly the least popular of all cuts with 36.3% of households serving lamb neck chops, 29.7% hogget neck chops and only 17.6% mutton neck chops. Mutton forequarter was only consumed by 15.4% of all households. No mutton cut had a very high household consumption rate; even lowly hogget neck chops (29.6%) were consumed by more households than any of the mutton cuts (26.4% for leg of mutton, the most consumed mutton cut).

The leg was the cut consumed by most households with 63.7% of households serving leg of lamb, 52.7% serving leg of hogget and 26.4% serving leg of mutton. In each sheep meat category, the loin chops were served by 4% less households than correspondingly served the leg cuts.

From Table 3.7 it can be seen that the actual weight of each meat eaten by the consumers of that meat was substantially higher than for the whole survey sample.

It can also be seen that as the size or weight of the cut of meat increases so the per capita consumption per annum increases. When chops are served individually, family members receive a fixed number of chops and hence consumption per meal is fixed. It would appear that with roasts, however, consumption per meal is not so strictly fixed as with chops and hence consumption per meal is higher for these larger cuts. Annual consumption depends not only on the weight of the cut but also on the frequency of serving of each cut.

A detailed consumption distribution is provided in Table 3.8. The per capita per annum distributions for all the lamb cuts showed less spread than the cuts of hogget or mutton. The distributions of lamb forequarter, lamb neck chops and particularly leg of lamb, leg of hogget and leg of mutton showed a marked bi-modal distribution with a group of households having a comparatively high consumption of the meats, i.e. over 12 kg per annum whilst the balance of those who ate the meat cuts tended to be grouped in the 3.0-9.0 kg per capita per annum range.

Table 3.8 Sheep Meat Consumption - Proportion of Households Eating Sheep Meat Cuts in Palmerston North in 1979.

Meat	kg/capita/annum						
	0	0.1-3.0	3.1-6.0	6.1-9.0	9.1-12.0	12.1-15.0	> 15.0
	%	%	%	%	%	%	%
Lamb forequarter	52.7	4.4	12.1	2.2	27.5	1.1	0
Lamb neck chops	63.7	4.4	15.4	5.5	11.0	0	0
Lamb loin chops	40.7	1.1	27.5	19.8	11.0	0	0
Leg of lamb	36.3	7.7	15.4	6.6	31.0	0	2.2
Hogget forequarter	64.8	1.1	8.8	4.4	6.6	1.1	13.2
Hogget neck chops	70.3	2.2	6.6	13.2	6.6	1.1	0
Hogget loin chops	52.7	3.3	13.2	18.7	11.0	2.2	1.1
Leg of hogget	47.3	2.2	11.0	8.8	8.8	2.2	19.7
Mutton forequarter	84.6	1.1	2.2	3.3	4.4	4.4	0
Mutton neck chops	82.4	1.1	5.5	5.5	5.5	0	0
Mutton loin chops	78.0	0	2.2	12.1	6.6	0	1.1
Leg of mutton	73.6	1.1	4.4	3.3	3.3	2.2	12.1
Valid Responses	91						

3.6 CONSUMPTION OF PIG MEAT CUTS IN PALMERSTON NORTH IN 1979

This group includes fresh pork cuts as well as ham and bacon. It can be seen from Table 3.9 that 96.7% of all households consumed some pig meat on a regular basis. However, no single pork cut was consumed by more than 75% of all households.

Table 3.9 Consumption of Pork Cuts by the Whole Sample and Those Actually Eating Pork Cuts in Palmerston North in 1979

Meat	Eating	Pork Consumption Over All Sample Mean	SE (S.D.)	Over Meat Eaters Mean	SE (S.D.)
	% of Sample	kg/annum/capita			
Pork					
Pork chops	70.3	3.3	0.3 (3.0)	4.7	0.3 (2.4)
Pork pieces	47.3	1.9	0.4 (3.6)	4.1	0.7 (4.4)
Leg of pork	51.6	7.6	1.11 (10.6)	14.7	1.5 (10.6)
Total pork	78.0	12.8	1.3 (12.8)	23.5	2.5 (17.4)
Ham					
Sliced ham	59.3	1.1	0.2 (1.9)	1.9	0.3 (2.2)
Ham-on-the-bone	52.7	11.2	1.7 (16.2)	21.3	2.5 (16.95)
Ham steak	53.8	1.7	0.2 (2.4)	3.1	0.4 (2.5)
Total ham	81.3	14.0	1.8 (17.5)	26.3	3.2 (21.65)
Bacon					
Shoulder bacon	42.9	0.9	0.3 (2.6)	2.3	0.6 (3.8)
Middle bacon	50.5	1.1	0.2 (1.8)	2.1	0.3 (2.1)
Total bacon	74.7	2.0	0.3 (3.2)	4.4	0.9 (5.9)
Total pigmeat	96.7	28.9	2.6 (24.9)	54.2	6.6 (44.95)

Valid Responses = 91

Pork chops at 70.3% of households was the most consumed pig meat cut, followed by sliced ham at 59.3%, ham steaks 53.8% and ham-on-the-bone and leg of pork at 52.7% and 51.6% respectively. Shoulder bacon, 42.9%, was the least served of all the pigmeat cuts.

The very high per capita per annum consumption figures for ham-on-the-bone and leg of pork for the whole sample can be explained by the very large group, 26.4% for leg of pork and 29.7% for ham-on-the-bone who consumed more than 15 kg of each meat (see Table 3.10).

The per capita per annum consumption figures for pork pieces, sliced ham, ham steaks and middle and shoulder bacon were comparatively quite small and lay between 0.9-1.9 kg per annum. Pork chops at 3.3 kg per annum were about the same consumption levels as the various beef steak cuts.

Table 3.10 Percentage of respondents Eating Pig Meat Cuts in Palmerston North in 1979

	kg/capita/annum						
Meat	0 %	0.1-3.0 %	3.1-6.0 %	6.1-9.0 %	9.1-12.0 %	12.1-15.0 %	>15.0 %
Pork chops	29.7	2.2	24.2	25.3	15.4	2.2	1.1
Pork pieces	52.7	6.6	28.6	3.3	7.7	0	1.1
Leg of pork	48.4	1.1	11.0	2.2	8.8	2.2	26.4
Sliced ham	40.7	36.1	18.8	2.2	1.1	1.1	0
Ham-on-the-bone	47.3	7.7	8.8	1.1	5.5	0	29.7
Ham steaks	46.2	6.6	30.8	11.0	4.4	1.1	1.1
Shoulder bacon	57.1	25.3	13.2	3.3	0	1.1	0
Middle bacon	49.5	27.5	18.7	3.3	1.1	0	0

The per capita distributions for sliced ham, shoulder and middle bacon were highly skewed to the 0.1-3.0 kg per annum end of the distribution. The pork chop and ham steak distribution was normally distributed about the 3.1-9.0 kg per capita per annum level whilst the ham-on-the-bone and, to a lesser extent, leg of pork distributions were bimodal with a large group centred around 3.1-6.0 kg per annum and another group with a very large consumption of over 15 kg for each of the meats.

3.7 CONSUMPTION OF OFFAL IN PALMERSTON NORTH IN 1979

Some form of offal was served by 68.1% of households (see Table 3.11). Lambs' fry (as it is known in New Zealand) or lambs' liver was the most frequently served offal cut with 59.3% of all households consuming it. The next most-consumed cut was lambs' kidney at 34.1%. Beef tongue, beef tripe and beef hearts were consumed respectively by 16.5%, 11.0% and 2.2% of the households. With the exception of lambs' fry, the offal cuts were clearly not very popular amongst the respondents.

Table 3.11 Consumption of Offal Products by the Whole Sample and Those Actually Eating each Type of Offal in Palmerston North in 1979

	Eating	Offal Consumption/Capita/Annum Over All Sample		Over Meat Eaters	
Meat	% of Households	Mean	SE (S.D.)	Mean	SE (S.D.)
		kg/capita/annum			
Beef tongue	16.5	0.8	0.2 (1.9)	4.6	0.6 (2.2)
Beef hearts	2.2	0.1	0.08 (0.8)	5.1	0.9 (1.3)
Beef tripe	11.0	0.3	0.1 (1.0)	2.8	0.5 (1.6)
Lambs' fry	59.3	1.8	0.3 (2.8)	3.1	0.4 (3.2)
Lambs' kidney	34.1	0.6	0.1 (1.2)	1.9	0.2 (1.3)
Total offal	68.1	3.6	0.5 (4.6)	17.5	2.6 (9.6)

Valid responses = 91

The per capita per annum consumption levels for each of the cuts clearly reflects this unpopularity with all but lambs' fry having a per capita consumption level less than 1 kg. However, the small percentage of people who did eat each of the cuts, particularly beef hearts, did eat a significant amount as can be seen from Table 3.12. With beef tongue, tripe and lambs' fry people tended to eat between 3.1-9.0 kg of each of the cuts per annum. The lambs' kidney distribution was skewed to the left at a lower consumption level of 0.1-6.0 kg per annum.

Table 3.12 Percentage of Respondents Eating Offal Products in Palmerston North in 1979

	kg/capita/annum						
	0	0.1-3.0	3.1-6.0	6.1-9.0	9.1-12.0	12.1-15.0	>15.0
Meat	%	%	%	%	%	%	%
Beef tongue	83.5	1.1	7.7	5.5	2.2	0	0
Beef heart	97.8	0	1.1	1.1	0	0	0
Beef tripe	89.0	1.1	7.7	1.1	1.1	0	0
Lambs' fry	40.7	11.0	30.8	13.2	3.3	0	1.1
Lambs' kidney	65.9	15.4	15.4	2.2	1.1	0	0

Valid Responses = 91

3.8 CONSUMPTION OF SAUSAGE PRODUCTS IN PALMERSTON NORTH IN 1979

An examination of Table 3.13 shows that some form of sausage product was consumed by 95.2% of all households. A further breakdown shows that 94.5% of households served either fresh pork or beef sausages,, 91.2% some form of traditional-type cooked sausage product such as luncheon and 72.5% of households consumed some form of continental sausage product. These figures are in themselves misleading and a closer examination shows that beef sausages with 79.1% of all households were the most frequently served sausage product followed by luncheon at 70.0%, saveloys at 67.0% and pork sausages at 60.4% of households. Ham and chicken (a variant of luncheon sausage) and hamburgers were next at 38.5% and 28.6% respectively. All the other meats were served by less than 20% of all households. Clearly, the traditional sausage products still reached a far larger market than salami and other continental-type sausages. Hamburgers, unlike the U.S.A. and other countries, are only served by a very small proportion of households in New Zealand. (Hamburgers were only included in the total sausage category.)

Table 3.13 Consumption of Sausage Products by the Whole Sample and Those Actually Eating Sausage Products in Palmerston North in 1979

		Sausage Consumption/Capita/Annum			
	Eating	Over All Sample		Over Meat Eaters	
		Mean	SE	Mean	SE
Meat	% of Households		(S.D.)		(S.D.)
			kg/capita/annum		
Fresh Sausages					
Beef sausages	99.1	2.7	0.3	3.4	0.4
			(3.2)		(3.3)
Pork sausages	60.4	1.6	0.2	2.8	0.1
			(1.6)		(1.0)
Total fresh sausages	94.5	4.3	0.4	6.2	0.5
			(3.5)		(4.3)
Hamburger	28.6	0.8	0.2	2.7	0.3
			(1.5)		(1.7)
Cooked Sausages					
Luncheon	70.0	1.4	0.1	1.8	0.1
			(1.3)		(1.2)
Ham-and-chicken	38.5	1.0	0.2	2.5	0.7
			(2.6)		(3.8)
Saveloys	67.0	2.04	0.2	3.1	0.2
			(1.8)		(1.4)
Black pudding	17.6	0.4	0.1	2.1	0.3
			(0.9)		(1.0)
Total traditional sausages	90.1	3.6	0.6	18.4	2.1
			(5.4)		(13.4)
Continental sausages					
Salami	17.6	0.3	0.1	1.7	0.4
			(0.8)		(1.4)
Frankfurters	11.0	0.2	0.1	2.3	0.3
			(0.8)		(1.1)
Garlic sausage	16.5	0.5	0.2	2.9	0.9
			(1.8)		(3.5)
Total Continental sausages	72.5	1.0	0.2	6.9	1.6
			(2.4)		(6.0)
Total sausages	95.2	10.9	0.6	25.3	3.7
			(6.01)		(19.4)

Valid Responses = 91

The per capita per annum consumption of beef sausages and saveloys were substantially higher than for the other sausage products. The other sausage product often used as a main meal meat, pork sausages, also had a higher per capita consumption than the luncheon-type products. The per capita consumption of luncheon, ham-and-chicken and hamburger were at an intermediate level of 0.8-1.14 kg compared to the comparatively low con-sumption figures for salami, frankfurters, garlic sausage and black pudding. As with the other meat categories, the actual consumers of the various meats had comparatively high meat consumption per capita for the sausage products as can be seen in Table 3.14.

Table 3.14 Percentage of Respondents Eating Sausage Products in Palmerston North

	kg/capita/annum						
Sausage Product	0 %	0.1-3.0 %	3.1-6.0 %	6.1-9.0 %	9.1-12.0 %	12.1-15.0 %	>15.0 %
Beef sausages	20.9	2.2	66.0	3.3	6.6	0	1.1
Pork sausages	39.6	6.6	47.3	2.2	4.4	0	0
Hamburger	71.4	8.8	14.3	3.3	2.2	0	0
Luncheon	23.1	45.1	28.6	2.2	1.1	0	0
Ham-and-chicken	61.5	16.5	21.9	0	1.1	0	0
Saveloys	33.0	9.9	47.3	6.6	3.3	1.1	0
Black pudding	82.4	9.9	6.6	61.1	0	0	0
Salami	82.4	11.0	5.5	2.2	1.1	0	0
Frank-furters	89.0	6.6	3.3	1.1	0	0	0
Garlic sausage	83.5	6.6	7.7	2.2	0	0	0

Valid Responses = 91

The per capita per annum distributions for beef and pork sausages, saveloys and hamburgers were normally distributed about the 3.1-6.0 kg per capita per annum level of consumption. One family reported a consumption level of over 15 kg per annum for beef sausages.

The per capita per annum distributions for luncheon, ham-and-chicken, salami, frankfurters and garlic sausage were skewed to the left with a high proportion of households reporting consumption levels between 0.1-3.0 kg per capita per annum.

3.9 CONSUMPTION OF CHICKEN, SHELLFISH & FISH IN PALMERSTON NORTH IN 1979

As can be seen from Table 3.15 both chicken and fish were served in an equally high proportion of the households (91.2%). This level of household coverage was highest amongst all the individual cuts of meat even surpassing the highly popular beef steaks. However, if individual types of fish or cuts of chicken had been included in the survey then the figures may have been quite different as regards the individual cuts. A very small proportion of households consumed shellfish (36.3%).

Table 3.15 Consumption of Chicken, Shellfish and Fish by the Whole Sample and Those Actually Eating Chicken, Shellfish and Fish in Palmerston North in 1979

		White meat Consumption/Capita/Annum			
	Eating	Over All Sample		Over Meat Eaters	
Meat	% of Households	Mean	SE (S.D.)	Mean	SE (S.D.)
		kg/capita/annum			
Chicken	91.2	6.2	0.4 (3.6)	6.7	0.4 (3.2)
Shellfish	96.3	0.7	0.1 (1.1)	1.9	0.2 (1.2)
Fish	91.2	3.5	0.2 (2.3)	3.8	0.2 (2.1)

Valid responses = 91

An examination of the per capita consumption distributions shows that of those who consumed shellfish the distribution was skewed to the left as indicated by the comparatively low consumption per capita per annum. The per capita consumption for fish was skewed slightly to the left with the majority of the consumers reporting a per capita consumption level of 3.1-6.0 kg per annum, although a sizeable proportion consumed between 9.1-12.0 kg. The per capita distribution for chicken was skewed to the right with a majority of households reporting a per capita consumption level of 9.1-12.0 kg per annum. The per capita consumption of chicken per annum (6.2 kg) was almost double that of fish at 3.5 kg per annum.

Table 3.16 Percentage of Respondents Eating Chicken, Shellfish and Fish in Palmerston North in 1979

	kg/capita/annum						
	0	0.1-3.0	3.1-6.0	6.1-9.0	9.1-12.0	12.1-15.0	>15.0
	%	%	%	%	%	%	%
Chicken	8.8	4.4	9.9	20.9	47.3	4.4	4.4
Fish	8.8	8.8	42.9	20.9	16.5	1.1	1.1
Shellfish	63.7	17.6	17.6	1.1	0	0	0

Valid Responses = 91

3.10 DISCUSSION ON MEAT CONSUMPTION IN PALMERSTON NORTH IN 1979

3.10.1 Proportion of Households Using Different Meats

Whilst consumers have problems in estimating the amount of meat that they purchased, this was not the case when stating whether they bought a particular meat or not. A comparison has been made in Table 3.17 of the results obtained in 1974 and 1979 by Wilkinson in Palmerston North and Brodie in Christchurch in 1977.

Brodie's 1977 results and the present survey results are reasonably similar in terms of the proportion of households that consumed the various meats. As has been commented earlier the pork consumption by the survey sample was exceedingly high and so the proportion of households consuming pork and its various cuts was much higher than Brodie's

1977 results. Brodie found a much higher proportion of households serving beef roasts, but as a large number of beef cuts, particularly the roast cuts, were left off the 1979 survey form it is not surprising to see such a large difference in the households using the various beef cuts. Brodie also found a much higher proportion of households consuming lamb chops compared with the present survey. The higher proportion of households consuming continental smallgoods was not unexpected given the promotion and evident changes in eating habits in the country.

Table 3.17 Percentage of Households Consuming Various Meat Cuts in 1974, 1977 and 1979

	Percentage of Households Consuming Each Cut		
	Wilkinson Palmerston North 1974	Brodie Christchurch 1977	Wilkinson Palmerston North 1979
Beef	98.6	98.6	98.9
Lamb	75.6	84.8	78.0
Mutton	58.2	66.1	62.6
Pork	61.7	62.7	78.0
Grilling Steak	54.0	85.1	83.5
Casseroling Steak	44.0	82.1	78.0
Lamb Chops	50.0	78.2	59.3
Mutton Chops	34.0	56.8	47.3
Pork Chops	21.0	54.5	70.3
Beef Roast (Topside)*	47.0	81.3	58.2 *
Lamb Roast	47.0	66.1	63.7
Mutton Roast	37.0	56.7	62.6
Pork Roast	16.0	43.5	51.6
Mince (Beef)	47.0	85.1	85.7
Traditional sausage products	70.0	88.5	91.2
Continental sausages	7.3	15.6	27.5
Offal	40.5	45.0	68.1
Ham	50.5	68.5	81.3
Bacon	65.0	84.4	74.7
Poultry	49.0	86.9	91.2
Fish (includes shellfish)		83.7	91.2

* Note: Not truly indicative of beef roast consumption as insufficient roast cuts were included in the present survey.

The results from Brodie's survey and the present survey are quite different to the 1974 survey results. This is not surprising as a small number of cuts were included in the 1974 survey compared to the 1979 survey. The survey methodologies were also different - the 1974 survey was a telephone survey where people had a very short time to give a considered answer; moreover the 1974 survey was conducted during the winter months, a time when ham and particularly luncheon-type sausage consumption is low. Given the differences in the survey methodologies, the difference in the time of year and the limited number of meat cuts included in the 1974 survey it is not surprising that the survey results were different to Brodie's 1977 survey and the 1979 survey.

Consequently the results of the 1974 survey cannot really be compared with the other two surveys.

3.10.2 Hierarchy of Meats in Palmerston North in 1979

If the meats are arranged in descending order of the proportion of households serving each meat as in Table 3.18 it is evident that with a few exceptions the per capita per annum consumption of each meat also declines in a very similar order from the most often consumed chicken at 6.2 kg/capita/annum (91.2% of households) to beef hearts at 0.1 kg/capita/annum (2% of households). There are exceptions, particularly the roasts, where the per capita consumption is high for these meats compared with the other cuts in spite of the smaller proportion of households consuming the roasts.

It is evident from the survey that if there was a substantial reduction in the number of households serving roasts, this would cause a marked drop in the national average per capita consumption of red meats. The households actually consuming the roasts had a markedly higher meat intake than the households eating the other cuts. It would appear that with roasts, household members consumed more meat than when fixed quantities of meat were served with each meal as would be the case with steaks and chops. Roasts also offer the opportunity for providing meat for lunches and other main meals.

The questions arise "why does the hierarchy of household consumption exist for these meats?" "Why are all the meats not eaten by 90% or more

of the households?" There must be reasons for the relative acceptability ratings of the different meats. The reasons or causes for the relative positions of the meats cannot all be the same because there were whole muscle meats and comminuted meats, meats from the same species in the high, medium and low acceptance categories. The reasons for this hierarchy must be elucidated. Possible variables that are common to all meats and to specific meats must be isolated to improve the marketing of meat and therefore increase the success of reversing the decline in sheep meat consumption that has been observed since 1976. The elucidation of the various factors is also essential for successful new product development as it would help the product developer to concentrate on only those variables that are of importance to the consumer and this would guarantee a more effective and efficient development environment.

Table 3.19 Hierarchy of Meats

	Proportion of Households Consuming Meat %	Consumption of Each Meat Per capita/per kg/Per annum
Chicken	91.2	6.2
Fish	91.2	3.5
Beef Mince	85.7	3.2
Wienersnitzel	84.6	2.0
Corned Beef	80.2	4.4
Beef Sausages	79.1	2.7
Stewing Steak	78.0	3.2
Luncheon	76.9	1.4
Rump Steak	73.6	3.2
Pork Chops	70.3	3.3
Porterhouse Steak	69.2	2.3
Saveloys	67.0	2.0
Leg of Lamb	63.7	3.7
Pork Sausages	60.4	1.6
Lamb Loin Chops	59.3	2.2
Sliced Ham	59.3	1.1
Lambs' Fry	59.3	1.8
Topside Steak	58.2	3.1
Ham Steak	53.8	1.7
Ham-on-the-Bone	52.7	11.2
Leg of Hogget	52.7	5.4
Leg of Pork	51.6	7.6
Middle Bacon	50.3	1.1
Lamb Forequarter	47.3	2.0
Hogget Loin Chops	47.3	2.0
Pork Pieces	47.3	1.9
Shoulder Bacon	42.9	0.9
Ham-and-Chicken	38.5	1.0
Lamb Neck Chops	36.3	1.4
Shellfish	36.3	
Hogget Forequarter	35.2	2.9
Lambs' Kidney	34.1	0.6
Hogget Neck Chops	29.7	1.4
Hamburger	28.6	0.8
Leg of Mutton	26.4	2.8
Mutton Loin Chops	22.0	1.2
Salami	17.6	0.3
Black Pudding	17.6	0.4
Mutton Neck Chops	17.6	0.8
Garlic Sausage	16.5	0.5
Beef Tongue	16.5	0.8
Mutton Forequarter	15.4	1.2
Tripe	11.0	0.3
Frankfurters	11.0	0.2
Beef Heart	2.0	0.1

3.11 CHANGES IN MEAT CONSUMPTION OVER THE PERIOD 1979-1985 AS OBSERVED BY RESPONDENTS IN PALMERSTON NORTH

Consumers in the January 1985 survey were asked to state what changes they had made to their meat consumption over the period 1979-85. Approximately 55.5% of the respondents stated that they had reduced their meat consumption levels, 41.3% stated that their meat consumption levels had either remained the same or increased, whilst 3.2% were unsure. Table 3.19 provides details of the changes that the sample had made to their meat consumption.

Table 3.19 Degree of Change in Meat Consumption Level in Palmerston North over the Period 1979-1985

Change in Meat Consumption 1979-85	Percentage of Respondents
Increased significantly	6.4
Increased moderately	7.9
Increased slightly	6.4
Remained the same	20.6
Decreased slightly	22.2
Decreased moderately	23.8
Decreased significantly	9.5
Unsure	3.2
Number of respondents	126

Whilst some (20.7%) had increased their meat consumption significantly, the majority of respondents had decreased their meat consumption either slightly or moderately. Details of the changes in consumption of each meat have been provided in Table 3.20.

Table 3.20 Percentage of Respondents in Palmerston North Changing their Meat Consumption Levels over the Period 1979-1985

Meat Cut	Eat More in 1985	Eat the Same in 1985	Eat Less in 1985
Frying steak	22.6	29.0	48.4 *
Stewing steak	20.7	43.1	36.2
Roasts of beef	10.0	20.0	70.0 *
Mince	21.3	44.3	34.4
Corned beef	13.1	36.1	50.8 *
Lamb chops	13.8	53.4	32.8
Leg of lamb	14.0	33.3	52.6 *
Mutton and hogget chops	20.0	36.4	43.6
Mutton and hogget legs	9.1	43.6	47.3 *
Lamb, hogget & mutton shoulder	9.1	43.6	47.3 *
Pork steaks	14.0	30.0	56.0 *
Pork chops	16.4	32.7	50.9 *
Roasts of pork	9.3	24.1	66.7 *
Sliced ham	15.5	50.0	34.5
Ham steaks	16.0	36.0	48.0 *
Bacon	17.2	43.1	39.7
Whole chicken	37.1	33.9	29.0
Chicken pieces	37.3	33.3	29.3
Fish	31.7	36.7	31.7
Shellfish	7.3	33.3	53.7 *
Fresh sausages	22.4	51.7	25.9
Saveloys/polonies	13.7	43.1	43.1
Luncheon-type sausage	14.8	48.1	41.3
Salami	16.7	35.7	47.6
Eggs	33.3	38.7	27.0
Cheese	46.8	38.7	14.5
Beans/nuts	21.3	57.4	21.3
Bread	38.1	47.6	14.3
Pasta	38.8	38.8	22.4

Seventy per cent and 76% of the respondents reported a reduction in the consumption levels respectively of beef roasts and pork roasts during the period 1979-1985, whilst over 50% reported a reduction in their consumption levels of corned beef, leg of lamb, pork steaks, pork chops and shellfish. Over 40% of the respondents reported that they reduced their consumption levels of frying steaks, mutton and hogget chops, mutton and hogget legs and shoulders, ham steaks, saveloys, luncheon-type sausage and salami.

Over 30% of the respondents reported an increase in their consumption levels of fish, eggs and cheese, all alternatives to red meat as a protein source. Bread and pasta consumption also increased, 39% of the respondents eating more bread and 39% eating more pasta. As shown in Table 3.20 it would appear that a high proportion of the respondents had cut their consumption levels of most red meats with mince, stewing steaks, lamb chops, sliced ham, bacon and fresh sausages showing the smallest per capita decline. With the exception of sliced ham and bacon, the above cuts are the cheapest meats. However, ham and bacon whilst being expensive meats are generally purchased in small quantities of 250 g or so at a time and may not seem to be quite so expensive to the consumers as a large quantity of rump steak.

3.12 COMPARISON OF PER CAPITA CONSUMPTION LEVELS FOR 1979-1985

The per capita consumption figures for the 1979 and 1985 surveys are presented in Table 3.21. Per capita consumption of beef, pig meat, offal and fish were all lower for the 1985 survey compared to the 1979 survey results. Pig meat per capita consumption levels for the 1985 survey were similar to the national consumption levels (N.Z. Dept. of Statistics: Monthly Abstract of Statistics, June 1985). Sheep meat per capita consumption levels together with chicken were up slightly on the 1979 survey results.

A high proportion of the respondents (over 50%) had reported a drop in per capita consumption over the period 1979-1985 and this was reflected in the per capita consumption levels of red meat, 80.4 kg/capita/annum for the 1985 survey compared to 94.5 kg/capita/annum for the 1979 survey - a drop of 14.8% over the 5-year period.

Table 3.21 Meat Consumption per Annum in Palmerston North, 1979-1985

Meat	Percentage of Respondents Eating Meat		Mean Meat per Capita Consumption per Annum kg/capita		
	1979	1985	1979	1985	Change %
Beef	98.9	98.0	25.6	22.9	-10.5
Lamb	78.0	71.4	9.4	10.5	+11.7
Hogget/mutton	68.6	52.4	18.0	18.7	+3.9
Total pig meat	96.7	92.6	28.9	14.2	-50.9
Pork	78.0	79.0	12.8	5.6	-56.3
Ham	81.3	87.3	14.0	5.1	-63.6
Bacon	74.7	92.1	2.0	3.6	+80.0
Offal	68.1	9.5	3.6	0.9	-75.0
Chicken	91.2	94.5	6.3	7.5	+21.0
Fish	94.5	94.5	4.2	3.7	-11.9
Sausages	91.2	82.5	9.0	13.2	+46.7
Total red meat	98.9	98.0	94.5	80.4	-14.8
Total all meats			103.8	91.6	-11.8
Vegetarian	1.1	2.0			

3.13 COMPARISON OF HIERARCHICAL RATINGS FOR MEAT CUTS FROM 1979-1985

In the 1979 survey it was found that certain cuts of meat, such as chicken, fish, beef mince and corned beef were eaten by over 80% of all the households included in the survey, whilst others were only consumed by a very small proportion of households. Although fewer cuts were included in the 1985 survey, a comparison of the results of the two surveys has been presented in Table 3.22.

Table 3.22 Comparison of Hierarchical Ratings for the Meat Cuts from the 1979-1985 Surveys in Palmerston North

Meat	Proportion of Households Consuming Meat			
	1979	1985	Change	
	%	%	%	
Chicken	91.2	90.5	-0.8	
Fish	91.2	81.0	-11.2	
Beef mince	85.7	87.3	+1.9	
Corned beef	80.2	69.8	-13.0	
Beef sausages	79.1	82.5	+4.3	
Stewing steak	78.0	77.8	-0.3	
Luncheon	76.9	57.1	-25.7	
Rump steak	73.6	90.5	+27.4	
Pork chops	70.3	55.6	-20.9	
Saveloys	67.0	47.6	-29.0	
Leg of lamb	63.7	54.0	-15.2	
Pork sausages	60.4	82.5	+36.6	*
Lamb loin chops	59.3	71.4	+20.4	
Sliced ham	59.3	87.3	+47.2	*
Lambs' fry	59.3	57.2	-3.5	
Topside steak	58.2	65.1	+11.9	
Leg of hogget	52.7	38.1	-27.7	*
Leg of pork	51.6	28.6	-44.6	*
Middle bacon	50.3	92.1	+83.1	*
Lamb forequarter	47.3	47.6	-0.1	
Hogget loin chops	47.3	52.4	+10.8	*
Pork pieces	47.3	42.9	-9.3	*
Shoulder bacon	42.9	92.1	+114.7	**
Ham and chicken	38.5	57.1	+48.3	*
Shellfish	36.3	15.9	-56.2	*
Hogget forequarter	35.2	47.6	+35.2	*
Lambs' kidney	34.1	30.1	-11.7	
Leg of mutton	26.4	38.1	+44.3	*
Mutton loin chops	22.0	38.1	+73.2	*
Salami	17.6	22.2	+26.1	
Tripe	11.0	6.0	-45.5	

It can be seen from Table 3.22 that the market penetration or hierarchical ratings of the meat cuts was quite fluid over the period 1979-1985. If percentage changes in excess of ±5% are considered as significant, then it can be seen that very few meats retained their hierarchical ratings. These included chicken (-0.8%), beef mince (+1.9%), beef sausages (+4.3%), stewing steak (-0.3%), lambs' fry (-3.5%) and lamb forequarter (-0.1%). All the other meats either decreased or increased their hierarchical ratings over the period 1979-1985. The meats to increase their ratings were: rump steak (+27.4%), pork sausages (+36.6%), lamb loin chops (+20.4%), sliced ham (+47.2%), topside steak (+11.9%), middle bacon (+83.1%), hogget loin chops (+10.8%), shoulder bacon (+114.7%), ham-and-chicken (+48.3%), hogget forequarter (+35.2%), leg of mutton (+44.3%), mutton loin chops (+73.2%) and salami (+26.1%). With the exception of hogget forequarter, leg of mutton and, to a lesser extent topside steak, all the cuts to increase their hierarchical ratings could be classified as convenience cuts. Leg of mutton and hogget forequarter were two of the cheapest cuts and so it was not totally unexpected to see an increase in ratings for these two cuts given the difficult economic times over the period 1982-1985.

The cuts to show a decrease in hierarchical rating over the period 1979-1985 were: fish (-11.2%), corned beef (-13.0%), luncheon (-25.7%), pork chops (-20.9%), saveloys (-29.0%), leg of lamb (-15.2%), leg of hogget (-27.7%), leg of pork (-44.6%), pork pieces (-9.3%), shellfish (-56.2%), lambs' kidney (-11.7%) and tripe (-45.5%). With the exception of fish, luncheon, saveloys, shellfish and lambs' kidney the remaining meats could be classified as roasting or non-convenience meats. The price of fish and shellfish has risen quite markedly over the period 1979-1985 (N.Z. Department of Statistics, Monthly Abstract of Statistics, 1980-1985) and so it was not surprising to see a decline in the hierarchical rating of these two products. Why saveloys, luncheon and lambs' kidney had declined in hierarchical rating was unclear.

To summarise, it would appear as though consumers had generally turned to more convenience meats and less of the roasting meats over the period 1979-1985, though there were a number of exceptions to this rule. The more convenient and versatile meats such as chicken, beef mince, stewing steak and beef sausages had shown virtually no change in their hierarchy ratings over this period 1979-1985.

The ratings for the two bacon products, i.e. middle and shoulder bacon both showed marked increases in their hierarchical ratings over the period 1979-1985. This increase in market penetration could have been due to the extensive Q-Mark Bacon campaign that had been conducted during much of the latter part of 1984 by the Pork Marketing Board. In spite of the Trim Pork marketing campaign all the pork cuts had shown a 20% or more decline in hierarchical rating over the period 1979-1985.

3.14 DISCUSSION

One of the objectives of the present study was to establish the trends in consumption of each meat type and if possible the trends in consumption of specific meat cuts so that the trends in the consumption of a meat type could be traced to one or more cuts of meat and hence specific marketing and development programmes could be developed to combat the decline in consumption of the specific meat type - the sheep meats and mutton in particular.

If an examination is made of the results of Yandle's (1967), Wilkinson's (1974), Brodie's (1977) and the present 1979 and 1985 surveys some quite clear-cut trends have emerged in the per capita consumption of meat in general, specific meats and indeed specific cuts. The nine-year period 1976-1985 has witnessed a decline in per capita consumption of red meat which has been partially replaced by an increase in per capita consumption of chicken (N.Z. Department of Statistics: Monthly Abstracts of Statistics, 1970-1985). Per capita consumption of mutton, however, started to decline in 1970 and continued to do so until 1978. During this 8-year period per capita consumption of mutton declined from 36.7 kg/capita/annum to 19.5 kg/capita/annum - a 46.9% decline (N.Z. Department of Statistics: Monthly Abstract of Statistics, 1970-1985), but has since levelled off at this figure. The per capita decline in mutton consumption was initially matched by an increase in consumption of beef, lamb, pig meat and chicken until the year 1976, but since then the national statistics have indicated a per capita decline in beef and pig meat comsumption. These figures are substantiated by the comparison between the 1979 and 1985 survey results. The Pork Marketing Board claims that per capita consumption of pig meat has risen steadily over the period 1981-1985. It claims that the Trim Pork marketing campaign in

1981 and the newly-launched Q-mark Bacon campaign in 1984 have been responsible for this steady rise (personal communication, 1985). However, neither the national statistics nor the two survey results substantiate this claim for Palmerston North at least.

The comparison between the 1979 and 1985 per capita consumption figures for each meat (see Table 3.21) showed that beef consumption had fallen by 10.5% (2.7 kg/capita/annum) whilst lamb consumption had increased by 11.7% (1.1 kg/capita/annum), mutton by 3.9% (0.7 kg/capita/annum) and chicken by 21.0% (1.3 kg/capita/annum). It appeared as though consumers chose to use lamb, mutton and chicken to replace part of the beef in their diet. Over the period 1983 to 1985 retail beef prices have tended to rise faster than those for lamb, mutton and chicken largely because the U.S.A. market tends to be the price setter for beef prices, being the largest market for New Zealand beef exports. The July 1984 New Zealand devaluation together with the exchange differences between New Zealand the the U.S.A. have ensured domestic retail beef prices have been high vis-a-vis the prices for lamb, mutton and chicken. Moreover, the country has had difficulties in disposing of all the lamb and mutton stocks and this has contributed to the sluggish rise in the prices of lamb and mutton. The survey results appear to substantiate the observations made by McShane (1973) who observed that the relative price of one meat against another had a large bearing on the substitution effect of one meat for another.

There have also been definite consumption trends for the various cuts within meat species over the period 1965-1985. Brodie (1977) when comparing his results with those of Yandle (1967) noted that Christchurch households had decreased their per capita consumption of most roasts, replacing them with a smaller quantity of the convenience cuts such as frying steaks and chops of lamb, mutton, hogget and pork. Wilkinson also noted very similar trends when comparing the 1974 and 1979 results - though the large differences in survey methodology and questionnaire content made strict comparisons between the two surveys difficult.

A comparison between the 1979 results and those from the 1985 survey also confirmed the observations made by Brodie that people were consuming less of the roasts and replacing them with a smaller quantity of the

convenience cuts such as frying steaks, chops and sausages. However, the survey also showed that consumers in Palmerston North at least were replacing a portion of their meat consumption with some of the non-meat alternatives such as cheese, eggs, bread and pasta.

However, the 1985 survey also showed that a majority of the consumers reported a decline in per capita consumption of most of the meats that were included in the survey. Prior to the 1985 survey it had been possible to say that the decline in per capita consumption of beef, mutton, lamb and hogget could largely be attributed to the decline in consumption of the large roast cuts of each meat and their replacement with a smaller quantity of the smaller convenience cuts which was also the reason for the overall decline in per capita consumption of red meat. The 1979 and 1985 survey results showed that consumers of the roasts tended to have higher meat consumption levels than non-roast consumers. However, the 1985 survey results showed that consumers in Palmerston North in addition to decreasing their consumption of the roasting cuts as had been observed in other surveys had also decreased their consumption levels of most of the other cuts, i.e. a decrease in consumption of all meats and not just specific meat cuts. In line with traditional economic theory, it could be argued that the consumers had decreased their consumption levels of most meats because of the economic conditions prevailing in New Zealand over the period 1982-1985 when net income of the average New Zealander declined relative to price increases; and that once the consumers had a net gain in their net income relative to price increases, their meat cut consumption levels could increase in proportion to the net income gain to price ratio. However, the overall trend for a decline in per capita consumption of red meat would appear to be too entrenched to simply be reversed by a net gain in per capita income and that there appear to be other factors which are also responsible for the long-term trend and that efforts should be made to establish what these factors are and their relative contribution together with price and income to the overall decline in per capita consumption of meat.

3.15 CONCLUSIONS

A number of conclusions can be drawn from the 1979 and 1985 survey results. These include:

* Per capita consumption of red meat has been observed to decline over the period 1970-1979; this trend was continued for the period 1979-1985. The 1970-1979 drop in per capita consumption could be traced to a per capita decline in sheep meat consumption, particularly that for mutton which declined by 46% over the period. Within each meat species, the decline could be attributed to a per capita decline in the consumption of the roast cuts and their partial replacement with more convenience cuts. However, the 1985 survey in addition to confirming the above trends for the 1979-1985 period, also suggested that consumers had decreased their per capita consumption of all meat cuts and replaced them with protein alternatives such as cheese and eggs, and even bread.

* The 1985 survey also confirmed McShane's (1973) observations that the relative price of one meat against another had a large bearing on the substitution effect of one meat for another - beef per capita consumption was observed to fall over the period 1979-1985 to be replaced by an equivalent consumption of mutton, lamb and chicken, meats that were all relatively cheaper than beef.

* The only red meat cuts to retain the same per capita consumption levels in 1985 compared with 1979 were the cheaper cuts such as mince, stewing steak and fresh sausages which would tend to suggest that the drop in net per capita income had had a marked effect on per capita consumption of meat.

* An analysis of the long-term trends in meat consumption together with the shorter-term trends observed over the 1979-1985 period would suggest that there were a number of structural changes being made by consumers to their meat consumption patterns and that economics was not the only influence for these changes and the results suggested that efforts should be made to quantify and understand these changes so that the trends could be reversed.

* The decline in per capita consumption of roasts was a major contributor to the overall decline in per capita consumption of each meat type. Efforts should be made to reverse this trend as it would firstly ensure that consumers ate more of a particular red meat at the main meal and also ensure that meat competed for the other meals during the day which appear to have been cornered by cheese and bread. Reversing the trend offers all sorts of marketing and product development opportunities. From a marketing perspective efforts should be made to set up a chain of retail shops throughout the main centres that would offer pre-roasted meals to be taken away by consumers, thus building into the roasts an aspect of convenience that is already provided for chicken with the Kentucky Fried Chicken outlets. New product opportunities exist to overcome many of the defects that appear to exist with some of the sheep meat and pork roasting cuts; however additional research would be needed to clearly characterise these defects.

* The main and worrying aspect to arise from the analysis was the long-term decline trend in per capita consumption of red meat and the serious problem of how best to market meat in the 1980's in the face of this very serious problem.

PART 2

THE EFFECT OF SOCIO-ECONOMIC VARIABLES ON THE CONSUMPTION OF MEATS

This section of the thesis examines the buying of meat and the effect of socio-economic variables on the buying of meat. Chapter 4 studies the meat consumption of a group of respondents in Palmerston North in 1979 and 1985; and also examines the effects of household size, number of adults in the household, children of various ages, income of the principal income-earner, age of respondent and stage of family in the 'family life-cycle' on the consumption of meat. It establishes which of the above socio-economic variables were responsible for the consumption of each meat cut in the households selected for the 1979 survey. Chapter 5 examines the consumption patterns of low, medium and high consumers of meat in general and specific meat groups to see whether for instance low beef eaters also consumed low levels of the sheep meats and pig meats as well. The chapter also studies the socio-economic characteristics of high, medium and low users, firstly of meat in general and secondly of individual meat types. Chapter 6 studies the reasons people gave for changing their meat consumption between 1979 and 1985.

CHAPTER 4

THE INFLUENCE OF SOCIO-ECONOMIC VARIABLES ON THE CONSUMPTION OF MEAT IN PALMERSTON NORTH

The aim of this chapter was to look at the consumption of meat in Palmerston North by examining the effects of a number of socio-economic characteristics of the consumer on the consumption of meats.

The first objective was to investigate the effects on per capita consumption of such socio-economic factors as household size, number of adults in household, children of various ages in household, income of the principal income earner, occupation of the principal income earner, age of the respondent, stage of the family in the 'family life-cycle', and to establish which, if any, of the above socio-economic factors were responsible for determining the meat consumption patterns of households in Palmerston North.

The overall objective was to more clearly characterise the Palmerston North meat consumers and hence identify specific market segments for new meat products.

4.1 INTRODUCTION

Baron (1976), in an extensive review of the literature on the behaviour of consumers to meat, particularly the work of Rhodes et al. (1956) and Lancaster (1966), stated that any of the traditional economic behavioural models, based on the socio-economic variables and household composition, usually only accounted for 20% of the observed variation in the consumer behaviour. A similar figure was obtained by Baron et al. in 1981. Baron (1976) concluded from his review that there must be other influential factors apart from income, family composition, age of the respondent and other socio-economic variables that were important in meat consumption behaviour.

However, in spite of these conclusions, other surveys on household meat consumption have found differences between households of different socio-economic compositions. Studies carried out in New Zealand by Market Research (NZ) Ltd. (1962), Yandle (1967), Wilkinson (1974), and

Brodie (1977) together with two Australian studies carried out by the Australian Bureau of Economics (1967, 1970) all showed that, at some point in time at least, there were differences in per capita consumption of a number of cuts and indeed some meats depending on the socio-economic variable that was under study. For instance, the two Australian studies and that of Yandle (1967) showed that per capita consumption of lamb, beef and pork increased with increasing income of the principal income earner.

The main problem has been the fact that per capita consumption of cuts rather than the meats themselves have changed with socio-economic variables and even these observed changes have not been consistent across the socio-economic variables. The other problem relates to the fact that the householders may fall into a number of socio-economic groupings and it is difficult to separate the effects of one variable from another unless a sample size of at least 1000 respondents is used for a study.

4.2 THE SURVEYS

The aim of the surveys was to determine household meat consumption in Palmerston North and the effect on household meat consumption of various socio-economic characteristics of the consumers. These consumer surveys were conducted in the months of November and December 1979, and October 1984 through to January 1985.

Nine-two respondents completed the 1979 survey and 126 completed the 1984/85 survey.

The respondents were asked the same questions in both the 1979 and 1984/85 surveys. The respondents were provided with a list of 45 meat cuts which pilot studies had shown to be the most frequently consumed cuts of each meat type or product type. They were also provided with space at the bottom of the page to include any cuts that their household consumed which were not included in the list of 45 meat cuts. Alongside each meat cut were two columns on which the respondents could write down the amount of each meat cut consumed by their household at each meal and in the second column the frequency of consumption of each of the 45 meat cuts. When providing details of the amount of meat consumed by their

household at each meal the respondents were allowed to either give the weight or the monetary value of the meat consumed at each meal. In addition, the respondents were also asked their household composition in terms of the number of adults, their ages, the number of children, their ages, and the number of people working in the household together with their occupation and income. The respondents were also asked to state their birthplace and how long they had been living in New Zealand if they were born overseas.

The questionnaire is shown in Appendix 2.1.

4.2.1 Determination of Per Capita Per Annum Meat Consumption

Price lists were obtained from as many retail outlets as possible. The respondents were asked to state from what retail outlet they mainly purchased their meat. If the respondent provided consumption details in monetary terms, then the relevant retail outlet price list was used to convert the monetary meat consumption data to actual weights of meat. The total amount of meat eaten by each household at each meal was then calculated from the monetary value or taken as the weight given in the form by the respondent. The respondents provided details of the frequency of consumption of each of the 45 cuts of meat. These figures were transformed to give annual consumption frequency figures. The annual consumption frequency figures for each meat were then multiplied by the respective weights of each meat cut eaten at each meal to give an annual household meat consumption figure for each meat cut. This annual household meat consumption figure was then divided by the number of people, including children in each household, to give an annual per capita consumption estimate for each of the 45 meat cuts (kg/capita/annum). No attempt was made to differentiate between children of different ages, between children and adults and between the sexes in determining the average meat consumption per capita households. The object of the procedure was to generate data comparable to the national per capita meat consumption figures which do not take into consideration such factors as the age of children etc. in the estimation of the per capita per annum consumption of meat.

4.2.2 The 1979 Survey Sample

The households in the sample consisted mostly (69%) of 3- and 4-member households with 2 adults and 1 or 2 children mostly below the age of 10, as shown in Table 4.1.

The sample was biased towards the typical New Zealand young family of mother, father and two children under 10. It did not represent the one-member household or the large family.

The respondents were women, 81.3% in the 20-40 age bracket, with 13.2% above 40 years of age and 4.4% under 20. The principal income earners in the households were salary and wage earners (87.9%), of which 18.7% were managerial and 26.4% were professional people. A large proportion of the sample was drawn from kindergarten and church groups and it would appear that wives of professional and managerial men play a very active role in these associations. Hence the heavy bias towards these groups in the sample.

Table 4.1. Household Structure of Survey Sample (1979 Survey)

Number of People in Households (Adults or Children)	Total People	Adults	Children under 2	Children 2-10	Children over 10
		% of Households in Sample			
None	-	-	60.4	69.2	91.2
1	2.2	2.2	38.5	25.3	6.6
2	13.0	84.4	1.1	4.4	1.1
3	21.7	8.9	-	1.1	1.1
4	46.7	3.3	-	-	-
5	13.0	1.1	-	-	-
6	2.2	-	-	-	-
7	1.1	-	-	-	-
Total	99.9	99.9	100.0	100.0	100.0
Valid Responses	92	92	92	92	92

Seventy-seven per cent of the sample had incomes between $8,000 and $18,000 per year so that they were mostly in the middle income groups when compared with the national income statistics.

Eighty-one per cent of the sample were born in New Zealand, 8.8% in the Pacific Islands and 5.5% in the United Kingdom. To sum up, this was a sample of typical New Zealand young family households with a rather higher proportion of managerial and professional occupations than in the general population. It cannot be regarded as either a statistical sample of the New Zealand population or a representative sample of the total New Zealand population.

The survey sample consisted mainly of New Zealanders who were in the 20-40 age bracket and came from either the trades (22.0%), managerial (18.7%) or professional (26.4%) classes and as a consequence of this the sample had a disproportionate number of principal income earners earning more than $14,000 per annum (36.3%). As a result of the age structure of the sample, i.e. the high proportion of people in the 20-40 age group, the sample tended to be biased towards families with children in the under-10 age group. The proportion of households with both husband and wife working was not too dissimilar to the national situation.

Clearly then, the sample was not a mirror of the socio-economic status of the national population. It would have been fortuitous if the sample had reflected the national population as the aim in obtaining the sample had been to find respondents who were capable of answering the three difficult survey questionnaires and in particular had the perseverence and motivation to spend up to 8 hours answering one of the questionnaires. One hundred and fifty people actually started the first questionnaire, but only 92 people had the perseverance to finish all three questionnaires. The sample size of 92 for the survey was not really large enough to examine the various socio-economic parameters in any great detail, because if there was significant variation within groups then it would be impossible to draw any meaningful results from the survey unless the differences between groups were gross. The details of the sample are shown in Appendix 4.1.

4.2.3 The 1985 Survey Sample

The households in the 1985 survey sample were more representative of the total population than the 1979 survey sample and as a consequence the 3- and 4-member households only accounted for 44.4% of the total (see Table 4.2).

Table 4.2 Household Structure of Survey Sample (1985 Survey)

Number of People in Households (Adults or Children)	Total People	Adults	Children under 2	Children 2-10	Children over 10
		% of Households in Sample			
None	-	-	82.5	65.1	71.4
1	7.9	12.7	17.5	17.5	19.0
2	28.6	65.1	n.a.	12.7	7.9
3	20.6	15.9	n.a.	4.8	1.6
4	23.8	4.8			
5	12.7				
6	3.2				
7	1.6				
Did not answer	1.6	1.6			
Total	100.0	100.0	100.0	100.0	100.0
Valid Responses	124	124			

The sample included 7.9% single-member households and 28.6% two-person households - 6.3% of which were solo parents with 1 child. The sample also included 17.5% of households with 5 or more members.

The respondents were women, 68.2% in the 20-40 age bracket - less than the 1979 survey - with 30.1% above 40 years of age and with no respondents under the age of 20. The principal income earners in the sample were wage and salary earners - 12.7% of whom were labourers, 20.6% clerical people, 22.2% in technical or trades-related occupations, 12.7% in managerial functions, and 3.2% were professionals and a further

3.2% were self-employed people. Seventeen and a half per cent of the sample were receiving some sort of benefit or other.

Apart from the high proportionof the sample who earned in excess of $30,000 per annum (17.5% of sample), the remaining incomes tended to follow a normal distribution with the mean at an income between $14,000-$17,000 - the national average annual income for males in New Zealand (New Zealand Department of Statistics: Monthly Abstract of Statistics, June 1985).

Almost 43% of the principal income earners had no qualifications, whilst 19.0% had a trade certificate, and 24.7% had a diploma or higher qualification.

Ninety-seven per cent of the sample were caucasian and only 1.6% were Maori with the remainder of unknown ethnic background. Approximately 73% of the respondents described themselves as moderates, 17.5% as traditionalists and 7.9% as feminists. In all the sample was a better representative sample of the whole population than the 1979 survey sample. The details of the 1985 sample can be found in Appendix 4.2.

4.2.4 Analysis Method

The per capita consumption of each cut of meat (45) was examined to see if there was any difference in per capita consumption of each of the cuts of meat between households of differing size; households with differing numbers of children under 2, between 2 and 10 and children over the age of 10; households with respondents of differing age; households with differing incomes, and households where the principal income earners had differing occupations.

One-way Analysis of Variance was used as it allows the researcher to statistically test whether the means of the sub-samples into which the sample data are broken are significantly different from each other; i.e., the use is testing the null hypothesis that:

$$(H_0) \quad : \quad y_1 = y_2 = \ldots = Y_k = y$$

If themeans are not significantly different then it is assumed that the differences or deviations which occur are the result of sampling error. Conversely, if the means are significantly different then the null

hypothesis that the true sub-population means are equal is rejected. The actual testing is done by comparing the computed F ratio (F = between groups mean square/within groups mean square), which is reported in the Analysis of Variance table, to the known sampling distribution of the F ratio.

The SPSS Breakdown procedure was used to analyse the data as this procedure has a one-way Analysis of Variance option.

4.3 EFFECT OF HOUSEHOLD COMPOSITION ON MEAT CONSUMPTION IN 1979 AND 1985 SURVEYS

4.3.1 Total People in Household (1979 Survey)

The 1979 survey picked up only two 1-person households, one 7-person household and two 6-person households. The majority (43 households) were 4-person households. (See Appendix 4.3)

The per capita consumption of a large number of cuts was significantly different at 99.99% confidence level and not just 95% confidence level. If the 6- and 7-person households were excluded from the analysis because the sample size of 3 was statistically insignificant, per capita consumption of total red meat tended to rise with increasing household size. However there was no uniform pattern of the consumption of the various cuts by households.

Some meats, such as all the lamb cuts and the steaks increased in per capita consumption with increasing household size; other meats, such as stewing steak tended to decline in per capita consumption with increase in household size from 2-person to 4-person households and then plateau with larger household sizes; other meat showed a cyclic pattern with increasing household size. In spite of the patterns of per capita consumption of the various meat cuts by household size, the overriding trend was for an increase in per capita consumption of the various cuts with increase in household size from 2 to 5 persons. This finding is contrary to the two Australian Bureau of Agricultural Economics studies conducted in Australia in 1967 and 1970 which found that per capita consumption of beef stew and mince tended to increase with increasing

household size. All other meat cuts showed a decrease with increasing household size.

4.3.2 Children Under 2 (1979 Survey)

Fifty-five households were included in the survey that did not have any children in the under 2 age category. There were 33 with 1 child under 2 and two with 2 children under 2. These two categories were combined to give 35 households with 1 or more children under 2.

Analysis of variance showed that there were very few cuts of meat where the per capita consumption of households with children under 2 was statistically different to those households with no children in this category. The few exceptions were shellfish (and hence total fish) and salami which were significant at the 95% and 99% levels respectively. Consumption of leg of hogget, pork pieces, saveloys and total continental sausages were significantly different at the 90% confidence level.

Households with children under 2 tended to eat less meat than households with no children under 2. However, they ate slightly more roasts and less convenience meats than households with no children. Households with no children under 2 ate more beef, mutton, pork pieces, sliced ham, bacon, chicken, fish, fresh sausages, traditional cooked sausages, eg. saveloys, steaks and continental sausages than households with children under 2. However, households with children under 2 ate more topside steak, hogget, lamb, mutton and pork roasts than households with no children in the under 2 age bracket. (See Appendix 4.4)

4.3.3 Families with Children Between 2 and 10 (1979 Survey)

A breakdown of the survey sample showed that there were 38 households with no children in the 2-10 years group, 23 households with 1 child in this age group, 25 households with 2 children, 1 household with 3 children and 5 with 5 children in this age group. (See Appendix 4.5)

Analysis of variance of households with none to 3 children in the 2-10 age bracket against per capita consumption of the various cuts of meat showed that there were very few cuts where there was a statistically significant difference in the per capita consumption of the different households. Hamburgers and lamb neck chops were the only two cuts that showed a statistically significant difference at the 95% confidence

level. Beef tongue and pork sausages showed a statistically significant difference between the groups at the 90% confidence level.

In general, total per capita meat consumption tended to increase with increasing numbers of children in the 2-10 age group in the household as did the consumption of the convenience meats. The per capita consumption of roast meats did not show a marked increase in consumption with increasing household size of children in the 2-10 age bracket.. Total steak, beef, corned beef, lamb, mutton, sheep meat, pork chops, pork pieces, sliced ham, offal, pork sausages, total fresh sausages, hamburgers and luncheon, all showed a per capita consumption increase with increasing numbers of children in the 2-10 age bracket. Per capita consumption of hogget and ham-on-the-bone showed a very slight decrease with increasing numbers of children in the 2-10 age group.

4.3.4 Households with Children over the Age of 10 (1979 survey)

A breakdown of the survey sample showed that there 78 households with no children over the age of 10, six with 1 child, six with 2 and two with 5 children in the over-10 age group. The two families with 5 children over the age of 10 had a per capita consumption in excess of 300 kg per annum, substantially higher than the other families with with children over the age of 10 and so the two families were left out of the analysis.

Analysis of variance indicated a very large number of cuts where the difference between the groups of households was significantly different.

Total per capita consumption of meat was substantially higher in households with no children over the age of 10, 103 kg per capita per annum compared with households with 1 child over 10 at 53 kg per capita per annum, and with 2 children at 84 kg per capita per annum. In general, the per capita consumption for all meats tended to be highest in those households without any children over 10, then came those households with 2 children over 10 and households with only 1 child over 10 had the lowest per capita consumption of all household sizes. The two exceptions were chicken and continental sausage, where households with only one child over 10 had the highest per capita consumption of these two meats. Households with children over 10 tended to serve very few roasts with a per capita consumption of 9.3 kg per capita per annum compared to

29.9 kg per capita per annum for households with no children over the age of 10. Total sausage consumption was lowest for households with no children over 10 and highest for those households with 2 or more children over 10. (See Appendix 4.6)

4.3.5 Summary of 1985 Findings on the Effect of Household Composition on Meat Consumption

An examination of the meat consumption of various sized households for the 1985 survey showed the following:

* Households with children under 2 tended to eat slightly less meat than households with no children under 2. Roasts of various sorts tended to be consumed more often and convenience meats less often in households with children under 2. Consumption of cuts such as pork pieces, salami and shellfish was also lower in households with younger children.

* Total per capita meat consumption tended to rise as the number of children in the household increased. The consumption of convenience meats tended to remain constant over all household sizes. Consumption of offal, mainly lambs' liver and kidney, tended to increase with the number of children in the household. Beef hearts were never served in households containing children of any age group. The consumption of rump, porterhouse steaks and corned beef also increased with increasing numbers of children in the household. However, consumption of topside and stewing steak tended to decline with increasing children in the household.

* Total meat consumption per capita was significantly less for households with children over the age of 10, though per capita meat consumption tended to rise with increasing numbers of chidren. Less convenience and roast meats were served in households with children over the age of 10. Most of the increase in sausage consumption appeared to be due to an increase in the quantity of cooked-type sausages rather than to an increase in the consumption of fresh sausages. Offal consumption was lower, as was the consumption of pork, mutton, hogget, lamb and beef. Chicken consumption was the exception, with households with

children over the age of 10 consuming more than those with no children over the age of 10.

The above findings for the 1985 survey were very similar to the results of the 1979 survey. (See Appendix 4.6)

4.4 EFFECT OF AGE OF RESPONDENT ON MEAT CONSUMPTION IN 1979 AND 1985 SURVEYS

A breakdown of the 1979 survey sample by age of respondent gave five households with the respondents under the age of 20, forty-eight in the 20-29 age bracket, twenty-six in the 30-39 age bracket and six in each of the 40-49 and 50-59 age groups. Only one respondent over the age of 60 completed the survey in spite of many more being included in the original sample.

The total meat consumptions per capita for the 20-29 and 30-39 age groups were very similar to the sample mean. However, the consumption of the 40-49 age group was almost double the sample mean, whilst the under 20's group (all unmarried women) was 52.3% less than the sample mean. Consumption of convenience cuts tended to increase with increasing age of the respondent up to the age of 50 after which per capita consumption started to decline. The under 20's consumed 82.4% less convenience meats than the 40-50 age group, the highest meat-consuming group. Roast meat consumption levels also increased with age of the respondent up to 50 and then also declined with increasing age as with the convenience meats. The 30-39 age group consumed marginally less roasting meat than either the 20-29 or 40-49 age groups.

The under 20's group consumed no porterhouse steak, lamb forequarter, hogget forequarter and neck chops, mutton chops, pork pieces and leg roasts, ham-on-the-bone, ham steaks, shoulder bacon, shellfish, beef offals, and most of the sausage products. Their consumption level of all other cuts was also very small compared to the other groups.

With the exception of topside and stewing steaks, the per capita consumption of all the other steak cuts was lowest in the under 20's group and largest in the 30-39 age group after which it showed a gradual

decline with age of the respondent. Topside and stewing steak consumption was highest in the 40-49 age group as was total steak and beef consumption. The 20-29 age group had a comparatively high corned beef consumption though the 40-49 age group had the highest per capita consumption of all age groups.

The consumption of lamb cuts tended to be lowest for the under 20's group and to rise, though gradual, with increasing age to the 40-49 age bracket before decreasing with increasing age of the respondent. With both the hogget and mutton cuts, the same general trend was observed, except the 30-39 age group's consumption of each cut was always lower than either the 20-29 or 40-49 age group's. The same pattern held true for all the pig meat cuts, except the 50-59 age group which had the second highest per capita consumption level of the groups for most of the pig meat cuts.

All the other cuts tended to follow the same pattern of growth with increasing age of the respondent as was observed for the hogget and mutton cuts.

Chicken consumption was practically constant across all groups.

The present survey when compared with the 1974 Wilkinson survey tends to indicate that the younger housewives, i.e. the under-40's were not purchasing as much meat as the same group did in 1974.

It is obviously important to find out whether the differences were due to the variation in the people who were respondents for each of the surveys (quite possible due to the method of selecting respondents for each of the surveys) or whether in fact the difference in meat consumption, i.e. the reduction in meat consumption, was a permanent change. If it were a permanent change then the national average per capita consumption figures for red meat should have shown a decrease in per capita consumption for subsequent years. This did in fact occur indicating that the trends observed in the 1979 survey were not quirks of the survey sampling procedure but indications of what was happening.

4.4.1 Summary of 1985 Survey Findings on the Effect of Age of Respondent on Meat Consumption

Household consumption was found in the 1985 survey to be highly dependent on housewife age. Per capita consumption was lowest for the under 20's and highest for the 40-49 age group. The 30-39 group was an anomaly because their consumption did not follow the general pattern. Meat consumption tended to drop off for households with respondents over the age of 50. The one exception was the pork cuts where the 50-59 age group had a very high pork consumption. These conclusions are identical to those of the 1979 survey (Appendix 4.7).

4.5 FAMILY LIFE CYCLE AS IT APPLIES TO MEAT CONSUMPTION

Wells and Gubar advanced the concept of the 'family life cycle' in 1966. They argued that there were 7 distinct stages through which a family progresses and that the family's requirements for consumer durables and consumables could be characterised by the stage at which a family happened to be in. Their seven stages are shown below:

1. The bachelor stage;
2. Newly-married couples: young married couples with no children;
3. The full nest 1: young married couples with youngest child under the age of 6;
4. The full nest 2: young married couples with youngest child over the age of 6;
5. The full nest 3: older married couples with children still at home;
6. The empty nest: older married couples with no children still at home;
7. The solitary survivor.

None of the previous studies examined per capita consumption of meat in the light of the 'family life cycle' concept. The result of Wilkinson's studies (1979, 1985) together with the results of Hughes' 1975 study carried out in the U.K., all showed that per capita consumption of certain cuts of meat and meats was dependent on the age of the respondent, household composition, and the age of the children in the household. For most households in New Zealand the above three variables are interrelated.

For both the 1979 and 1985 studies per capita consumption of total meat, principal meats and many of the cuts was seen to be dependent on the age of the housewife. The under 20's group, i.e. the young unmarrieds, ate very little meat - none of the steaks, roasts or pork cuts. The 20-29 age group, all of whom were married, consumed substantially more meat than either the under 20's or the 30-39 age groups, including more roasts, the sheep meats, pork cuts and steaks. The 40-49 age group, allof whom had only teenage children, had the highest per capita consumption of all groups. The 50-59 age group consumed less meat per capita than either the 20-29, 30-39 or the 40-49 age groups. The over 60's generally consumed even less meat than the 50-59 age group.

Wilkinson's 1979 and 1985 studies showed quite different trends compared with the two Australian Bureau of Economics (1967, 1970) studies for the effect of household composition on per capita consumption of meat. The two Australian studies showed an increase in per capita consumption from one-person to two-person households, but then a decline thereafter with increasing household size. However, Wilkinson's two studies did show that per capita consumption of cuts such as steaks and the convenience cuts of pork tended to decrease with increasing household size whilst the consumption of all sausage products tended to increase with increasing household size and these findings were very similar to the two Australian studies (1967, 1970). Wilkinson's two studies together with the two Australian studies (1967, 1970) did show that the newly-married couples consumed more meat than either the young singles or the solitary survivors.

The 1985 and 1979 studies did not use the same age basis as Gubar and Wells (1966) to define the first, second and third stages of the 'family life cycle'; instead families with children under the age of 2, 2-10 and over 10 were used as the basis for defining the three stages of the life cycle. Families with children under the age of 2 ate more meat than families with older children. The difference appeared to be due to a much higher consumption of roasts by the families with children under 2 because they consumed less of the convenience meats than families with older children. Moreover, families with children under the age of 2 ate a much smaller variety of meats than families with older children. This

lack of variety of meats in the diet of families with young children under the age of 2 could either be a result of the young children themselves curtailing the time that the housewives have for the preparation of meals or it could be an experience effect as most of the respondents with children under the age of 2 tended to be in the 20-29 age group, i.e. still learning something about the range of meats available and how best to cook them.

The number of children in the 2-10 age bracket did not appear to affect the range of cuts consumed in the household, but did affect the total amount of meat consumed in the household, with per capita consumptionincreasing with increasing numbers of children in the 2-10 age group in the household. The effect of the numbers of children in the household over the age of 10 had quite a marked effect on the range and amount of meat consumed in the household, with meat consumption and the range of cuts decreasing with the increase in numbers of children over the age of 10 in the household. The households with 2 or more children over the age of 10 consumed large quantities of the sausage products compared to other households.

4.6 EFFECT OF OCCUPATION AND INCOME OF THE PRINCIPAL INCOME EARNER ON PER CAPITA CONSUMPTION OF MEAT IN 1979 AND 1985 SURVEYS

The two variables, i.e. income and occupation of the principal income earner tend to be dependent except for one or two highly paid labouring jobs, such as freezing workers and some tradespeople, where the labourers get paid more than many managerial and professional people. Wilkinson's 1979 and 1985 studies showed that per capita meat consumption of respondents tended to increase with increasing income up to a certain income ($14,000 for the 1979 survey and $18,000 for the 1985 survey) and to then level off threafter. The people earning more than the critical maximum income tended to purchase more of the expensive cuts such as the steaks and pork cuts rather than increase their total meat consumption. Per capita consumption of the convenience cuts followed the same pattern as total per capita meat consumption, except the $14,000 - $17,999 group in the 1979 survey and the $20,000 - $23,999 group in the 1985 survey, who consumed the most convenience meats of all the groups. Households on less than $6,000 (1979) and

$10,000 (1985) consumed only 45% of the total per capita meat consumption of the $10,000 - $13,999 (1979) and $14,000 - $17,999 (1985) group.

The over $18.000 group in 1979 and over $24,000 in 1985 consumed approximately 13% more rump steak than the next highest group, 45% more porterhouse steak, slightly more hogget, pork chops and leg of pork.

In the case of the 1985 survey, which had been conducted after most income earners had experienced a real drop in income, the lower income earners (less than $10,000) had increased their consumption of mutton and sausage products - two relatively cheap meats compared to beef and pork.

In the 1979 survey it was found that self-employed people tended to have the highest per capita consumption of meat of all the occupational groups; a similar result was observed for the 1985 survey. Managerial people tended to have the second highest per capita consumption of all the groups as found in the 1979 survey. The managerial group also consumed a large quantity of the expensive steaks, other convenience cuts and the more expensive roasts of pork and beef. Labourers, as with the 1979 survey were found to consume low amounts of beef and higher quantities of mutton and hogget than any other group, and also fresh sausages. Clerical staff ate moderately high amounts of the convenience meats but ate little in the way of roasts, particularly the legs and forequarters of all the sheep meats, except topside. Once again these findings were almost identical to the results of the 1979 survey (Appendix 4.8).

4.7 DISCUSSION

Wilkinson in the 1974 survey in Palmerston North found that with the exception of pork, the per capita consumption of beef and sheep meat tended to follow a general pattern; high for the under 30's group, a decline in the 30-49 age group and an increase in the 50-59 age group before decreasing thereafter with the age of the respondent. The per capita consumption of most pig meat products tended to increase with age of the housewife before declining sharply for the over 60's. The per

capita consumption of chicken products tended to increase with age of the housewife, to be highest for the over 60's age group. Women in the under 30's age group tended to use less frying steak than older women and more roasts of beef, legs of hogget and mutton than older women. This was definitely not the case with the present studies.

Hughes (1976b) found that young, single women in the 18-25 age group felt that they needed to eat less meat than males of a comparable age. This finding was substantiated by both the 1979 and 1985 surveys where the under 20's age group, all of whom were single men and women, ate very little meat compared to the other age groups. However, once they were married they increased their meat consumption substantially compared to their single days, not only in terms of total meat consumed, but also in the variety of meat cuts. The amount of meat consumed and the variety tended to increase with age until the respondents reached the age of 50 at which stage the amount and the variety decreased quite markedly and this trend continued with age with the over 60's consuming about as much meat as they did in their early single days with as much variety too.

Both the 1979 and 1985 surveys when compared with the 1974 survey tend to indicate that the younger housewives, i.e. the under 40's, were not purchasing as much meat as the same group did in 1974. It is obviously important to find out whether the differences were due to the variation in the people who were respondents for each of the surveys (quite possible due to the method of selecting respondents for each of the surveys) or whether in fact the difference in meat consumption, i.e. the reduction in meat consumption, was a permanent change.

The results of the 1979 and 1985 studies were very similar to the findings of the two Australian Bureau of Economic studies (1967, 1970) and those of Hughes (1976) in terms of per capita consumption of meat increasing with increasing income and then levelling off, with further increases in income resulting in people switching to the more expensive cuts such as the beef steaks, and certain pork cuts. In Australia and New Zealand the lower income people tended to eat relatively large quantities of the cheaper beef cuts such as stewing steak, beef mince, mutton and the sausage products whilst lower income groups in the U.K. tended to consume chicken, canned meats and the cheaper cuts of all

meats. However, this is a reflection of the relative prices of the different meats in the three countries.

Yandle (1967) in the survey carried out in Christchurch found that per capita expenditure on poultry, non-carcase meat, lamb and beef went up with increased income. Yandle also found that the consumption of bacon, ham and pork only increased marginally with increased income. The results of this 1979 survey and the one carried out in 1974 (Wilkinson) suggested that the consumption of bacon, ham, and pork cuts increased as much as any other cut with increased income. Yandle reasoned that this very small increase in expenditure on bacon, ham and port with increasing income was in part due to the way that the meats were used; bacon because it was used in conjunction with other meats as a flavouring meat, and pork and ham because they were used to provide variety.

Yandle (1967) also found that the lower income groups had comparatively low per capita consumption of the more expensive cuts, though tending to cut down on all meats while still eating most of the cuts for the sake of variety. The same comments would appear to have held for both the 1979 and 1985 surveys, as no income group was observed to have a very restricted meat consumption pattern, particularly the under $6,000 income group who, because of limited disposable income, were the most likely group to have a restricted meat consumption pattern.

4.7.1 Criticism of the 1979 and 1985 Studies

The 1979 and 1985 studies suffered from a number of defects which are summarised below:

* The method of sampling, particularly of the 1979 survey was not representative of the New Zealand population;
* The 1979 survey sampling procedure was not based on any statistical basis, but was instead designed to obtain a group of highly motivated and intelligent people who could answer three very long and difficult questionnaires;
* The 1985 survey tended to be biased towards respondents who purchased their meat from supermarkets as a result of the method of selecting a portion of the sample from supermarket shoppers;
* The sample size of both the 1979 and 1985 studies - 92 and 126 respectively - was too small to effectively study the various

socio-economic variables independently from each other. However, this was to be expected since the objective of the survey was to examine analytical techniques which could be applied to the study of new product development. Sample sizes in excess of the numbers used for the two studies would have been much too large for some of the techniques that have been studied in subsequent chapters such as Multidimensional Scaling (MDS).

4.7.2 Recommendations for Future Studies

The two studies identified certain relationships between per capita consumption of total meat, principal meats and specific meat cuts and socio-economic variables such as age of the respondent, stage in the 'family life cycle', income of the principal income earner and structure of the households. However, these relationships are only valid for respondents in Palmerston North. Furthermore, the sample sizes of both the 1979 and 1985 studies were so small that is was not possible to examine the effects of the various socio-economic variables independently from one another.

A national study should be carried out in the near future with the objective of examining the inter-relationships between per capita consumption of total meat, principal meats and cuts of meat the the various socio-economic variables. If a sample size of 2000 were used it would not only be possible to make regional comparisons, but also be possible to effectively study the various socio-economic variables independently from one another. Such a study would confirm or refute some of the findings of the present two surveys which were conducted in Palmerston North.

4.8 CONCLUSIONS

The 1979 and 1985 studies indicated that per capita consumption of total meat, principal meats and specific meat cuts was affected by the socio-economic status of the households. Age of the respondent, income of the principal income earner and the composition of the households were identified as being the most important socio-economic variables. However, the effects of the various socio-economic factors were not expressed uniformly across all meat cuts and this made segmentation of

the sample on the basis of one or more of the socio-economic variables extremely difficult.

It would appear that per capita consumption of meat and indeed the range of cuts is controlled by the stage at which the family happens to be 'in the family life-cycle' proposed by Gubar and Wells (1966). It was shown in both the 1979 and 1985 studies that households at different stages in the life cycle appeared to consume differing amounts of meat and also a different range of meats.

CHAPTER 5

PER CAPITA CONSUMPTION OF MEAT BY LOW, MEDIUM AND HIGH MEAT CONSUMERS IN 1979 IN PALMERSTON NORTH

The aim of this chapter was to look at the consumption of meat in Palmerston North by examining the per capita consumption of total meat and the principal meats by low, medium and high consumers.

The first objective was to investigate the per capita consumption of all meat cuts by the respondents when the sample was arbitrarily divided into three approximately equal groups based on their total meat consumption to see whether there was some uniform trend in the consumption of all cuts when moving from the low to the high meat-consuming group.

The second objective of the chapter was very similar to the first except the sample was arbitrarily subdivided into three equal groups based on the respondents' consumption of the three principal meats: beef, sheep meat and pig meat.

The third objective was to more clearly characterise the Palmerston North meat consumers and hence identify specific market segments for new meat products.

5.1 INTRODUCTION

In Chapter 4 it was shown that segmenting the sample of respondents on the basis of their socio-economic status was not particularly helpful in identifying market segments for which new meat products could be developed because there was no uniform response in per capita consumption of all or most of the meat cuts to a change in one or more of the socio-economic variables. An alternative method of segmenting the market had to be found if one of the major objectives of the study was to be satisfied, namely the identification of specific market segments for which new meat products could be developed.

Luck (1979) showed that consumption could be used as a basis for segmenting a market. However, as none of the previous studies in New

Zealand (Yandle, 1965; Wilkinson, 1974; Brodie, 1977) or indeed overseas studies (The Australian Bureau of Economics, 1967; 1970; Baron et al., 1973; Hughes, 1975a, b; Gendall, 1978; Baron et al., 1981) had segmented their sample on the basis of the respondents' desirability or indeed the suitability of undertaking the proposed analysis for the study of per capita consumption of meat.

5.2 THE SURVEY

The 1979 survey results reported in Chapter 4 were used for the analysis. The per capita consumption of meat cuts by the low, medium and high meat consumers of total meat, beef cuts, sheep meat cuts and pig meat cuts were analysed by one-way Analysis of Variance to see whether there was any difference in per capita consumption of the various meats between the members of the various sub-groups.

5.2.1 Analytical Method

The sample was sequentially broken into three approximately equal groups, firstly on the basis of total meat consumption, secondly on the basis of total beef consumption, thirdly on the basis of total sheep meat consumption and finally on the basis of total pig meat consumption. The three groups were high, medium and low meat consumers of the above meat categories. The basis for the assignment of the respondents to the various meat consumption groups is shown below in Table 5.1.

Table 5.1 Basis for the Assignment of the Respondents to Various Meat Consumption Groups

Meat	Low Meat Consumers kg/capita/annum	Medium Meat Consumers kg/capita/annum	High Meat Consumers kg/capita/annum
Total meat	<66.0	66.0 - 120.0	>120.0
Total beef	<12.0	12.0 - 17.0	>17.0
Total sheep meat	<15.0	15.0 - 24.0	>24.0
Total pig meat	<6.0	6.0 - 15.0	>15.0
No. of respondents in 1979 survey	30	32	33
No. of respondents in 1985 survey	40	61	25

The amounts of meat for each sub-group were chosen for the 1979 survey so that an approximately equal number of the respondents would be grouped in each sub-group. The weights of meat used in the 1979 survey were then retained so that the two surveys could be compared. The per capita consumption of the 45 meat cuts of the three meat-consuming groups were then compared by the SPSS (Version 9) Breakdown procedure to see if there were any significant differences in the per capita consumption of each cut between the three groups.

5.3 MEAT CONSUMPTION PATTERNS OF LOW, MEDIUM AND HIGH MEAT CONSUMERS IN PALMERSTON NORTH IN 1979

The meat consumption patterns of low, medium and high total meat consumers is presented in Table 5.2. A similar analysis was completed for the low, medium and high consumers of beef, sheep meat and pig meat. The results of these latter analyses can be found in Appendices 5.1, 5.2 and 5.3 respectively.

The modal values for each of the socio-economic characteristics have also been presented in Table 5.2. The socio-economic characteristics of the majority of the high and medium total meat-consuming groups were very similar with respect to household size, number of children, age of respondent and income of the principal income earner. However, the low total meat-consuming group tended to be mainly made up of three-member households - 2 adults and 1 child - with the principal income earner's salary equivalent to the average annual salary for males in 1979, i.e. $8,000 - $9,000, whilst the salaries of the other two meat-consuming groups was generally above the average annual salary.

An examination of Table 5.2 indicates that total per capita beef consumption increased linearly from 16.4 kg/capita/annum for the low meat-consuming group to 36.1 kg/capita/annum for the high total meat-consuming group. However, there were a few cuts of beef that demonstrated trends that were exceptions to this general rule. These included wienersnitzel, stewing steak and beef mince.

In the case of wienersnitzel the medium and high meat-consuming groups ate about the same amount at 2.2 - 2.3 kg/capita/annum, which was higher than the consumption of the low meat-consuming group at 1.4 kg/capita/annum. With stewing steak and beef mince, two of the cheaper beef cuts, per capita consumption was highest for the high meat-consuming group and similar for the low and medium meat-consuming groups. Total steak consumption, as with total beef consumption, tended to rise linearly from 8.8 kg/capita/annum for the low meat-consuming group to 18.7 kg/capita/annum for the high meat-consuming group.

Total lamb consumption, like total beef consumption, tended to rise linearly with total meat intake, increasing from 3.4 kg/capita/annum for the low meat consumers to 14.7 kg/capita/annum for the high meat consumers. The two chop cuts were the exception to this rule. With both cuts, the medium and high meat consumers ate similar amounts which were higher than for the low meat-consuming group.

Total hogget consumption, together with consumption of all four hogget cuts, showed a linear increase in consumption with increasing total meat intake from 3.1 kg/capita/annum to 26.0 kg/capita/annum for the high

Table 5.2 Socio-economic Characteristics and Meat Consumption Pattern of Low, Medium and High Meat Consumers

Socio-economic Characteristic	Whole Sample	Low Meat Consumers < 66.0	Medium Meat Consumers 66.0-120.0	High Meat Consumers >120.0	Significance %
Total People in household		3	4	4	
No. of children		1	2	2	
Age of respondent		20-29	20-29	20-29	
Income of principal income earner $/annum		8,000-9,999	10,00-13,999	10,000-13,999	
Meat	kg/capita/annum	kg/capita/annum	kg/capita/annum	kg/capita/annum	
Wienersnitzel	2.0	1.4	2.3	2.2	73.0
Rump steak	3.2	2.0	3.2	4.3	98.4
Porterhouse steak	2.2	1.0	2.6	2.8	99.9
Stewing steak	3.2	2.8	2.7	4.4	97.4
Topside steak	3.1	1.6	2.8	5.1	99.63
Total steaks	13.7	8.8	13.6	18.7	99.9
Beef mince	3.2	3.0	2.8	4.0	94.4
Corned beef	4.4	2.2	3.6	7.7	99.9
Total beef	22.1	16.4	23.4	36.1	99.9
Lamb forequarter	2.0	0.7	2.4	2.7	99.0
Lamb neck chops	1.3	0.7	1.5	1.6	78.7
Lamb loin chops	2.0	1.7	2.0	1.9	99.9
Leg of lamb	3.6	0.8	3.0	7.1	99.6
Total lamb	9.2	3.4	9.2	14.7	99.9
Hogget forequarter	2.9	0.9	1.4	7.2	99.9
Hogget neck chops	1.4	0.6	1.1	2.5	98.5
Hogget loin chops	2.0	0.9	1.5	3.7	99.9
Leg of hogget	5.4	0.8	2.5	12.6	99.9
Total hogget	11.6	3.1	7.5	26.0	99.9
Mutton forequarter	1.0	0.1	0.8	2.3	95.5
Mutton neck chops	0.7	0.5	0.3	1.7	99.5
Mutton loin chops	1.0	0.3	0.6	2.2	97.5
Leg of mutton	2.5	0.2	1.7	5.9	99.9
Total mutton	5.2	1.1	3.3	12.1	99.9
Total sheep meat	28.5	9.2	22.0	56.8	99.9
Pork chops	3.3	1.0	3.6	5.0	99.9
Pork pieces	1.9	0.8	2.0	2.7	83.7
Leg of pork	7.8	1.0	5.4	17.9	99.9
Sliced ham	1.1	0.4	1.1	1.8	97.5
Ham-on-the-bone	10.3	0.3	10.9	18.8	99.9
Ham steaks	1.6	0.5	1.5	2.7	99.0
Middle bacon	1.1	0.9	1.0	1.4	31.5
Shoulder bacon	1.0	0.5	0.8	2.0	86.4
Total pig meat	28.0	5.5	26.3	52.2	99.9
Fish	5.5	2.7	3.4	4.3	95.9
Shellfish	0.6	0.2	0.7	0.9	90.4
Chicken	5.9	4.5	5.9	7.4	98.1
Total non-red meat	10.0	7.4	10.0	12.6	
Beef tongue	0.7	0.1	0.7	1.2	91.9
Beef heart	0.1	0.0	0.2	0.0	46.5
Tripe	0.2	0.0	0.2	0.6	94.6
Lambs' fry	1.9	1.3	1.4	3.2	97.1
Lambs' kidney	0.6	0.4	0.6	0.8	41.6
Total offal	3.5	1.8	3.1	5.8	
Beef sausage	2.8	2.3	2.4	3.9	83.7
Hamburger	0.7	0.3	0.6	1.1	91.2
Pork sausage	1.6	0.8	1.7	2.3	99.5
Luncheon	1.3	0.9	1.6	1.3	79.2
Ham-and-chicken	1.0	0.3	0.7	2.1	93.7
Salami	0.3	0.1	0.5	0.1	80.4
Frankfurters	0.2	0.0	0.2	0.4	86.8
Saveloys	2.0	0.8	2.3	2.8	99.9
Black pudding	0.3	0.1	0.5	0.4	67.6
Garlic sausage	0.4	0.1	0.3	0.9	77.5
Total sausage	7.2	3.2	7.6	10.2	99.9
Total meat	99.3	43.5	92.4	173.7	
Valid Responses	92	30	32	30	

meat-consuming group. The low meat-consuming group ate almost a ninth less than the high meat-consuming group.

With the mutton cuts as with the other sheep meat cuts the consumption increased linearly with increasing total meat consumption for all but the mutton neck chops where the low and medium meat-consuming groups ate about the same per capita which was substantially less than the high meat-consuming group. The high meat-consuming group ate 4 times as much mutton per capita as the medium meat consumers and almost 12 times more than the low meat consumers.

Per capita consumption of all the pig meat cuts increased linearly with increasing total meat consumption. The per capita consumption of the most expensive pig meat cuts, i.e. leg of pork and ham-on-the-bone was substantially higher for the high meat consumers than the low meat consumers. The high meat consumers ate twice as much pig meat as the medium meat consumers and 10 times more than the low meat consumers.

In the case of fish, shellfish and chicken, per capita consumption of these cuts tended to increase linearly with increasing per capita consumption of meat - the high meat consumers ate 70% more of the non-red meats than the low meat consumers and only 26% more than the medium meat consumers.

The per capita consumption of the offal cuts, with the exception of lambs' fry, was very small compared to the other meats, though per capita consumption of these cuts too tended to increase with increasing per capita consumption of total meat.

Though per capita consumption of the total sausage products increased linearly with increasing per capita consumption of meat, there were a number of exceptions to this rule. These exceptions included: beef sausages; luncheon; salami, and black pudding. With salami, luncheon and black pudding the medium meat-consuming group had the highest per capita consumption followed next by the high meat-consuming group and then the low meat-consuming group. In the case of beef sausages, the low and medium meat-consuming groups ate about the same, which was less than the high meat-consuming group.

To summarise, the high meat consumers, i.e. those eating more than 120 kg/capita/annum, consumed more of all the principal meats and practically all the meat cuts than the medium meat-consuming group, who in turn consumed more of all the principal meats and cuts than the low meat-consuming group. The biggest difference between the three groups in terms of per capita consumption was with the three sheep meats and the pig meats, where the high meat consumers ate almost 10 times more of the four principal meats than the low meat consumers. The same general trends were evident for the separate analyses of low, medium and high consumers of beef, sheep meat and pig meat.

5.4 COMPARISON OF PER CAPITA CONSUMPTION OF MEAT BY LOW, MEDIUM AND HIGH CONSUMERS OF BEEF, SHEEP MEAT AND PIG MEAT

The results of this analysis are presented in Table 5.3. The table shows firstly that if consumers ate a small amount of either beef, sheep meat or pig meat then they also ate comparatively small amounts of all the other cuts of meat compared to the respective medium and high meat-consuming groups. Similarly, the medium meat-consuming group, if they ate a medium quantity of either beef, sheep meat or pig meat then they also ate a medium amount of all the other cuts of meat compared to the high meat-consuming group.

If the respondents ate a medium or high amount of beef then their total per capita consumption of meat tended to be significantly less than if they ate a medium or high amount of either sheep meat or pig meat. Beef per capita consumption was generally higher than the other principal meats and so it would appear that if the respondents cut back on their beef intake they did not quite replace their reduced beef intake by a per capita increase of either sheep meat or pig meat.

An examination of the medium and high meat-consuming groups indicated that individuals with reduced total beef intake tended to have a slightly lower consumption of each of the other meat cuts and hence a lower total meat consumption, when compared with the other medium and high meat-consumption groups. High pig meat consumers tended to also have a very high sheep meat consumption and vice versa. Total beef consumption tended to be relatively constant across each of the medium and high meat-consuming groups - the medium beef-consuming group was the one exception where the beef consumption level was substantially lower than the beef consumption level in the medium pig and sheep meat sub-groups.

An examination of the medium and low meat-consumption groups indicated that if per capita consumption of one of the major meats was low, then this was replaced in the diet by the other two major meats. The low beef-consuming group had a relatively high consumption of sheep meat and pig meat compared to the other low meat-consuming groups.

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Table 5.3 Comparison of Meat Consumption by Low, Medium and High Total Meat, Beef, Sheep Meat and Pig meat Consumers (kg/capita/annum)

Meats	Whole Sample	Low Total Meat	Low Total Beef	Low Total Sheep Meat	Low Total Pig meat	Medium Total Meat	Medium Total Beef	Medium Total Sheep Meat	Medium Total Pig meat	High Total Meat	High Total Beef	High Total Sheep Meat	High Total Pig meat
Total Steaks	13.7	8.8	5.1	10.4	9.9	13.6	9.4	14.8	16.4	18.7	16.1	15.4	14.4
Total Beef	22.1	16.4	7.3	18.1	17.7	23.4	12.9	26.0	27.4	36.1	26.4	29.3	27.2
Total Lamb	9.2	3.4	5.1	3.6	4.2	9.2	6.5	7.9	7.0	14.7	10.4	13.6	11.7
Total Hogget	11.6	3.1	4.3	1.4	3.1	7.5	9.6	6.2	13.4	26.0	13.4	20.9	14.2
Total Mutton	5.2	1.1	4.0	0.6	0.5	3.3	3.1	2.4	5.1	12.1	5.7	9.8	7.1
Total Sheep Meat	28.5	9.2	14.7	5.6	9.8	22.0	21.2	16.5	27.6	56.8	32.3	25.4	35.8
Total Pig meat	28.0	5.5	16.2	11.3	2.5	26.3	26.9	24.9	11.0	52.2	30.8	40.7	42.5
Total Non-red Meat	10.0	7.4	7.4	8.7	7.7	10.0	7.5	8.6	6.3	12.6	10.9	10.8	11.1
Total Offal	3.5	1.8	0.9	1.7	2.4	3.1	2.0	4.2	3.3	5.8	4.0	5.3	3.9
Total Sausages	7.2	3.2	5.1	3.6	3.2	7.6	3.8	8.1	7.7	10.2	8.0	9.0	8.5
Total Meat	99.3	43.5	51.6	49.0	43.3	92.4	74.2	88.3	83.3	173.7	111.4	120.5	129.0

5.5 DISCUSSION

The present study showed that it was possible to subdivide the sample of respondents into three segments based on the per capita consumption levels of meat by the respondents. Low meat consumers were shown to eat relatively small quantities of all meats, medium meat consumers medium levels of all meats and high meat consumers large amounts of all meats. In other words the study showed that it was possible to create three distinctly different market segments based on the amount of meat consumed by each segment. Moreover, unlike the market segmentation based on the socio-economic variables, there was a uniform response across all meats and meat groups, i.e. low total per capita meat consumption also meant low beef, low sheep meat, and low pig meat consumption, in fact low consumption of all cuts. Similarly with medium and high consumption of meat.

However, as only small differences were observed in the socio-economic status of the three meat-consuming groups, socio-economic status would not appear to be the major reason for the inclusion of households in one or other of the clearly identifiable market segments.

From a marketing and product development point of view it is absolutely essential to determine the reasons or factors that are responsible for the inclusion of households in one or other of the market segments. Whilst socio-economic factors must be and are implicated, there would appear to be other factors, such as the respondents' attitudes, beliefs, lifestyle, health concerns, peer pressure, and susceptibility to media pressure which are also responsible for the inclusion of households in the three segments.

A further study should be conducted to find out the characteristics of the members of each of the segments. This could involve up to 2000 respondents drawn from throughout the country, if the intention were to ascertain whether the three groups were evident in other parts of the country. A sample of 2000 would enable comparisons to be made not only between different groups but also between samples drawn from different parts of the country.

5.6 CONCLUSIONS

High meat consumers, i.e. those consuming more than 120 kg/capita/annum, eat large quantities of all cuts of meat. Medium consumers, i.e. those eating between 66 and 120 kg/capita/annum eat medium levels of all meats and those eating less than 66 kg/capita/annum eat small amounts of most meats.

Consumers who eat a small quantity of one of the major meats, say beef, also consume a relatively small amount of the other two major meats, i.e. sheep meats and pig meat, though their per capita consumption of sheep meat and pig meat is marginally increased to almost account for the drop in their beef consumption.

Low meat consumers generally have a lower annual income than members of the high and medium meat-consuming groups and their households generally consist of three members - 2 adults and 1 child.

Low meat consumers generally eat larger quantities of stewing steak and beef mince than medium meat consumers, though less of each cut than the high meat consumers. For the remaining meat cuts they tend to eat less of all meat cuts than the other two groups.

Medium meat consumers eat more wienersnitzel, beef heart, luncheon, salami and black pudding than the high meat-consuming group. With the remainder of the cuts the medium meat consumers eat less of them than the high meat consumers, but more of each than the low meat consumers.

An examination of the market on the basis of per capita consumption of meat offers a most effective method of segmenting the market.

CHAPTER 6

REASONS FOR CHANGES IN MEAT CONSUMPTION FROM 1979 TO 1985

The initial consumer survey was conducted in 1979 and during the course of the analysis it became apparent that there had been some major changes in per capita consumption of some meats over the period 1974 to 1979. The national per capita consumption statistics (New Zealand Department of Statistics: Monthly Abstract of Statistics 1985) showed that the changes which had occurred over the period 1974 to 1979 had continued over the period 1979 to 1982, and so in August of 1984 it became apparent that a further survey would have to be carried out to establish what had happened to per capita meat consumption over the period 1979 to 1985 and to establish, if possible, the causes for these changes in Palmerston North at least. The aim of this chapter then, was to identify, if possible, the major reasons for the changes that consumers in Palmerston North had made to their per capita consumption of meat over the period 1979 to 1984.

6.1 INTRODUCTION

An examination of the national statistics (see Table 6.1) for per capita consumption of red meat together with comments made by marketing executives of the large national supermarket chains clearly indicate that per capita consumption of red meat had declined over the period 1979-1982. Beef and pig meat showed the greatest per capita decline over this period. This trend of declining per capita consumption of red meat has not only occurred in New Zealand in recent years, but has also been evident in other western countries (Meat Processing, November 1984).

The trend could be of a short-term nature and be readily reversible simply as a result of an improvement in net disposable income of consumers. However, the trend could also be firmly established and be of a long-term nature that will require heavy advertising, promotion and new product development together with innovative marketing to overcome it. The fact that the trend has been evident for almost six years together with the adverse publicity concerning the health dangers of consuming meat that have appeared in the journals, newspapers,

magazines and TV over the period 1979-1984 suggest that the trend could be long term, continue and possibly accelerate.

Table 6.1 Per Capita Consumption of Red Meat 1978-1982

	Meat Consumption (kg/capita/annum)						
Year	Beef	Veal	Mutton	Lamb	Pig Meat	Offal	Total
1978	57.31	2.98	20.29	10.77	12.98	5.54	109.87
1979	51.34	1.95	20.42	11.02	12.14	5.53	101.85
1980	46.70	1.95	20.60	10.63	11.49	5.02	95.62
1981	45.46	1.20	19.87	9.24	10.09	5.02	90.88
1982	44.39	1.19	19.75	9.18	10.03	4.98	89.53

Source: New Zealand Department of Statistics, Monthly Abstracts of Statistics, May 1985.

The international implications of a per capita decrease in red meat consumption together with the decline in per capita consumption in New Zealand have very severe implications for the farming and related industries in New Zealand. It is obviously important to gain some understanding of the causes for the decline in per capita consumption of meat so that efforts can be made to at least halt the trend and hopefully overcome it. It was beyond the scope of the present study to examine the problem on an international, and even national basis; instead the problem was investigated in Palmerston North as the trend was evident locally and if reasons could be found for the decline in per capita consumption of red meat in Palmerston North, these same reasons could be cautiously advanced as being responsible for the per capita decline of red meat consumption throughout the country. Consequently, a survey was carried out in Palmerston North in January, 1985 to find out what changes people in Palmerston North had made to their meat consumption over the period 1979-1985 and the reasons for these changes.

6.2 SURVEY

The objective of the survey was to identify what changes people in Palmerston North had made to their meat consumption over the period 1979-1985, who had made the changes - wife, husband, children, what meats they had reduced and for what meats they had increased consumption, and the reasons for the changes and the relative importance of the reasons.

The method of sampling, and the number of respondents who were included in the survey have been outlined in Chapter 3.

The survey form included questions that elicited what quantity of each meat cut the respondents served in their households and the frequency of serving per month. Questions relating to the changes in consumption of each meat that had been made by the consumers over the period 1979-1984 and the degree of change were also included. The respondents were also asked who in the household had made the changes in the per capita consumption of meat. Finally the respondents were asked for possible reasons for the changes that people had made to their per capita consumption of each meat by way of free questions and structured questions. The respondents were then asked to rank the three most important reasons for the changes that they had made to their per capita consumption of meat.

Mindful of the importance of net disposable income in the per capita consumption of meat, the consumers were asked what they would do if they were to have more money left in their housekeeping. The intention was to find out if the respondents would purchase more meat or whether they would spend the additional money on other foods.

Details of the questionnaire are in Appendix 3.2. One hundred and twenty-six respondents completed the questionnaire.

6.2.1 Analytical Method

The two sets of survey forms, i.e. the mail and supermarket forms, were coded and entered into the computer separately. The data were analysed using the SPSS Frequency and Analysis of Variance programmes. The results from the two sets of data were compared and as the results were

very similar, the two sets of data were combined and analysed as one sample.

6.3 REASONS FOR DECLINE IN PER CAPITA CONSUMPTION OF MEAT

Consumers were asked to state the three most important reasons that were responsible for the changes in their meat consumption levels over the period 1979-1984. The results are presented in Table 6.2.

It would appear from Table 6.2 that no single reason was responsible for the changes that people made to the amount of meat they consumed in 1985 compared to 1979. The three main reasons cited as being responsible for the changes in meat consumption over the 5-year period were:

* Health;
* Price of Meat; and
* Change in Family Age.

Health and price of meat were the main reasons given for the decline in meat consumption, whilst some cited change in family age, i.e. children getting older, as being responsible for an increase in per capita consumption of meat. For some, of course, an increase in the age of the children meant that their children had left home and this was accompanied by a fall in per capita consumption in line with the findings of Chapter 4 where it was shown that respondents in the over 50 age group had started to reduce their per capita consumptions of meat compared to respondents from other age groups who had children.

The second group of reasons for changing per capita consumption of red meat were not so clear cut. Eighteen per cent of the respondents cited price as being the second most important reason, but lifestyle changes, awareness of alternatives to meat, health, less family income and change in the family age were all cited by between 6-10% of the respondents as being the second most important reason responsible for the changes in their per capita consumption over the period 1979-1984.

Table 6.2. Most Important Reasons for Changes to Meat Consumption Levels over Period 1979-1984.

Reason	Most Important Reason %	Second Most Important Reason %	Third Most Important Reason %
Change in family age	31.5	6.8	0.0
Price of meat	20.4	18.2	21.4
Family health	18.5	9.1	10.7
Doctor's advice	3.7	2.3	0.0
More income	3.7	2.3	0.0
Changed lifestyle	3.7	6.8	7.1
Fewer roasts	3.7	2.3	0.0
Aware of meat alternatives	1.9	13.6	7.1
Less family income	1.9	9.1	0.0
To stay in shape	1.9	4.5	3.6
More vegetarian meals	1.9	4.5	17.9
Different preference	1.9	2.3	3.6
Price of other food	1.9	0.0	3.6
Animal flesh (don't like handling)	1.9	0.0	0.0
Meat unnecessary	1.9	2.3	3.6
Smaller meals	0.0	2.3	0.0
Quality of meat	0.0	2.3	0.0
More nuts and beans	0.0	2.3	0.0
Same food budget	0.0	2.3	0.0
More meals away from home	0.0	2.3	0.0
Printed advice	0.0	2.3	3.6
Preparation time	0.0	0.0	10.7
Less meat for meal	0.0	0.0	3.6
More fish	0.0	0.0	3.6
Valid responses	126	126	126

Price of meat and more vegetarian meals were cited by approximately 17% of the respondents as being the third most important reasons for the changes made in their per capita consumption of meat. Health, preparation time, awareness of alternatives and changed lifestyles were other reasons cited by between 7-11% of the respondents as reasons for their changes in per capita meat consumption.

6.4 CHANGES IN FOOD CONSUMPTION PATTERN WITH INCREASING INCOME

Economic conditions in New Zealand over the period 1982-1985 have been difficult for the low and middle income earners and it was assumed that this had some limiting effect on the meat consumption levels of most households, and so the respondents were asked a hypothetical question of whether they would buy more meat if they had more disposable income. If they answered yes they would buy more meat, then they were asked "what meats would they buy?" and if the answer was no, "what other foods would they buy instead?" The results are summarised in Table 6.3.

Only 28.3% of the respondents stated that they would definitely increase their per capita consumption of meat if they had more money to spend on food and of these 43.5% stated that they would purchase more frying steaks, and a further 21.7% stated that they would purchase more whole chicken and roasts of beef. In no case was mention made of an increase in the consumption of sheep meat cuts.

However, a majority of the respondents, i.e. 53.3% of the respondents stated that they would not purchase more meat if they had more money in their housekeeping with which to purchase more food. Instead, these respondents stated that they would purchase more fruit (42.9%), vegetables (28.6%) and cheese (23.8%).

Eighteen per cent of the respondents were undecided as to whether they would increase their meat consumption given more money to spend in their housekeeping on food or whether they would buy other food items.

Table 6.3. Food Consumption Changes by the Respondents Given Increased Disposable Income

Whether Respondents would Purchase More Meat:

Yes	28.3%
Possibly	18.3%
No	53.3%

If Yes, More of What Meats?

Frying Steak	43.5%
Roasts of Beef	8.7%
Pork Steaks	4.3%
Pork Roasts	4.3%
Whole Chicken	8.7%
Fish	21.7%
Bacon	8.7%

If no, What Other Foods?

Cheese	23.8%
Pasta	4.8%
Vegetables	28.6%
Fruit	42.9%

Valid Responses 126

6.5 CHANGES IN FOOD CONSUMPTION BY LOW, MEDIUM AND HIGH MEAT CONSUMERS

The sample was subdivided into three groups based on their meat consumption. Those respondents with a total per capita consumption of red meat less than 66 kg/capita/annum were labelled as low meat consumers, those consuming between 66 and 120 kg/capita/annum were classified as medium meat consumers and those consuming more than 120 kg/capita/annum were classified as high meat consumers. The three groups' answers to the questions relating to the changes in per capita

consumption of meat were compared using Analysis of Variance to see whether there was a significant difference in response by the three groups, i.e. to see whether the low, medium or high meat-consuming groups had made different responses to the other groups with regard to their meat consumption over the period 1979-1984.

The analysis of the 1979 survey had suggested that either the low and/or the medium meat-consuming groups were more likely to reduce their per capita consumption of the various meats rather than the high meat-consuming group. The Analysis of Variance showed that there was no significant difference in response between the three groups with regard to the importance of the various reasons for the changes that each group had made to their meat consumption nor to the response regarding what they would do given more money to purchase more food. The results suggested that each group had reduced their meat consumption over the last five years, rather than a single group. The results for each group were similar to those shown in Tables 6.2 and 6.3.

6.6 DISCUSSION

The change in the family age was listed by 31.5% of the respondents as being the main reason for their per capita change in meat consumption made between the years 1979-1984. The fact that people had made changes to their per capita consumption of red meat as a result of a change in their family age would not appear to be the major factor that was responsible for the per capita decline in meat consumption observed over the period 1979-1984. It would appear to be tied to the family life cycle and represent a natural course of events given that per capita consumption of meat varies as the family progresses through the various stages of the family life cycle as propounded by Wells and Gubar (1966). If anything, given the declining birthrate over recent years, there has been an increase in older-aged families which appear to consume more meat per capita than younger families and so according to the family life cycle concept there should have been an increase in per capita consumption of red meat and not the decline as has been witnessed. However, there has been an increase in older people and this would have caused a decline in meat intake.

The price of meat was listed by 60% of the respondents as being either the most important, second most important or third most important reason for influencing their per capita consumption of meat over the period 1979-1984. If reasons linked to the price of meat such as 'less income' and 'price of other foods' are also considered with price of meat then price becomes even more important in explaining the observed changes. However, the question must be asked "Was price responsible for a short-term change or a long-term trend in the decline in per capita consumption of meat?"

Price is one of the four main marketing tools at the disposal of the marketer. The price of meat could be dropped should the meat industry desire, and this could result in an observable increase in per capita consumption of red meat. (This is unlikely to happen.) However, the changes made by the consumers to a price drop would depend on the price elasticities and cross elasticities of the various meats and would also depend on whether the price of meat had reached and possibly exceeded some psychological 'price-barrier' which had forced consumers to look for alternatives to meat and whether the consumers had made structural changes to their diets to accommodate these meat alternatives. The consumers' replies to the question "What would you do if you had more money to spend on food?", where only 28.3% of the respondents stated that they would purchase meat and over 50% stated that they would purchase more of other foods, suggests that the effects of the price of meat had forced the respondents to make structural changes to their diets and that the majority were quite happy with the changes that they had made to their per capita consumption of meat. It would appear that the price of meat has been one of the major factors that have contributed to the apparent long-term trend of declining per capita consumption of red meat and that this trend will not be reversed by simply reducing the price of meat.

The third reason given by approximately 36% of the respondents either as most important, second most important or third most important reason was a concern for the health of the family. Advice from the doctor accounted for 6% of the respondents' reasons for reducing their meat intake, whilst the need to stay in shape accounted for a further 10% of the respondents' reasons for the changes they had made. Quite clearly the material emanating from the press, radio and TV concerning the risks

associated with too high a red meat intake appears to have had some impact on the minds of consumers and resulted in a sizeable proportion of the sample modifying their diet to cater for a reduction in per capita consumption of red meat. The effects of this health issue would appear to be long term and will not be easily reversed without very heavy promotional budgets and the assistance of 'respected' professional groups such as the doctors and nutritionists.

The other important group of reasons that was mentioned by the respondents as being responsible for the changes they had made to their per capita consumption of meat related to lifestyle. Over 17% of the respondents listed a change in lifestyle as being a cause for their meat consumption decline and a further 24% mentioned more vegetarian meals as a factor in the decline of their per capita consumption of meat; this would tie in with the response elicited from the question "What would you do if you had more money to spend on food?" where 28.6% of the respondents stated that they would purchase more vegetables and 42.9% said they would purchase more fruit. Once again this group of reasons, i.e. the lifestyle changes, would appear to have long-term implications for the per capita consumption of meat, suggesting that per capita consumption of meat will continue to fall given these attitudes and changes to lifestyle habits.

Some respondents mentioned that their meat consumption had dropped because they were consuming less roasts (6.0%), others because they were serving less meat at meals (3.6%), and still others because they were eating more meals outside of the home (2.3%). Over 10% of the respondents listed the time to prepare meals as their third most important reason for the decline in per capita consumption of meat. However, all these reasons whilst important do not appear to be as important as price, health or lifestyle changes in determining what will happen to meat consumption in the future. These last three reasons would appear to indicate that per capita consumption of meat will not increase in the future and may still fall given the fact that each of the factors was forcing people to modify their dietary pattern in favour of non-meat alternatives.

6.7 CONCLUSIONS

The main reasons for the decline in per capita consumption of the red meats appeared to be the price of meat, health reasons, lifestyle changes and change in family age.

Subsidiary reasons for the decline in meat consumption appeared to be awareness of non-meat alternatives and increasing consumption of vegetarian dishes.

Only 28.3% of the respondents would increase their meat consumption given a higher disposable income and this additional expenditure would be mainly spent on frying steaks (45% of respondents) and fish (28% of respondents).

The majority of the respondents would purchase non-meat alternatives such as fruit (48% of respondents), vegetables (28% of the respondents) and cheese (23.8% of the respondents).

There did not appear to be any differences in response between high, medium and low total meat consumers on questions relating to the reasons for the decline in their meat consumption levels and what each group would do given a higher disposable income to purchase more food.

The results would tend to suggest that the decline in per capita consumption levels of red meat have not been limited to any one group, but have occurred across all groups, i.e. high, medium and low meat consumers. The price of meat over the period 1979-1984 would appear to have been one of the major reasons for the observed decline in per capita consumption (60% of the respondents). However, the fact that only 28.3% of the respondents would increase their per capita consumption of meat given a higher disposable income, when 56% of the respondents reported a decline in per capita consumption would tend to suggest that the trend cannot be readily reversed. This view is substantiated by the other reasons given by the respondents for their decline in per capita consumption of meat, i.e. health considerations, changing lifestyles, awareness of alternatives and more vegetarian meals. A major proportion of the respondents would appear to have made marked changes to their dietary patterns over the period 1979-1984. Over 50% of the respondents

appear to be happy with these dietary changes, i.e. a decrease in red meat consumption appears to be acceptaable for over 50% of the respondents.

At the time of the 1979 consumer survey red meat per capita consumption levels had started to decline, particularly those of the sheep meats. The 18% decline over the period 1979-1985 would appear to suggest that the trend is continuing.

Research, new product development and promotion is needed to counter the adverse health and nutritional labels that meat has inherited over the last 15 years so that consumers can be convinced of the importance of red meat in their diet. If this is not done then it would appear from the results of the survey that per capita consumption levels of red meat will continue to decline, to be replaced by chicken, fish, cheese and other protein alternatives. Action should start now, as the trend will be very difficult to counter in future years when alternative protein foods have become established in the dietary pattern of New Zealanders.

PART 3

A STUDY ON THE USE OF MULTIDIMENSIONAL SCALING IN CONSUMER ATTITUDES TO MEAT

Multidimensional scaling (MDS) has been used to study how consumers view foods when making buying decisions - the dimensions they use when comparing foods and the groups of foods which they regard as similar. However, nothing has been published on the use of multidimensional scaling in studying consumer attitudes to meat. The methods of using this technique for comparing meat products was studied. Consumers were asked to give their preferences for meat products and also to compare the similarities between meat products. The data was then used in the multidimensional study.

Chapters 7, 8, 9 and 10 are based on the 1979 survey results. Chapter 7 compares three different scaling methods for determining consumers' preferences for 15 meats. These different scaling methods were: Thurstone's General Law of Comparative Judgements and the simpler version of the law known as the Thurstone's Case V Method - two well-established procedures - and Baten's (1946) Semi-structured Linear Scale. The dominance preference data from the three scaling methods are then used in Multidimensional Scaling analysis using KYST II. Finally the consumers' preferences for the 41 cuts are presented in Chapter 7.

Chapter 8 studies the use of substitutability comparisons for 15 meats and 41 meat cuts in Multidimensional Scaling. Chapter 9 compares the use of preference similarity data with substitutability data in Multidimensional Scaling. In Chapter 10, the MDS substitutability spaces obtained from both the 15 meat and 41 meat cut data are used to identify 'ideal' types of meat products based on the consumers' preferences which were established in Chapter 7. Three different methods of identifying the 'ideal' are compared: Fenker's (1972); Kruskal et al.'s (1972) and a method developed by the author.

CHAPTER 7

A COMPARISON OF SCALING METHODS IN STUDYING CONSUMER MEAT PREFERENCES

The aim of this chapter was to compare the traditional methods of obtaining unidimensional rank orders of preference with firstly, Thurstone's General Scaling method and secondly, with the application of Baten's (1946) semi-structured linear scale and thirdly, multidimensional scaling.

7.1 INTRODUCTION

Product developers and marketers have long been concerned with problems such as which product is the most preferred in the market place, which of its attributes are preferred most, what is the optimum level of a particular attribute and so on.

All of these problems require the respondents to organise the set of stimuli into a set of ordered categories. There are a number of procedures which can be used and the procedures differ depending on whether the people have:

* A free versus a forced assignment of x number of stimuli per category and
* The assumption of equal intervals between category boundaries versus the weaker assumption of category boundaries that are merely ordered with regard to the attribute of interest.

With forced ranking procedures we end up with an ordinal scale with n objects arranged in some order of the possession of one attribute. With this type of scale one can only say one object is better, less or equal to another with respect to some property. However, comparative statements cannot be made about the intervals separating the entities.

However, with interval scaling, ratio statements can be made about the intervals separating pairs of points.

A first ordered metric scale is defined as a scale in which adjacent intervals can be ordered. It arises where n objects or points, for

example A, B, C, D and E are ordered along some continuum and that the intervals separating the adjacent points can be ordered as follows:

$$\overline{AB} < \overline{BC} < \overline{DE} < \overline{CD}$$

where the bar denotes "distance" between a specific pair of points. The representation below would satisfy these inequalities

```
   A      B      C      D      E
___!______!______!______!______!__
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But so would other representations. This type of scale normally arises when similarities (dissimilarities) are examined.

Higher ordered metric scales arise when preferences are being examined. With this type of scale the points AB, BC, DE, and CD could only be represented by one arrangement which would satisfy the inequalities except where there are inconsistencies in the evaluations, in which case a number of arrangements would satisfy the inconsistencies and the number of arrangements would increase in proportion to the number of triads etc. A higher ordered metric scale assumes that the 1/2 n (n-1) intervals associated with n objects taking two at a time can be ordered. If a large number of observations is made with increasing number of objects it should be possible to obtain an interval scale. This scale is still a ranking scale, but the order is on all intervals separating pairs of points. As such, it is much more informative than the simple ordinal scale. With this sort of scale we have what Coombs (1964) calls a dominance relationship where the set of elements has been strictly ordered with respect to some attribute or property level.

Since the intention was to use the preference information from this chapter in subsequent model development (Chapter 14) it was decided that only those methods of measuring preference which gave the results as an interval scale would be used to determine consumers' meat preferences. The reason for selecting methods that gave an interval scale as opposed to methods that produced an ordinal scale was the fact that an interval scale can be used for subsequent analysis by most statistical techniques, including Multiple Regression. Since Thurstone's General Law of Comparative Judgements and his simpler version the Thurstone Case

V Method were known to produce an interval scale they were included in the analysis of the survey results. Stone et al. (1974) and Cooper (1981) have shown that a Semi-structured Linear Scale can produce an interval scale when used to measure sensory attributes of foods and so it was included in the analysis to see whether the method could also be used to produce an interval scale of preference.

The reasons for including the two Thurstone methods were:

* Act as a back-up in case the Semi-structured Linear Scale did not result in an interval scale; and
* Enable a check to be made on the reliability of the Semi-structured Linear Scale to produce an interval scale of preference.

7.1.1 Thurstone's Law of Comparative Judgements

Thurstone (1927) introduced a procedure for developing a scale from preference or other comparison data. The aim of the procedure was to produce an interval scale from comparative judgements of the type "A is preferred to B". Scale values may be estimated either from data in which single individuals make a series of repeated comparative judgements for each possible pair of a set of stimuli or from data obtained from a group of individuals with few or no replications per pair of stimuli.

The main advantage of the method is that it enables the researcher to transform ordinal data into interval scale data and thus obtain some measure of the magnitude of differences between two or more products.

Thurstone's general law of Comparative Judgement is stated as:

$$R_j - R_k = Z_{jk}\sqrt{\sigma_j^2 + \sigma_k^2 - 2\rho\sigma_j\sigma_k}$$

where $R_j - R_k$ = a linear distance on the subject's psychological scale between stimulus j and stimulus k

Z_{jk} = standard (unit normal) variate associated with the observed proportion in which stimulus j is preferred to stimulus k.

$\sigma_j^2 \sigma_k^2$ = discriminal dispersions of stimuli j and k

A particularly simple form (known as Case V) of Thurstone's law can be stated if one assumes that (a) the discriminal dispersions are equal, and (b) the correlation between the discriminal processes of the same set of judgements is zero. Letting $\sigma_j^2 = \sigma_k^2 = 1$ we obtain the following simple form of the law :

$$R_j - R_k = Z_{jk}\sqrt{2}$$

This is known as (Case V) of Thurstone's Law.

Scale values are obtained for each stimulus by first assuming that the respondent reports a series of differences between the two discriminal processes elicited by each pair of stimuli. If a pair of stimuli is presented a large number of times, the mean of this distribution of differences is equal to the difference in the mean values of the discriminal processes associated with the stimulus pair.

However, what the researcher observes is the proportion of times stimulus j is preferred to stimulus k. The researcher's task is to infer scale values from the frequency data developed on each pair of stimuli.

The main advantage of the method is that it enables the researcher to transform ordinal data into interval scale data and thus obtain some measure of the magnitude of differences between two or more products.

The method is essentially a special case of paired comparison, where a person is asked to state a preference for one object or the other in a pair. We often find that people are not always consistent with their judgements. Given three pairs to evaluate a person may prefer A to B, B to C but C to A, i.e. we have a circular triad. It is possible to get tetrads and polyads. Now, Thurstone's method inherently recognises that there are going to be inconsistencies in an individual's judgement when given repeats of a pair of stimuli or indeed over a population.

The unidimensional interval scale that results from Thurstone's Law of Comparative Judgements is highly dependent on the number of circular or

inconsistent judgements made by an individual in each repeated test or in the more usual case the number of inconsistencies made by each individual out of m people in the group.

Kendall (1975) has shown that the total number of circular triads in the 1/2 n (n-1) judgements made by an individual is given by 1/24 (n^3-n) if the n of objects is odd and 1/24 (n^3-4n) if the n of objects is even. The more circular triads there are, so to speak, the further we depart from the forced ranking position toward a position of inconsistency under which A may be preferred to Y and Y to Z but nevertheless Z is preferred to A. If the number of circular triads is zero then Thurstone's scale will closely resemble an ordinary ranking situation. As the number of circular triads increases so the ranking and hence the scale derived from Thurstone's method will depart from the forced ranking situation.

7.1.2 Semi-structured Linear Scales

This type of scale has been used by Weiss (1972), Stone et al. (1974), Mecredy et al. (1974), Larmond (1976) and Larson-Powers and Pangborn (1978) for measuring sensory responses along a number of physical continua.

Baten (1946) originally showed that a scale, word-anchored only at the ends yielded greater product differences than the typical category scale. Stone et al. (1974) discarded the category scale for judgements because of the inherent statistical problems associated with category scales and adopted an interval scale which consisted of a line of specified length (6 inches long) with anchor points half an inch from each end and usually, but not always, with a third anchor point at the midpoint. One word or expression was placed at each anchor point. The subject had the task of placing a vertical mark across the line at the point which best reflected the magnitude of his or her perceived intensity of that particular attribute (Stone et al., 1974). Stone et al. felt that this type of scaling yielded data appropriate to the statistical model and consistent with what would be predicted with an equal interval scale. However, apart from Cooper (1981) there has been little published literature to support this claim and whether this scale should be used as though it were an equal-interval scale requires further validation.

In terms of measurement theory, the use of this method produces an interval scale which differs from the traditional category scale in that there is almost an infinite number of positions on the line from which the panelist can choose. There are boundaries which prevent a panelist from rating a product as high or as low on the attribute as he or she would like (Cooper, 1981). There are also 'end effects' bias which occur when panelists refuse to use the extremes of the scale for fear of running out of positions (Stevens & Galenter, 1957). As a result of these 'end effects' the interval properties of each end of the scale fail to hold.

7.1.3 Multidimensional Scaling

Multidimensional scaling (MDS) refers to a family of models by means of which information contained in a set of data is represented by a set of points in a space. These points are arranged in such a way that geometrical relationships such as distance between the points reflect the empirical relationships in the data. For example, the complex associations between a set of variables which is contained in a correlation matrix can be represented spatially by portraying each variable as a point, placing them in such a way that the distances between them reproduce the numerical value of the correlation coefficients. Thus, a picture of the data is produced which is much easier to assimilate (visually) than a large matrix of numbers. It may well also bring out features obscured in the original matrix of coefficients (Coxon, 1982).

According to Coxon (1982) there are three crucial things which the researcher must consider in using multidimensional scaling:

* the data which provide the information which is to be represented;
* the model which interprets the data in a particular way, eg. as giving information about the relative proximity of the objects;
* the transformation which specifies which information in the data is to be preserved in the solution - eg. in the basic non-metric MDS model we seek to reproduce only the rank-order of the entries in the data matrix.

The data

In the basic MDS model (frequently called smallest-space analysis or non-metric distance scaling) the data take the form of a square, symmetric 2-way table, whose entries indicate how similar or how dissimilar any two points are. By convention, the entry in the ith row and the jth column of the table is denoted by d_{ij}, and gives the value of the dissimilarity measure between object i and object j. Because the data are symmetric ($d_{ij} = d_{ji}$) and each object is considered to be identical to itself, the diagonal entries are ignored, and only one half of the matrix, usually the triangle below the diagonal, is presented.

The model

The model used in basic MDS is the simple Euclidean distance model. In terms of this model, the data d_{ij} will be interpreted as being 'distance like'; not as actual distances, but as approximate or distorted estimates of distance. The aim of the MDS analysis is to turn such data into a set of Euclidean distances. The solution (also called the final configuration) consists of an arrangement of points in a small number of dimensions, located so that the distance between the points matches the dissimilarities between the objects as closely as possible.

The transformation

The ordinal or monotonic transformation used in non-metric MDS assumes that only the rank order of the entries in the data matrix contains significant information. Consequently, the distances of the solution should, as far as possible, be in the same rank order as the original data.

The purpose of the basic non-metric MDS procedure, then, according to Coxon (1982) is to find the configuration of points whose distances reflect as closely as possible the rank order of the data. This is done by trying to find an ordinal rescaling of the data which transforms them into Euclidean distances.

The Shepard diagram

An examination of the ordinal transformation function is an essential task with MDS. This is done by producing a 'Shepard diagram' (named after Shepard's seminal paper of 1962), where the data dissimilarities and the distances of the solution are first plotted against each other, and then the ordinal transformation is depicted by joining the points in an upward direction for dissimilarity data and downwards for similarity data.

Strong and weak monotonicity

This particular rescaling function illustrates a strong (or strict) monotonic relationship between the data and the distances, defined in the following way:

Strong Monotonicity: Whenever $\underline{d}_{ij} < \underline{d}_{kl}$ then $d_{ij} < d_{kl}$.

That is if one datum is less than another then the corresponding distances must be in the same order.

A less restrictive requirement often encountered in scaling is that a weak monotonic relationship holds between data and distances. Weak monotonicity only requires that no inversions in order should occur between the data and distance. That is, if $\underline{d}_{ij} > \underline{d}_{kl}$ then it should never be the case that $d_{ij} \leq d_{kl}$. However, in the case of weak monotonicity note that d_{ij} may equal d_{kl}, even when $d_{ij} \leq d_{kl}$.

Weak Monotonicity: Whenever $\underline{d}_{ij} \leq \underline{d}_{kl}$ then $d_{ij} \leq d_{kl}$.

In this case, the transformation function moves upward (even vertically upward) but it may never move downwards.

Monotone regression

In using non-metric MDS a perfect ordinal rescaling of the data into distances is usually not possible. What is sought is as good a rescaling as can be achieved. This involves finding a series of configurations in which the interpoint distances come more and more

closely into conformity with the data (Coxon, 1982).

The fitting values are ratio level quantities defined as 'distances' which would preserve perfect monotonicity with the data. Once calculated for each pair of points (j, k), the discrepancy between the actual distance (d_{jk}) and that disparity (d^o_{jk}), which would give a perfect monotonic solution (i.e. $k_{jk} - d_{jk}^o$), serves as a basis for measuring how far the distances of the configuration depart from those 'pseudo-distances' necessary to keep perfect order with the data.

Goodness/badness of fit: stress

The difference between a particular distance and its corresponding 'pseudo-distance' ($d_{jk} - d^o_{jk}$) serves as an index of how badly the distance between j and k in the solution configuration departs from the value required to preserve an ordinal relation with the data. If there is no inversion in the required ordering then the difference will be zero. Alternatively, the difference can be looked on as a residual from monotone regression, i.e. an index of the difference between the solution distance and (an ordinal rescaling of) the data.

A simple overall measure of how the distances in a configuration ordinally fit the data can be constructed by squaring the differences between the actual distances in the configuration and the 'distances' fitted by monotone regression, and then sum them. MDS almost universally adopts the habit of using a badness-of-fit measure - the higher the index, the worse the fit - to assess the fit between the solution and the data. This basic index, called variously raw (Kruskal), raw phi (Guttman, Lingoes, Roskam) or stressform 0 has the same form as the 'residual sum of squares' in other types of regression, except that in this case it measures the residuals from monotonic regression.

$$S_o = \text{Raw Stress} = \sum_{\substack{\text{all pairs} \\ (jk)}} (d_{jk} - d^o_{jk})^2$$

The first metric procedure for MDS was developed by Richardson (1938) and his procedure was based on a theorem by Young and Householder

(1938). Torgerson (1958) rediscovered Richardson's procedure and modified it.

Hays, according to Coombs (1964: p.444), suggested the first procedure for non-metric MDS. His method was non-metric in two senses: the strong metric assumption of the Torgerson procedure was replaced by an assumption of an ordinal relationship between the proximities and the distances; and only the rank order of stimuli on each dimension was determined.

Shepard (1962) focused attention on the relationship between proximities and distances, demonstrated that it was possible to derive metric MDS solutions assuming only an ordinal relationship between proximities and distances, and provided the first computer programme to accomplish MDS. Kruskal (1964a,b) built directly on Shepard's 'analysis of proximities', but improved it in important ways; these advances were incorporated in the computer programme M-D-SCAL and subsequently in KYST. Bennet and Hays (1960) were some of the first workers to examine the use of preference data in Multidimensional Scaling. Since then a large number of workers have used preference data in Multidimensional Scaling, including Stefflre (1966), Carrol and Chang (1967), Green and Rao (1972), Shocker and Srinivasan (1974), Srinivasan and Shocker (1973), Whipple (1976) and Wierenga (1980 a,b; 1983).

7.2 RESEARCH PROCEDURE

An examination of the literature on the measurement of consumers' preferences showed that there was a large number of measurement procedures which could have been used. However, in view of the fact that Thurstone's Case V method has become an accepted method of measuring consumers' preferences and is used in marketing and other fields it was decided to use the Thurstone Case V method as the yardstick for comparing other methods of measuring consumers' preferences for meats. Thurstone's Case V method requires the use of a paired comparison procedure for eliciting consumers' preferences and so it was decided that a comparison would be made between the Thurstone Case V method and the more General Thurstone method with very little additional effort from the respondents. The literature survey showed

however that the Thurstone Case V method, because it was based on the method of paired comparison, required a tremendous effort from the respondents in time and application, particularly for large numbers of items as was going to be the case for the present study. And so it was decided that a simpler and less exhausting procedure for obtaining respondents' preferences would be used and compared with the Thurstone Case V and the Thurstone General methods of obtaining respondents' preferences for meat. The simpler method was an adaption of Stone et al. (1974) procedure. The objective of using the simpler measurement procedure was to see whether it would be as reliable and precise in measuring consumers' preferences as Thurstone's Case V method had proved to be. If it did prove to be as good as Thurstone's Case V method, then it could be used in studies that required large numbers of stimuli to be rated by the respondents.

The three methods of measuring consumers' preferences were then compared as input to the KYST II MDS programme to see firstly whether the three measuring methods produced similar MDS solutions and secondly, the modifications that needed to be carried out on the raw data to ensure the original rank order present in the data was recaptured in the subsequent MDS solutions of the three preference measuring procedures, i.e. the Thurstone Case V, Thurstone General and the Semi-structured linear scale based on Stone et al.'s procedure.

The objectives of the present study were to

* Determine consumers' preferences of 15 meats using Thurstone's Case V, Thurstone's General and a modification of Stone et al.'s (1974) semi-structured linear scale.

* Compare the results of the rankings and interval scales derived from the Thurstone Case V, Thurstone General and semi-structured linear scale with a view to assessing the appropriateness of using the modified semi-structured linear scale in situations where consumers have to rank a large number of items.

* Determine consumers' preferences for 41 meat cuts derived from 13 of the 15 meats, i.e. beef, lamb, hogget, mutton, pork, ham, bacon, offal, sausage, chicken, fish, shellfish and salami.

* Analyse the preference data for the 15 meats derived from the Thurstone Case V, Thurstone General and semi-structured linear scale by multi-dimensional scaling (KYST II) to establish whether the 3 methods of determining preference produced similar n-dimensional solutions.

* Establish the most appropriate data transformation that should be carried out on the raw paired comparison data to ensure that MDS analysis of preference data recovers all or most of the original rank order in the raw data.

* Ascertain, if possible, whether preference is an n-dimensional continuum as claimed by Kendall (1975) or whether it is a single continuum.

7.2.1 The Sample

The 150 respondents who had answered the first questionnaire concerning meat consumption, purchase behaviour, attitudes to meat and socio-economic criteria were asked to complete the second questionnaire dealing with their meat preferences. However, only 80 respondents completed the questionnaires satisfactorily.

7.2.2 The Questionnaire

The final format of the questionnaire was determined after pilot testing and redrafting. It was divided into three sections or questions.

Question 1: Meat preference in general. The intention of the question was to look at the respondent's preferences for 15 meats. The respondent was presented with 105 pairs of meats, i.e. 1/2 n (n-1) pairs of meats, where each meat had been compared with every other meat. Alongside each meat there was a box and a semi-structured linear scale with the words "like the same" at one end and "like very much more" at the other end as shown below.

	like the same	like very much more
[ ] Beef [ ] Lamb	_____!_____	!_____

The respondents were firstly asked to place a tick in the box adjacent to the meat that was preferred of the pair and also to place a cross, or mark on the semi-structured linear scale that expressed the difference in preference, i.e. the linear distance on the psychological preference scale between meat A and meat B.

The line adjacent to the meat pairs measured 8.0 cm in length. This was much shorter than Stone et al. (1974) had recommended (6 in or 15.2 cm long). However pilot work had shown that the scale did nothave to be as long as Stone et al. suggested as the respondents were only placing one mark on the line and not a number as was the case in Stone et al.'s sensory work. The respondents were asked to place a mark on the line at a point along the line which reflected the difference in preference magnitude between the two meats.

Once the survey forms had been completed the positions of the respondents' marks on each of the lines were measured with a grid. The grid was made in such a way that it effectively subdivided the line into 8 sections of equallength, i.e. 1 cm long to give a 9 point scale. Respondents' marks that fell between 0 and 0.5 on the line scale were scored as 0. Values between 0.5 and 1.5 cm were scored as 1 and so on.

The order of meats in each pair and indeed the order of each pair should have been randomised to avoid systematic errors. This was not done. Only the order of the pages was randomised, because of the high costs of printing, decoding and chances of decoding errors associated with randomising of the pairs for every or most of the questionnaire forms.

Question 2: Preference for Specific Meat Cuts.

The objective of this question was to determine the respondent's preferences for specific meat cuts. The respondents were presented with 820 pairs of meat cuts, i.e. (1/2 41 [41-1]) and asked to state which meat cut of the pair they preferred and put a mark on the semi-structured line adjacent to the pair which reflected the difference in preference between the two meats.

The intention of the survey was to examine respondents' multidimensional preference continua and see whether they used the same set

of inputs to evaluate both broad groups of meat and also specific cuts or whether there was a hierarchical order where they used one set of preference inputs to look at the broad groups of meat i.e. a general set and a more specific set to look at specific meat cuts.

Question 3: Meat Preference in General.

The intention of this question was to look once again at the respondent's preference for the various meat species. The respondents were given the same set of meat species as were presented in Question One. They were given a 14 cm long vertical semi-structured linear scale with the words "like the most" at the top and "like the least" at the bottom. To avoid end-scale bias effects (Steven, 1957) they were asked to place the most-liked meat at the top of the scale and the least-liked meat at the bottom. They were then asked to position all the remaining meats on the line starting from the top with the second most-preferred meat, then the third and so on until they got to the least-preferred meat. They were told that the position of the meats on the line should reflect their meat preferences.

The first objective was to determine whether the respondents would use the scale as an interval scale. Secondly the objective was to compare the rank order of preference from this question with that obtained from the first question to see whether such an approach to the problem of preference could be justified. The paired comparison test and indeed many of the statistical designs require a great deal of time and effort from the respondent, particularly if there is a large number of pairs to be evaluated. It was hoped that the linear scale approach whilst not recovering all the rank order could at least recover most and so be used as a scale for obtaining preference data.

The last and most important intention of this question was to discover the dominant or major dimensions of preference. Preference, as originally conceptualised by Thurstone is not a unidimensional psychological continuum but a multi-dimensional one. The comments made by the respondents while they were answering the first question clearly illustrated this when they openly admitted that their evaluative criteria were changing for each pair of meats. The dangers of forcing people into a strict rank order are that the respondents are not allowed to use the multi-dimensional aspects of preference but must instead

produce an amalgam of the various scales which they then use to order the objects.

7.2.3 The Interviews

As stated in Chapter 3, the interviews were carried out during the months of November and December 1979. Three consecutive nights were set aside when each group participating in the survey (usually 20 per group) were asked to meet. With this second survey, problems and comments associated with the consumption survey were discussed first and once this had been done the respondents were handed the second survey. They were given 10 minutes to read the questionnaire and then a further 15 minutes were spent answering their questions. They were then asked to answer the first question to make sure there were no problems. The Pilot Studies had shown that the questionnaire would take 4 hours to complete and so the respondents were allowed to leave and asked to have the questionnaire completed before the next meeting. Most of the respondents took up to 8 hours to complete the questionnaire and complained about the length of the questionnaire, particularly of Question 2, and admitted that they had tackled Question 2 in bursts because of its length.

7.2.4 The Analysis

The collected data were checked, all the values on the semi-structured linear scales were measured, the data were then transferred to computer coding sheets and entered into the Prime computer. The data for each question were initially analysed using verson 9 of Nie *et al*.'s (1979) SPSS programme. Frequency histograms, means, modes, medians and ranges were calculated for each of the meat pairs in Questions 1 and 2 and for the meats in Question 3. This was done to establish the type of data analysis which would be subsequently made on each of the data sets.

7.2.4.1 Thurstone Analysis: The data values for the Thurstone General analysis were calculated as follows. The distance along the scale adjacent to each pair of meats was recorded. Values less than 0.5 on the 9 point scale were scored as 0. Values between $0.5 \leq 1.5$ were scored as 1.0 and so on. If the respondents ticked the meat in the left-hand column then the distance was given a positive score and if they ticked the meat in the right-hand column the distance was scored

with a minus distance. The above procedure resulted in a scale that ranged from a score of -9 to +9.

Thurstone's Law of Comparative Judgement was then used to calculate the interval preference scale for the broad meat categories and the specific meat cuts using both his simple Case V method which considers just the proportion preferring stimulus j to stimulus k and the more General Method where the ordered metric distances from the semi-structured linear scale were used. The mathematical details for Thurstone's method are in Section 7.1.

Kendall's coefficient of agreement was determined on the Case V data for both Questions 1 and 2. Details of Kendall's Coefficient of Agreement have been provided in Appendix 7.1.

Kendall's Coefficient of Consistence was also determined on both the Thurstone Case V data and Thurstone General data. Details can be found in Appendix 7.2.

7.2.4.2 Semi-structured Linear Scale: The respondents were provided with a 14 cm long scale and were asked to place their most preferred meat at the top of the scale and their least preferred meat at the bottom of the scale, and to then rank the remainder of the 15 meats in order of preference and to place a mark alongside each meat on the line that reflected the degree of preference for each meat. The lines were measured and the distance from the bottom in cms was taken as the score.

7.2.4.3 Multi-dimensional Scaling Method: Practically all the multi-dimensional scaling analyses were performed using the computer programme Kyst II (1974), and the Prime computer. Kyst was chosen because of its versatility in use and robustness against sub-optimal solutions. The programme provides the following advantages

: Two formulae for stress calculations, depending on the form of the data and the type of analysis required

: It enables the user to split the data into sublists and perform analyses on each sublist

: It provides for an unfolding analysis

: It enables the user to examine the data over a range of Minkowski metrics

: It provides a number of output options such as a history of the calculations showing the progress of the iterative numerical calculation and a number of plots, such as the spatial configuration of plots, distances and fitted distances versus data and stress versus dimension. A detailed description of the programme can be found in the Computer Operations Manual Kyst II by Kruskal et al. (1974).

The practical reason for using the programme was the fact that the only other multi-dimensional programmes in operation at the University Computer Centre were PREFMAP (1977) and INDSCAL (1971).

All multi-dimensional analyses of the dominance matrices, i.e. the Thurstone Case V matrix, the ordered metric matrix and the matrix derived from the semi-structured linear scale were performed using the Minkowski -2 metric, i.e. the Euclidean space. The data were entered in the form of a lower half matrix. Solutions were obtained in 5 through to 1 dimension according to the control statements shown in Figure 7.1.

Control Statement 1 generated the initial configuration using the TORSCA procedure. Control Statement 2 fixed the maximum number of iterations, i.e. 3 for the TORSCA procedure. Control Statement 3 specified the number of scales the data were to examine from a maximum of 5 dimensions down to 1 dimension. Control Statement 4 specified that the final configuration was to be rotated to principal components. Control Statement 5 specified the maximum number of iterations that were to be performed in any single scaling solution. Statement 6 specified that the dissimilarity data became increasingly dissimilar with increasing data values and as a consequence 'monotone ascending' regression was to be used on the data. Statements 7 and 8 stated that both data and distances should be provided on the output together with a history of the computations and that all configurations should also be provided. Statement 9 described the matrix, Statement 10 was a title statement.

Statement 11 indicated the number of rows and columns of each matrix (namely 15), the number of values for each matrix (namely 1) and the number of such matrices included in the data deck (namely 1). Statement 12 described the format of the input data.

```
 1  TORSCA
 2  PRE-ITERATION = 3
 3  DIMMAX = 5, DIMMIN = 1
 4  COORDINATES = ROTATE
 5  ITERATIONS = 50
 6  REGRESSION = DESCENDING
 7  PRINT = DATA, PRINT = DISTANCES
 8  PLOT = SCATTER = SOME, PLOT = CONFIGURATION = ALL
 9  DATA, LOWERHALFMATRIX, DIAGON = PRESENT
10  THURSTONE CASE V DOMINANCE DATA
11  1511
12  (15F5.2)

    oo

                        Lower half matrix of data

    15                  oo

13  COMPUTE
14  DIMMAX = 3, DIMMIN = 1
15  REGRESSION = POLYNOMIAL = 1
16  COMPUTE
17  STOP
```

Figure 7.1. Control Statements for Kyst

7.3 COMPARISON OF PREFERENCE TESTING METHODS

The results of the preference testing by paired comparison and by scoring are shown in Tables 7.1, 7.2 and 7.3.

The paired comparison data were initially analysed by the SPSS frequencies sub-programme to determine firstly the number of respondents who preferred one meat in each pair of meats and secondly to examine the frequency distribution of the scores in the semi-structured linear scale.

7.3.1 Analysis of General Meat Preference Paired Comparison Data by Thurstone's Comparative Judgement Method (Case V Procedure)

The percentage of people who preferred each of the meats in each pair is presented in Table 7.1. The number of triads in the aggregated Thurstone's matrix was 79 and the coefficient of consistence 0.436. The significance level of 0.999 for the coefficient of consistence suggests that the 80 respondents were reasonably consistent in their judgements in spite of the seemingly high number of triads.

Table 7.1 Paired Comparison of Preferences - Percentages of Respondents.

	Beef	Veal	Mutton	Hogget	Lamb	Pork	Bacon	Ham	Smallgoods	Offal	Fish	Chicken	Turkey	Shellfish	Salami
Beef	0.0														
Veal	34.5	0.0													
Mutton	18.5	40.0	0.0												
Hogget	39.0	60.0	75.5	0.0											
Lamb	50.5	67.0	84.5	64.5	0.0										
Pork	68.5	84.5	90.0	86.5	72.0	0.0									
Bacon	44.0	63.5	71.0	64.5	43.0	29.5	0.0								
Ham	77.0	87.0	86.0	86.0	72.0	49.0	74.0	0.0							
Smallgoods	14.0	28.5	46.5	30.5	10.0	5.0	16.5	8.5	0.0						
Offal	7.0	18.5	21.5	10.0	6.0	7.5	10.0	8.0	31.0	0.0					
Fish	64.0	82.0	88.0	74.0	56.5	45.0	66.0	43.0	87.0	94.0	0.0				
Chicken	77.0	85.5	95.0	85.0	72.0	53.5	75.0	47.5	93.0	96.5	64.0	0.0			
Turkey	48.0	63.0	66.0	56.5	46.5	31.5	47.0	28.5	72.0	86.0	39.5	25.0	0.0		
Shellfish	46.0	53.0	53.5	56.0	39.0	37.0	45.0	31.5	66.5	83.5	35.5	34.0	50.0	0.0	
Salami	21.5	31.0	37.0	27.0	25.5	20.0	22.5	21.0	36.5	56.5	16.5	19.0	30.0	29.0	0.0

The Kendall's coefficient of agreement was found to be 0.26. If there is complete agreement, the coefficient of agreement is 1 so a value of 0.26 suggests that there was a reasonable amount of disagreement amongst the respondents regarding their preferences for the meats. On testing the significance of the coefficient of agreement, it was concluded that the coefficient of agreement could not have arisen by chance from a population in which all the respondents allotted their preferences at random. So it was assumed that the paired comparison data were reliable indications of the preferences of this population sample.

Table 7.2 Paired Comparison of Preferences - Z Values - Thurstone Case V.

	Beef	Veal	Mutton	Hogget	Lamb	Pork	Bacon	Ham	Smallgoods	Offal	Fish	Chicken	Turkey	Shellfish	Salami
Beef	0.0	-0.40	-0.90	-0.28	0.01	0.48	-0.15	0.74	-1.08	-1.48	0.36	0.74	-0.05	-0.10	-0.79
Veal	0.40	0.0	-0.25	0.25	0.44	1.01	0.34	1.13	-0.57	-0.90	0.92	1.06	0.33	0.08	-0.49
Mutton	0.90	0.25	0.0	0.69	1.01	1.28	0.55	1.08	-0.09	-0.79	1.18	1.64	0.41	0.09	-0.33
Hogget	0.28	-0.25	-0.69	0.0	0.37	1.11	0.37	1.08	-0.51	-1.28	0.64	1.03	0.16	0.15	-0.62
Lamb	-0.01	-0.44	-1.01	-0.37	0.0	0.58	-0.17	0.58	-1.28	-1.55	0.16	0.58	-0.09	-0.28	-0.66
Pork	-0.48	-1.01	-1.28	-1.11	-0.58	0.00	-0.54	-0.02	-1.64	-1.44	-0.12	0.09	-0.48	-0.33	-0.84
Bacon	0.15	-0.34	-0.55	-0.37	0.17	0.54	0.0	0.64	-0.97	-1.28	0.41	0.67	-0.07	-0.12	-0.76
Ham	-0.74	-1.13	-1.08	-1.08	-0.58	0.02	-0.64	0.0	-1.37	-1.40	-0.17	-0.06	-0.57	-0.48	-0.80
Smallgoods	1.08	0.57	0.09	0.51	1.28	1.64	0.97	1.37	0.0	-0.49	1.12	1.48	0.58	0.43	-0.34
Offal	1.48	0.90	0.79	1.28	1.55	1.44	1.28	1.40	0.49	0.0	1.55	1.81	1.08	0.97	0.16
Fish	-0.36	-0.92	-1.18	-0.64	-0.16	0.12	-0.41	0.17	-1.12	-1.55	0.0	0.35	-0.26	-0.37	-0.97
Chicken	-0.74	-1.06	-1.64	-1.03	-0.58	-0.09	-0.67	0.06	-1.48	-1.81	-0.35	0.0	-0.67	-0.41	-0.88
Turkey	0.05	-0.33	-0.41	-0.16	0.09	0.48	0.07	0.57	-0.58	-1.08	0.26	0.67	0.0	0.0	-0.52
Shellfish	0.10	-0.08	-0.09	-0.15	0.28	0.33	0.12	0.48	-0.43	-0.97	0.37	0.41	0.0	0.0	-0.55
Salami	0.79	0.49	0.33	0.62	0.66	0.84	0.76	0.80	0.34	-0.16	0.97	0.88	0.52	0.55	0.0
Total	2.90	-3.73	-7.87	-1.84	3.96	9.75	1.88	10.98	-10.29	-16.18	7.30	11.35	0.89	0.18	-8.39
Mean	0.19	-0.25	-0.52	-0.12	0.26	0.65	0.13	0.73	-0.69	-1.08	0.49	0.76	0.06	0.01	-0.56
Rank	6	11	12	10	5	3	7	2	14	15	4	1	8	9	13

The proportions of the sample preferring each meat were transformed to . values, as shown in Table 7.2, using a standard normal curve. Unidimensional preference scale values were obtained using Thurstone's Standard Case V method. The interval preference scale using Thurstone's Case V method is presented in Figure 7.2.

2.00	-
1.84	- Chicken
1.81	- Ham
1.73	- Pork
1.57	- Fish
1.34	- Lamb
1.27	- Beef
1.21	- Bacon
1.14	- Turkey
1.09	- Shellfish
0.96	- Hogget
0.83	- Veal
0.56	- Mutton
0.52	- Salami
0.39	- Smallgoods
0.00	- Offal

Figure 7. 2 Thurstone's Case V Scale of Preference

Chicken, ham, pork and fish were clearly the most preferred meats, then came lamb on its own followed by a group which included bacon, beef, turkey and shellfish that were all tightly grouped and the preference order could easily be switched around. Hogget and veal were the next loose grouping followed by mutton, salami, New Zealand type smallgoods with offal the least preferred of all meats.

7.3.2 Thurstone's General Method Data

The data for this analysis were the respondents' assessment of the difference in preference intensity between meat pairs (see Table 7.3 and Figure 7.3).

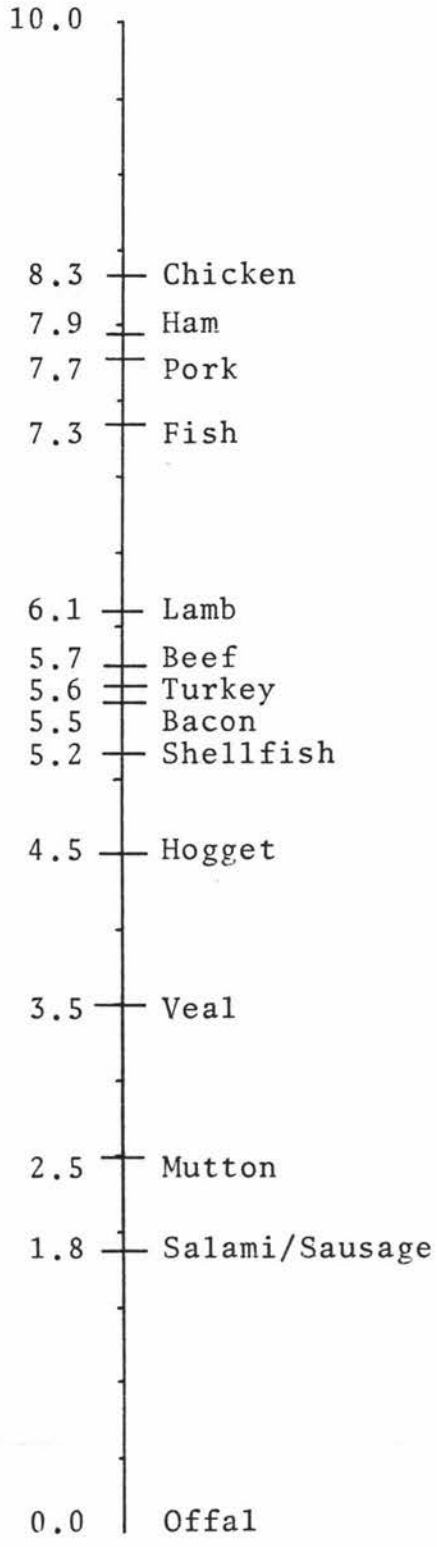

Fig. 7.3. Preference Scale for the 15 Meats Obtained from the Thurstone General Data.

Table 7.3 Paired Comparison of Preferences - Thurstone's General Method

Meat	Beef	Veal	Mutton	Hogget	Lamb	Pork	Bacon	Ham	Smallgoods	Offal	Fish	Chicken	Turkey	Shellfish	Salami
Beef	0.0	-2.4	-3.9	-0.6	0.6	2.6	-0.4	3.0	-4.5	-6.4	1.7	3.1	-0.3	-0.4	-4.2
Veal	2.4	0.0	-1.1	1.6	2.6	4.8	2.5	4.8	-2.3	-4.8	4.5	4.9	2.2	1.2	-3.1
Mutton	3.9	1.1	0.0	3.2	4.4	5.7	3.2	5.2	-0.2	-3.3	4.8	6.2	2.7	1.4	-1.9
Hogget	0.6	-1.6	-3.2	0.0	1.8	4.5	2.0	4.7	-3.4	-5.7	3.2	4.4	1.3	0.7	-3.5
Lamb	-0.6	-2.6	-4.4	-1.8	0.0	2.4	-0.5	2.7	-4.8	-6.3	1.2	2.8	-0.5	-1.2	-4.1
Pork	-2.6	-4.8	-5.7	-4.5	-2.4	0.0	-2.4	0.2	-5.7	-6.5	0.1	0.9	-2.0	-1.8	-4.8
Bacon	0.4	-2.5	-3.2	-2.0	0.5	2.4	0.0	2.6	-3.8	-5.5	2.4	3.3	0.5	-0.6	-3.9
Ham	-3.0	-4.8	-5.2	-4.7	-2.7	-0.2	-2.6	0.0	-5.9	-6.7	-0.5	0.5	-2.2	-1.9	-4.8
Smallgoods	4.5	2.3	0.2	3.4	4.8	5.7	3.8	5.9	0.0	-2.5	5.6	6.7	3.6	2.8	-0.7
Offal	6.4	4.8	3.3	5.7	6.3	6.5	5.5	6.7	2.5	0.0	6.8	7.3	5.4	4.9	1.1
Fish	-1.7	-4.5	-4.8	-3.2	-1.2	-0.1	-2.4	0.5	-5.6	-6.8	0.0	1.7	-1.0	-2.2	-5.2
Chicken	-3.1	-4.9	-6.2	-4.4	-2.8	-0.9	-3.3	-0.5	-6.7	-7.3	-1.7	0.0	-2.8	-2.2	-5.0
Turkey	0.3	-2.2	-2.7	-1.3	0.5	2.0	-0.5	2.2	-3.6	-5.4	1.0	2.8	0.0	-0.1	-3.3
Shellfish	0.4	-1.2	-1.4	-0.7	1.2	1.8	0.6	1.9	-2.8	-4.9	2.2	2.2	0.1	0.0	-3.5
Salami	4.2	3.1	1.9	3.5	4.1	4.8	3.9	4.8	0.7	-1.1	5.2	5.0	3.3	3.5	0.0
Total	12.1	-20.2	-36.4	-5.8	17.7	42.0	9.4	44.7	-46.1	-73.2	36.2	51.8	10.3	4.1	-46.9
Mean	0.81	-1.35	-2.43	-0.39	1.18	2.80	0.63	2.98	-3.07	-4.88	2.43	3.45	0.69	0.27	-3.12
Rank	6	11	12	10	5	3	8	2	13	15	4	1	7	9	14

An examination of the frequency distributions of the individual scores for 105 pairs of meats, i.e. 1/2n (n-1) pairs showed the following general trends.

: where the meats were widely spaced on the unidimensional scale obtained from the Thurstone's Case V method, the distribution from the Thurstone General Procedure tended to be skewed towards the more preferred meat, with skew values of 0.35 - 0.50.

: Where the difference in preference between meats in each pair was small on the derived Thurstone's Case V Interval Scale and the meats were in the middle of the scale, the distribution tended to have a tri-modal shape with groups of respondents at either end of the scale and a third group of respondents in the middle of the distribution where the distribution went from -9 - 0 - +9.

: Where the difference in preference between meats in each pair was small on the derived Thurstone's Case V Interval Scale and the meats were either at the top end of the scale or the bottom then the frequency distribution tended to have a bi-modal distribution with one group of respondents grouped at one or other end of the scale and a second group of respondents grouped in the middle of the distribution.

There were exceptions to the above generalisations and there were cases where the distribution tended to be normally distributed with mean, median and mode almost equal.

As a consequence of the differences in the frequency distributions for each of the meat pairs it was decided that the data would be analysed by Thurstone's General method where

$$R_j - R_k = Z_{jk}\sqrt{\sigma_j^2 + \sigma_k^2 - 2\rho\sigma_j\sigma_k}$$

for both the modal values and mean values to see if there would be any difference in the rank order of the meats given the mean and modal values. The upperhalf cell entries of the matrix were opposite in sign

to the lowerhalf matrix cell entries. The rank order for the meat was obtained by summing the cell value to give the column totals.

The most preferred meat had the highest column total and so on down to the least preferred meat. The matrices for the modal and mean values can be found in Appendix 7.3. The rank orders for the meats derived by the two approaches is presented below in Table 7.4.

Table 7.4 Rank Order of Meats Derived from Use of Mean and Modal Values of the Thurstone's General Data

	Thurstone's General Data		
Meat	Rank Order Obtained from Modal Values	Rank Order Obtained from Mean Values	Thurstone's Case V Method
Chicken	1	1	1
Fish	2	4	4
Ham	3	2	2
Pork	3	3	3
Lamb	5	5	5
Beef	6	6	6
Bacon	6	8	7
Turkey	8	7	8
Shellfish	8	9	9
Hogget	10	10	10
Mutton	11	12	12
Smallgoods	12	13	14
Veal	13	11	11
Salami	14	14	13
Offal	14	15	15

Note: The Spearman's rank correlation coefficients for the rankings produced by the modal and mean values and the modal and Thurstone's method and mean and Thurstone's method are respectively 0.968, 0.968 and 0.993.

The three approaches to the data give very similar rank orders. However, the use of the mean, not unexpectedly, produced a closer rank order to Thurstone's method than the use of the modal values. Thurstone's method is based on the underlying assumption that the differences in the discriminal processes follows a normal distribution and as a consequence the mean, mode and median are the same.

With the present data, the majority of the respondents tended to use the extremes of the scale, with the result that the responses tended to be grouped at either end of the extended scale i.e. at -9 or +9, or grouped around -1 to 1. As a result of this general frequency dispersion the modal value entered into each cell of the matrix tended to be either +9 or -9, i.e. there was a large number of ties in the matrix. This meant that the rank order obtained from the modal values was less precise than either Thurstone's Case V method or use of the means because a number of ties were produced in the unidimensional rank order. Therefore the mean values were used, as shown in Table 7.3.

7.3.3 Semi-structured Linear Preference Scale

The means, modes and medians for the scores of the 15 meats are presented in Table 7.5.

Table 7.5 Rank, Mean, Mode and Median of the 15 Meats Obtained from the Semi-structured Linear Scale

Meats	Mean	Mode	Median	Rank Based on Means	Rank Based on Modes	Rank from Thurstone Case V Method
Pork	11.5	14.0	12.5	1	1	3
Chicken	11.3	12.0	11.5	2	3	1
Beef	10.7	12.0	11.3	3	3	6
Ham	10.5	13.0	11.0	4	2	2
Lamb	9.8	10.0	9.9	5	7	5
Fish	9.7	11.5	10.5	6	5	4
Hogget	8.5	8.0	8.5	7	8	10
Turkey*	7.7	11.0	7.9	8	6	8
Bacon	7.6	8.0	8.0	9	8	7
Veal	7.5	7.0	7.7	10	11	11
Shellfish*	7.1	0.5	7.3	11	14	9
Mutton	6.1	8.0	6.1	12	8	12
Smallgoods	4.1	5.0	4.1	13	12	14
Salami	3.5	2.0	2.4	14	13	13
Offal	1.6	0	0.05	15	15	15

* Distributions were Bi-modal.

The preference responses for each of the meats tended to follow a normal distribution. The two exceptions to this general trend were turkey and shellfish where the distributions were bi-modal with a majority of respondents grouped at either end of the scale for these two meats. It would appear that the respondents were able to use the scale as an interval scale, although this would need to be validated with a sample size of 1000 respondents (Coombs, 1964). The respondents tended to use the whole scale rather than either end as was the case with the Thurstone General scale and they appeared to have no difficulty in arranging the 15 meats in an order which reflected their relative differences in preference between the meats.

The rank order derived from the modal values and from the means were compared with the rank order derived from the paired comparison data

using Thurstone's Case V method. The means had a Spearman's rank correlation coefficient with the Thurstone's rank order of 0.952 whilst the rank correlation coefficient for the modes was 0.821. The ranks of the meats derived from the modal values had clearly departed significantly more from the Thurstone rank order than the ranks derived from the means. However, use of the modes had also changed the rank order of the meats compared with the ranks derived from the means and the Spearman rank correlation coefficient for these two ranks was 0.923.

	-	14
	:	
	:	
11.5	-	Pork
11.3	-	Chicken
10.7	-	Beef
10.5	-	Ham
	:	
9.8	-	Lamb
9.7	-	Fish
	:	
8.5	-	Hogget
	:	
7.7	-	Turkey
7.6	-	Bacon
7.5	-	Veal
7.1	-	Shellfish
	:	
6.1	-	Mutton
	:	
	:	
4.1	-	Smallgoods
	:	
3.5	-	Salami
	:	
1.6	-	Offal
	:	
	-	

Figure 7.4 Interval Preference Scale Obtained from Semi-structured Interval Scale

The preference interval scale derived from the semi-structured linear scale (see Figure 7.4) did not provide the same separation of the meats as the Interval Scale, derived by Thurstone's Case V method. As with the Thurstone Case V Scale a number of meats was grouped at the top of the scale and this group included pork, chicken, beef, ham, lamb and fish, a second group consisting of hogget, turkey, bacon, veal, shellfish and mutton was grouped in the middle of the scale and a least-preferred group consisting of smallgoods, salami and offal at the bottom of the scale.

7.3.4 Comparison of the Thurstone Case V, Thurstone General and Semi-structured Linear Scales

7.3.4.1 Derived ranks for the 15 meats: The respective rankings of the 15 meats derived from the paired comparison, the metric paired comparison and the semi-structured linear scale are presented in Table 7.6. As would be expected the two Thurstone methods tended to produce a very similar rank order as the Thurstone Case V method assumes that the differences in discriminal processes tend to follow a normal distribution and hence the mean, median and mode are the same. As a consequence the Thurstone Case V method uses means to derive the final interval scale. The Spearman rank correlation coefficient for the two rank orders was a very high 0.992. There were slight differences in the rank order but this was expected given the very close interval scale values for bacon, beef and turkey.

Table 7.6 Rank Order of the 15 Meats Using Different Procedures

	Rank Order Derived from Paired Comparisons by Thurstone's Case V Method	Rank Order Derived from Paired Comparison by Thurstone's General Method	Rank Order Derived from Semi-structured Linear Scale Means
Chicken	1	1	2
Ham	2	2	4
Pork	3	3	1
Fish	4	4	6
Lamb	5	5	5
Beef	6	6	3
Bacon	7	8	9
Turkey	8	7	8
Shellfish	9	9	11
Hogget	10	10	7
Veal	11	11	10
Mutton	12	12	12
Salami	13	14	14
Smallgoods	14	13	13
Offal	15	15	15

Spearman's Correlation coefficient for Thurstone's Case V and Thurstone General = 0.992

Spearman's Correlation coefficient for Thurstone Case V and Linear Scale = 0.925

Spearman's Correlation coefficient for Thurstone General and Linear Scale = 0.932.

The rank order of the 15 meats derived from the Thurstone Case V method and the Semi-structured linear scale method tended to differ slightly with the 4 meats at the top of the preference scale and with the 5 meats in the middle of the scale, where the rank orders tended to be flipped. This was not too unexpected given the comparatively small preference differences between "pork, chicken, ham, fish" and "bacon, turkey, shellfish, hogget". The one exception was beef where the rank order changed quite markedly from the linear scale to the Thurstone Case V

scale. The rank order of the meats from the semi-structured linear scale was closer to the rank order derived from Thurstone's General method than Thurstone's Case V method as evidenced by the respective Spearman rank correlation coefficient of 0.932 and 0.925.

4.3.4.2 Comparison of Scales: The scale values for the three methods are shown in Table 7.7.

Table 7.7 Comparison of Scale Values for Three Preference Methods.

	Paired Comparison Thurstone Case V	Paired Comparison Thurstone General	Semi-structured Linear Scale
Chicken	1.84	3.45	11.3
Ham	1.81	2.98	10.5
Pork	1.73	2.80	11.5
Fish	1.57	2.43	9.7
Lamb	1.34	1.18	9.8
Beef	1.27	0.81	10.7
Bacon	1.21	0.63	7.6
Turkey	1.14	0.69	7.7
Shellfish	1.09	0.27	7.1
Hogget	0.96	-0.39	8.5
Veal	0.83	-1.35	7.5
Mutton	0.56	-2.43	6.1
Salami	0.52	-3.12	3.5
Smallgoods	0.39	-3.07	4.1
Offal	0.00	-4.88	1.6

The three meats - chicken, ham and pork were highly preferred in all three scales, but beef was also in this group in the semi-structured interval scale. Fish and lamb, the next preferred meats, had similar scales in the paired comparison and the semi-structured scale, but lamb was half the fish score in the Thurstone General paired comparison.

The scales were all converted to the same base, with offal having a zero score as shown in Table 7.8.

Table 7.8 Adjusted Scale Values for Three Preference Methods

	Paired Comparison Thurstone Case V	Paired Comparison Thurstone General	Semi-structured Linear Scale
Chicken	1.84	8.3	9.7
Ham	1.81	7.9	8.9
Pork	1.73	7.7	9.9
Fish	1.57	7.3	8.1
Lamb	1.34	6.1	8.2
Beef	1.27	5.7	9.1
Bacon	1.21	5.5	6.0
Turkey	1.14	5.6	6.1
Shellfish	1.09	5.2	5.5
Hogget	0.96	4.5	6.9
Veal	0.83	3.5	5.9
Mutton	0.56	2.5	4.5
Salami	0.52	1.8	1.9
Smallgoods	0.39	1.8	2.9
Offal	0.00	0.0	0.0
Total	16.26	73.4	93.6
Mean	1.08	4.89	6.24

Pearson Correlation Coefficients

Thurstone Case V/Thurstone General = 0.981
Thurstone Case V/Linear Scale = 0.934
Thurstone General/Linear Scale = 0.942

The greatest lack of fit was between Thurstone Case V/Linear scale and the best fit was between Thurstone Case V/Thurstone General Scales.

7.3.4.3 Discussion of Comparison of Scales: Which of the preference ranking methods more truly demonstrates the consumers' preference? The Thurstone Case V method is essentially a populist method of determining preference and rests on the assumption that the differences

between two discriminal processes follow a normal distribution, i.e. the method basically considers the proportion of respondents preferring one product over another. The method does not actually ask respondents to define the magnitude of the difference between two discriminal processes; instead these differences are derived. Thurstone's General method, where respondents are asked to assess the difference in the discriminal processes, considers both the proportion of respondents preferring one product over another and the magnitude of the difference between the discriminal processes. Similarly the semi-structured linear scale asks the respondents to assess the difference in the discriminal process, considers both the proportion of respondents preferring one product over another and the magnitude of the difference between the discriminal processes. However, the ranking procedure underlying the semi-structured linear scale contravenes the philosophical background of preference where it is assumed that a number of dimensions or variables is involved in preference and the semi-structured linear scale does not enable consumers to change the balance of these variables, but instead forces consumers to use an amalgam of the variables to make their assessments. With the two Thurstone methods the consumers can change the balance of variables underlying preference as they move from one pair of products to another. Whilst the two Thurstone methods satisfy this basic philosophical requirement for measuring preference they are time-consuming as was clearly illustrated in the survey where some respondents took up to 8 hours to answer the questionnaire. To overcome this time problem experimental design procedures have evolved to minimise the time effort required of respondents. However, the experimental designs introduce reliability problems of their own and as a consequence have not been whole-heartedly adopted by researchers (Green, 1975). On balance the Thurstone General method would appear to be the best method of assessing consumers' preference because the method:

- allows the consumers to change the mix of variables underlying preference at will;
- considers both the proportion and the size or magnitude of the discriminal process between products.

However, as the results show, the picture is not quite so clear-cut, because the paired comparison data, the data used for both the Thurstone

Case V method and the Thurstone General method contained 79 triads out of a maximum of 140. The number of triads was significantly higher than Kendall considered appropriate for either of the two ranking procedures. Moreover, the distributions on the preference intensity scale alongside each meat pair tended to be either bi-modal or tri-modal. Clearly the major assumption of a normal distribution underlying the differences in discriminal processes for the Thurstone Case V method had been violated. The bi-modal distributions were mostly found for meats that were ranked at the top and bottom of the consumers' preference scale. The tri-modal distributions tended to occur for meats in the middle of the preference ranking and it is likely that with a larger sample size these distributions would have matched a normal distribution.

In the case of the Thurstone General method the means on the preference intensity scale were used in the determination of the interval scale and hence preference rank order of the meats. It could be argued that the mode values should have been used in the analysis because the preference intensity scale was not a true interval scale, i.e. some respondents were tending to use the extreme ends of the scale rather than the whole scale.

A comparison of the rankings of the 15 meats derived from the two Thurstone methods with that derived from the semi-structured linear scale showed that the meats with a major change to their respective rankings were beef and hogget. With the two Thurstone methods, the meats could be subdivided into 5 major preference categories with the paler meats - chicken, ham, pork and fish - at the top of the scale; lamb, bacon and beef a second category, turkey and shellfish a third; hogget, veal and mutton a fourth category; with salami, smallgoods and offal at the bottom of the preference scale. However, with the semi-structured scale where people were forced to rank the meats according to one criterion beef and hogget moved up one category and shellfish and ham dropped down a category.

The relatively high Spearman rank correlation coefficients together with the high Pearson correlation coefficient for the respective rankings and scales would suggest that the methods produced similar rankings for the 15 meats given the relatively small preference differences between the meats where the preference order could be easily changed. In other

words, the scales appeared to be determining and measuring the same thing.

This being the case it would appear that the semi-structured linear scale could be used as a reliable method of determining consumers' product preferences and hence save the consumers from the exhausting trial by 'paired comparison' when determining their product preferences.

7.4 MULTIDIMENSIONAL SCALING ANALYSIS OF PREFERENCE DATA FOR 15 MEATS

7.4.1 Matrices

The data consisted of the percentage preferences shown in the lower left-hand section of Table 7.1 and the lower half of the Thurstone Case V matrix as shown in Appendix 7.4. The Thurstone Case V lower half matrix consisted of both positive and negative numbers. The negative numbers indicated that less than 50% of the respondents preferred a particular meat, whilst positive numbers indicated that over 50% of the respondents preferred the particular meat. The negative and positive numbers imply strict order and will be referred from here onwards as 'dominance' data.

Dominance data matrices were also obtained for the General Thurstone ordered metric data and the semi-structured Linear Scale data. The General Thurstone ordered metric data was the lower part of the data in Table 7.3 and is shown in Appendix 7.5. The semi-structured linear scale data was calculated from the mean scale by determining the scale differences between the two meats; if the score of the second meat was higher than the first, then the value was negative; if lower, it was positive. The matrix is shown in Appendix 7.6.

7.4.2 M.D.S. Spaces for Fifteen Meats

Monotonic scaled solutions were obtained for the Thurstone Case V, the Thurstone General, the Linear Scale and the Percentage Preferences half matrices in 5 through to 1 dimensions. Stress values for each of the dimensional configurations were obtained and a plot of stress versus dimension for each of the matrices can be found in Figure 7.5a. The points of 'elbowing' in these plots were used in the choice of dimensionality of the final configuration. Anderson (1975) found that the

'elbow' procedure of obtaining the dimensionality of multi-dimensional scaling output was adequate compared with the graphical procedure used by Spence and Graef (1974).

Two-dimensional configurations, together with the associated Shepard plot were obtained for each of the data sets. As the Shepard plots were practically identical for all the data sets only one Shepard plot, that of the Thurstone Case V 2-dimensional solution has been included in the text and this can be found in Figure 7.5b.

The configurations for each of the data sets has been included in Figure 7.6 for comparative purposes and the associated scale values can be found in Appendix 7.6. As the 2-dimensional configuration of the monotonically regressed Percentage Preferences data set was different to the other three 2-dimensional configurations a separate 15 meat 2-dimensional configuration has been provided in Figure 7.7 for the 'percentage preferences' data set and the associated scale values can be found in Appendix 7.7.

The Thurstone Case V, the Thurstone General and the Semi-structured Linear Scale data produced a very similar 2-dimensional, spatial arrangement of the 15 meats, with most of the 15 meats occupying very similar positions in the 2-dimensional space. As would be expected, one or two meats had flipped their respective positions suggesting a possible local minimum solution for one of the data sets rather than a true global minimum. However, five re-runs of the Thurstone Case V data set with different starting configurations did not overcome the local minimum problem and rather than continue until a global minimum had been obtained it was decided that the local minimum solution would be accepted given the characteristics of the Shepard plot and stress versus dimensionality plot for the Thurstone Case V data set.

An examination of Figure 7.5a, the stress versus dimension plot for all four solutions together with the Shepard plot in Figure 7.5b all point to degeneracy problems with the data sets. The monotonic regression model clearly does not provide a particularly good fit to the data. The Shepard plot indicates that there was a high degree of clustering in each of the data sets which can be inferred from the highly stepped Shepard plot for each of the data sets.

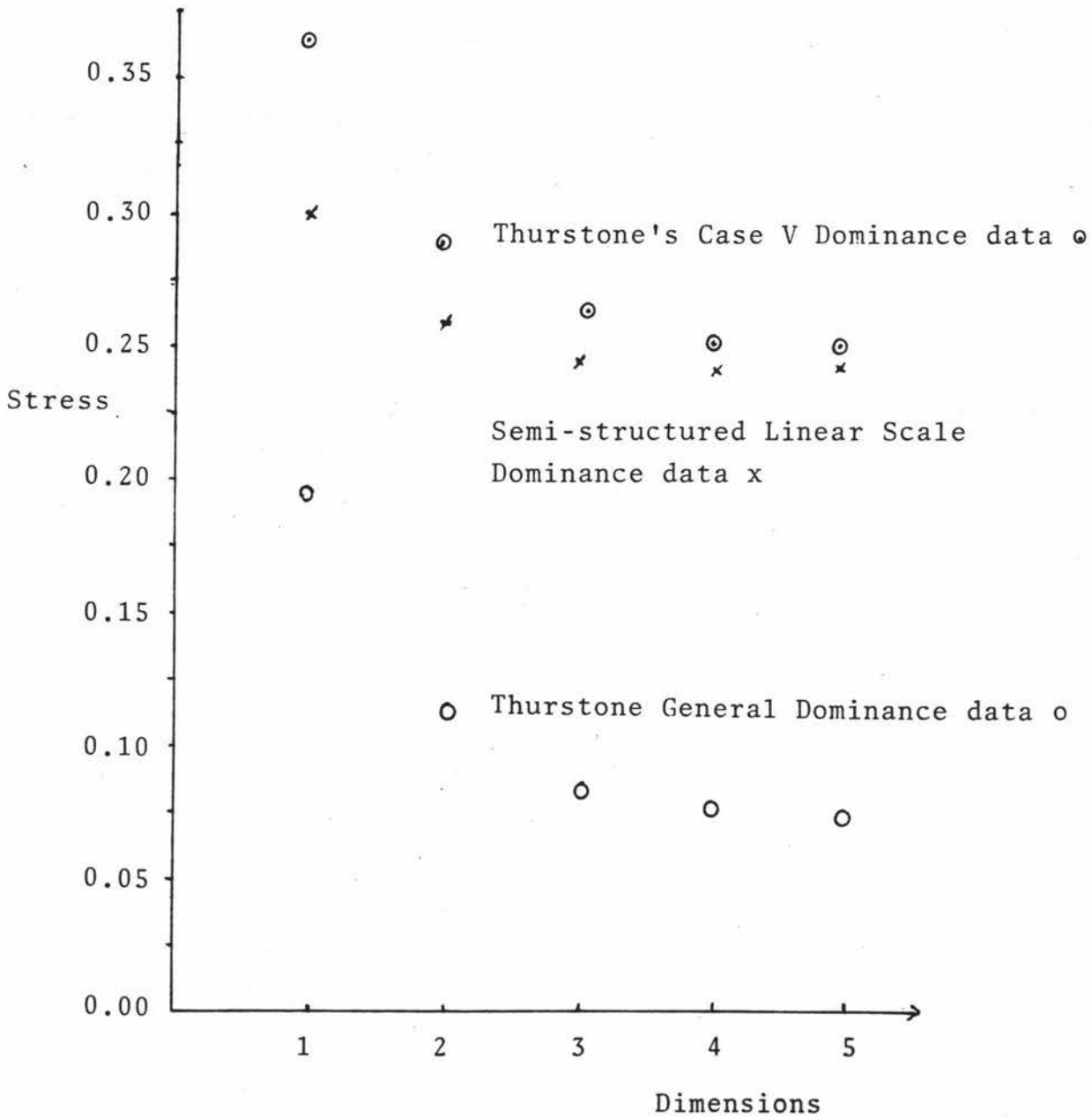

Fig. 7.5a Comparison of the Stress versus Dimension Plots for the Thurstone Case V, Thurstone General and Semi-structured Linear Scale Dominance Data.

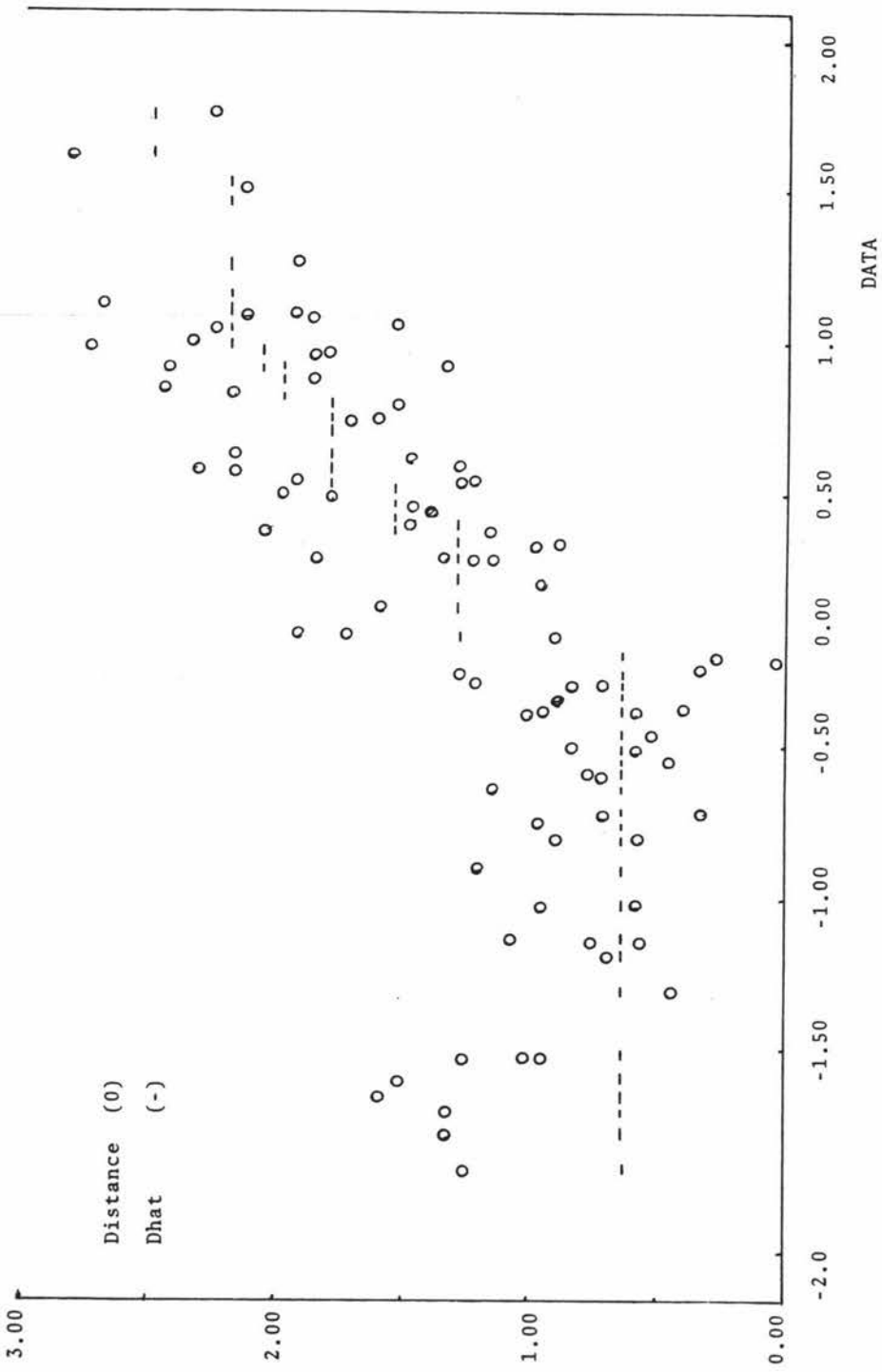

Fig. 7.5b Shepard Plot for the Thurstone Case V Dominance Data.

Key

1. Denotes Thurstone Case V Dominance Configuration
2. Denotes Thurstone General Dominance Configuration
3. Denotes Semi-structured Linear Scale Dominance Configuration.

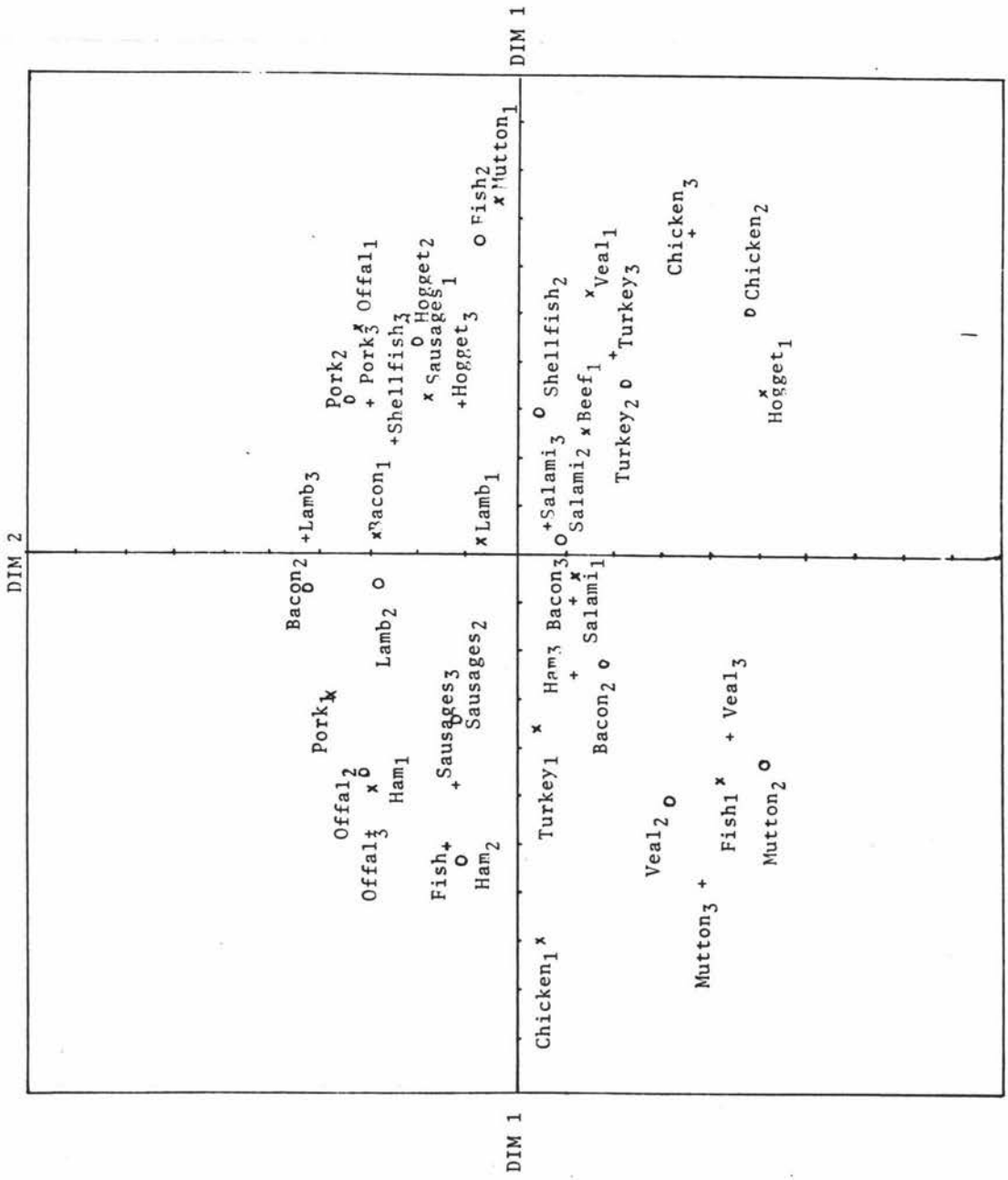

Fig.7.6 Comparison of the 2-Dimensional Configurations of the Thurstone Case V, Thurstone General and Semi-structured Linear Scale Dominance Data.

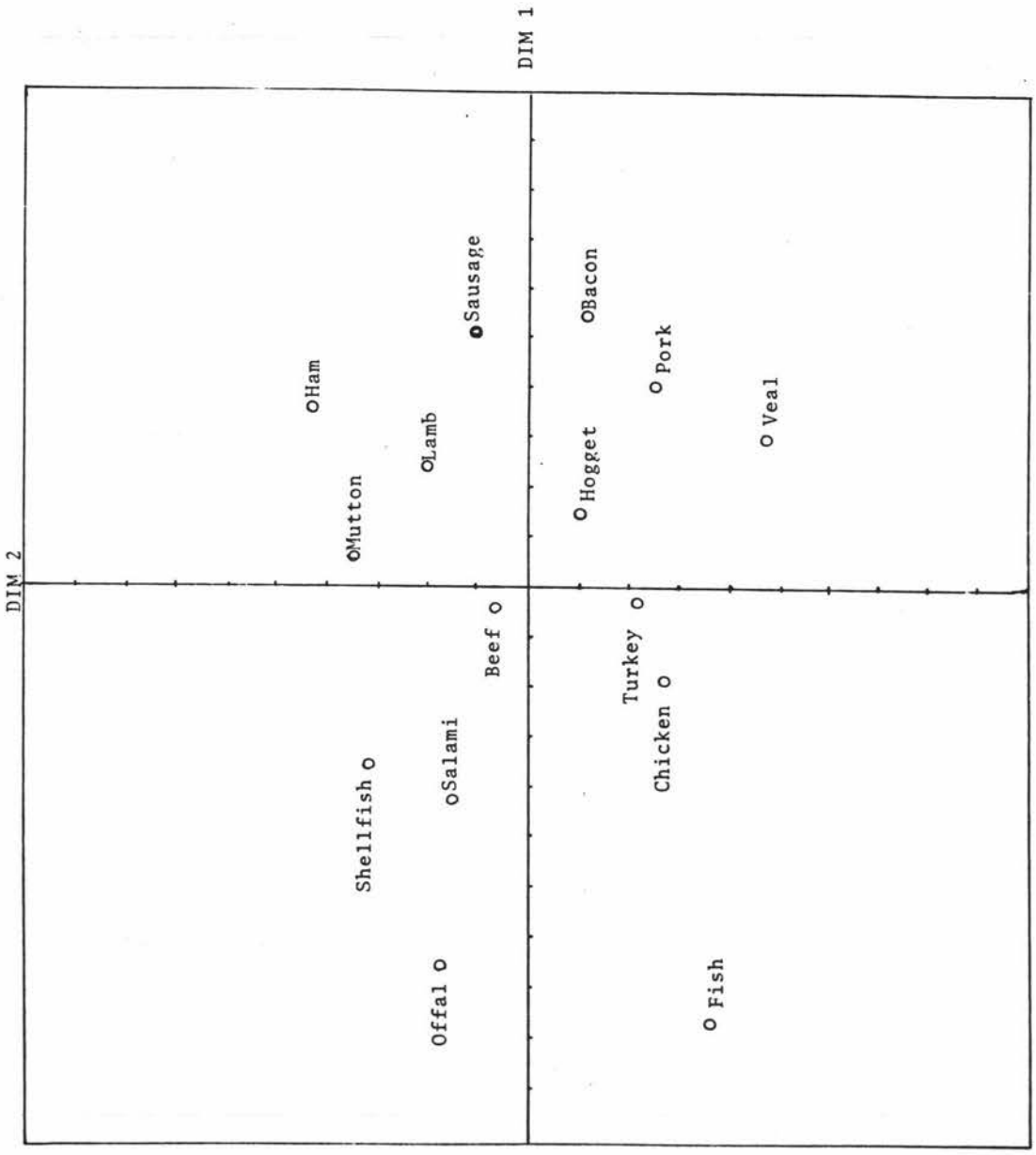

Fig 7.7 2-Dimensional Configuration of the 15 meats Using the Thurstone Case V Percentage Data.

It is possible that the 2-dimensional configurations could have arisen as a result of chance. If this were the case then it could be reasonably expected that the 2-dimensional configurations for the 15 meats would have been different for each of the data sets and in which case it could be inferred that the solutions were indeed degenerate. The fact that 4 separate data sets produced a similar configuration would tend to indicate that the 2-dimensional configurations were real and not due to errors in the data sets. Moreover, because the linear half matrix was derived from an 'interval' linear scale there were no errors in that particular half matrix from which the configuration could have arisen.

7.4.3 Effects of Rearranging Matrices

The 2-dimensional configurations of each of the data sets were not stable. Changing the relative positions of the meats in the half matrix of each data matrix tended to produce a different spatial arrangement of the 15 meats. However, the 4 data sets produced very similar spatial arrangements when the meats occupied the same positions in each of the 4 data matrices.

The meats were arranged in order of preference with the most-preferred meat allocated the first row and column of the half matrix and so on down to the least-preferred meat in column 15 and row 15 of each of the data sets and these were analysed using monotonic regression with KYST II. The resulting 2-dimensional configuration for each of the data sets was an S-shape along the x-axis. The 2-dimensional solution from the Thurstone Case V data is provided in Figure 7.8 as an example of the solution obtained from each data set. The analysis would tend to support Shepard's (1974) view that if the entries in each row and column of the matrix either increase or decrease monotonically with distance from the principal diagonal then the underlying structure is truly one-dimensional.

Coxon (1982) suggests that if a highly-stepped Shepard plot occurs with monotonic regression, then a "reanalysis should be made using options which counteract the weakness concerned. One such option is to fit a linear (or even a power) function between the data and distances." This was carried out by using the command statement Regression = polynomial = 1 for all the data sets. The Thurstone Case V, the Thurstone General and the Linear Scale data sets produced S-shaped 2-dimensional configu-

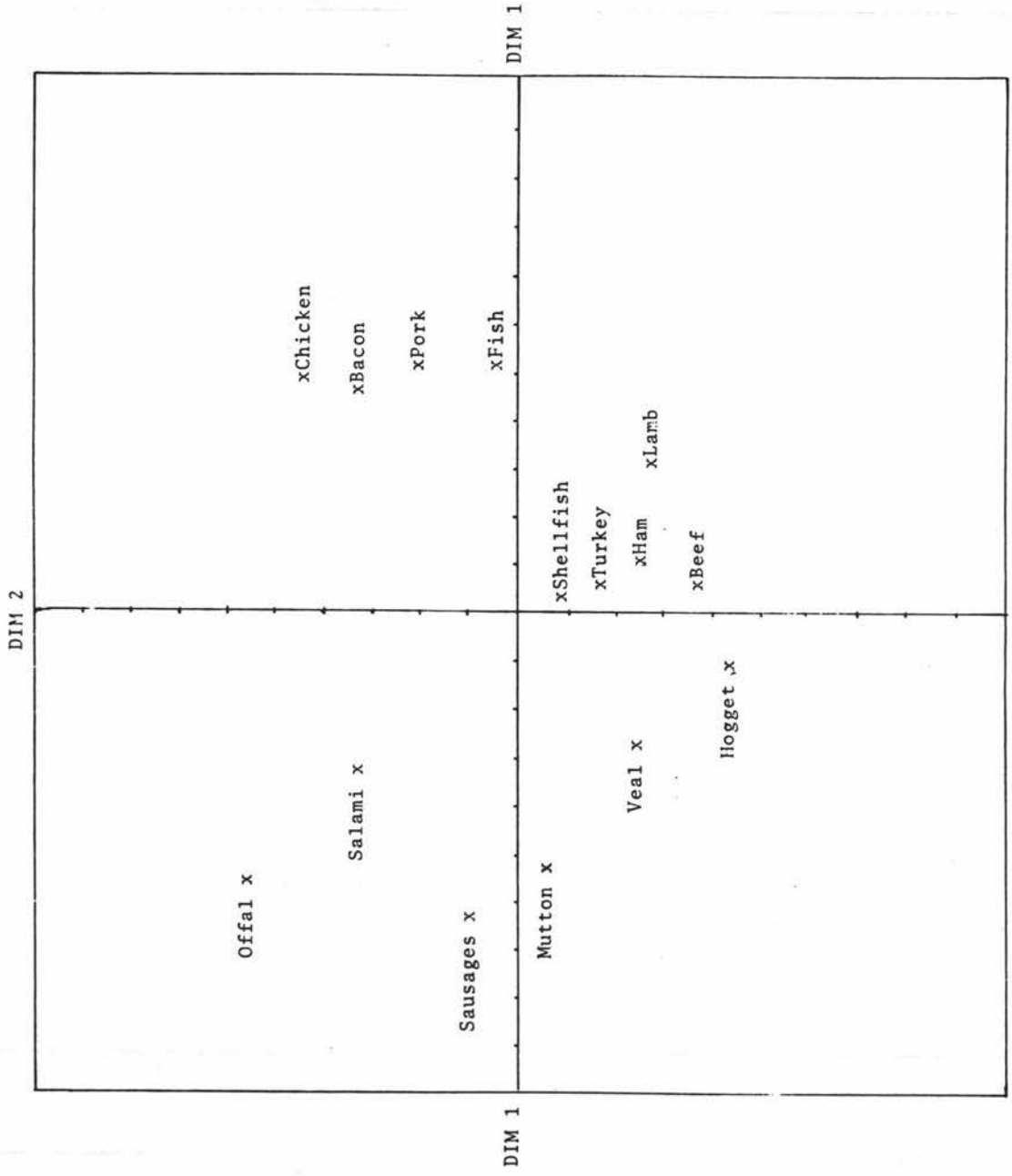

Fig. 7.8 2-Dimensional Configuration of the 15 Meats with Thurstone Case V Data rearranged in order of Preference.

rations of the meats, identical to that shown in Figure 7.8. The Percentage Preferences data set produced an identical 2-dimensional configuration of the 15 meats to that shown in Figure 7.6, i.e. the configuration obtained from the monotonic MDS regression of the Thurstone Case V, the Thurstone General and the Linear Scale data sets.

7.4.4 Evidence for One Dimensional Solution

It would appear that in spite of the fact that a very similar 2-dimensional spatial arrangement of the 15 meats was obtained from the monotonic MDS regression, the Thurstone Case V, Thurstone General and the linear data sets and the linear MDS regression of the 'percentage preference' data sets, a one-dimensional solution was the true dimensionality of each of the data sets.

The evidence for a one-dimensional solution is as follows:

* Kruskal and Wish (1978) maintain that a true n-dimensional configuration is stable under different regression functions. This was certainly not the case for the Thurstone Case V, Thurstone General, Linear Scale or the Percentage Preference data sets. The former 3 data sets gave S shapes when regressed linearly.

* The 2-dimensional configurations of each of the data sets were highly dependent on the arrangement of the meats in the original data half matrix. The data sets finally gave S-shapes when the meats were arranged in descending order of preference. Shepard (1974) reported that if a "permutation of the rows and columns of a matrix can be found such that, except for random fluctuations, the entries decrease monotonically with distance from the principal diagonal then the dimensionality underlying the data is unidimensional."

* The high stress versus dimensionality for each of the data sets together with the highly stepped Shepard plots pointed to the existence of a degenerate or at least trivial 2-dimensional solution.

* And finally the S-shapes produced from the linear MDS regression of the Thurstone Case V, Thurstone General and Linear Scale data sets all pointed to the existence of a unidimensional solution to the 'dominance' data. This was not entirely unexpected given the implications of 'dominance', i.e. the implication of strict order.

7.4.5 Re-analysis of 'Percentage Preference' Data Set

The monotonic MDS regression of the 'percentage preference' data set showed a very high stress versus dimensionality plot and a highly stepped Shepard plot (see Figures 7.5a and 7.5b respectively) which tended to indicate a degenerate or trivial solution. Following the advice of Coxon (1982), re-analysis by linear regression gave a much improved Shepard plot (see Figure 7.9) but a very high stress versus dimensionality plot indicating a very poor fit of the data to the model.

Analysis of the upper half of the percentage preference matrix shown in Table 7.1 using linear MDS regression gave a different 2-dimensional configuration to that obtained from the lower half of the same matrix. It appeared that the upper and lower halves of the matrix were giving input and output configurations, i.e. mirror images (see Coxon, 1982 p. 30) and so it was decided that a symmetric difference matrix would be created by letting $x^f_{ij} = x_{ij} - x_{ji}$, i.e. the new matrix entries would be given by the difference between the respective upper and lower half cell entries. The new matrix can be found in Appendix 7.8.

The data were analysed using KYST II with both monotonic and linear MDS regression. Both procedures produced very similar configurations. The stress versus dimensionality plot of the linear solution together with the 2-dimensional Shepard plot can be found in Figures 7.10a and b respectively. The 2-dimensional configuration of the 15 meats can be found in Figure 7.11 and the associated scale values in Appendix 7.10.

The Shepard plot together with the stress dimensionality plot indicated a much improved fit of the model to the data. There was a substantial reduction in stress between the first and second dimensions, 0.24 to 0.12 with very little improvement thereafter for increasing dimensionality. The elbow in the stress versus dimensionality clearly indicated a 2-dimensional solution for the data set.

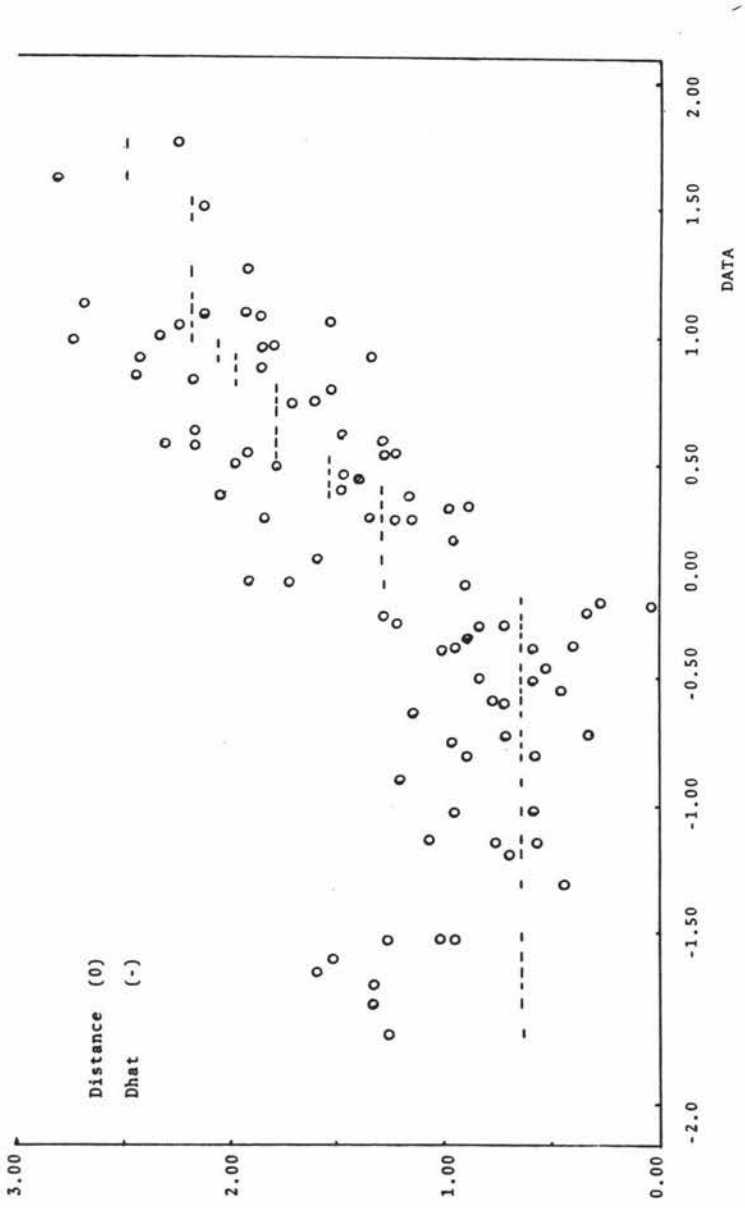

Fig. 7.9 Shepard Plot for the Percentage Data Reanalysed by Linear Regression MDS Function.

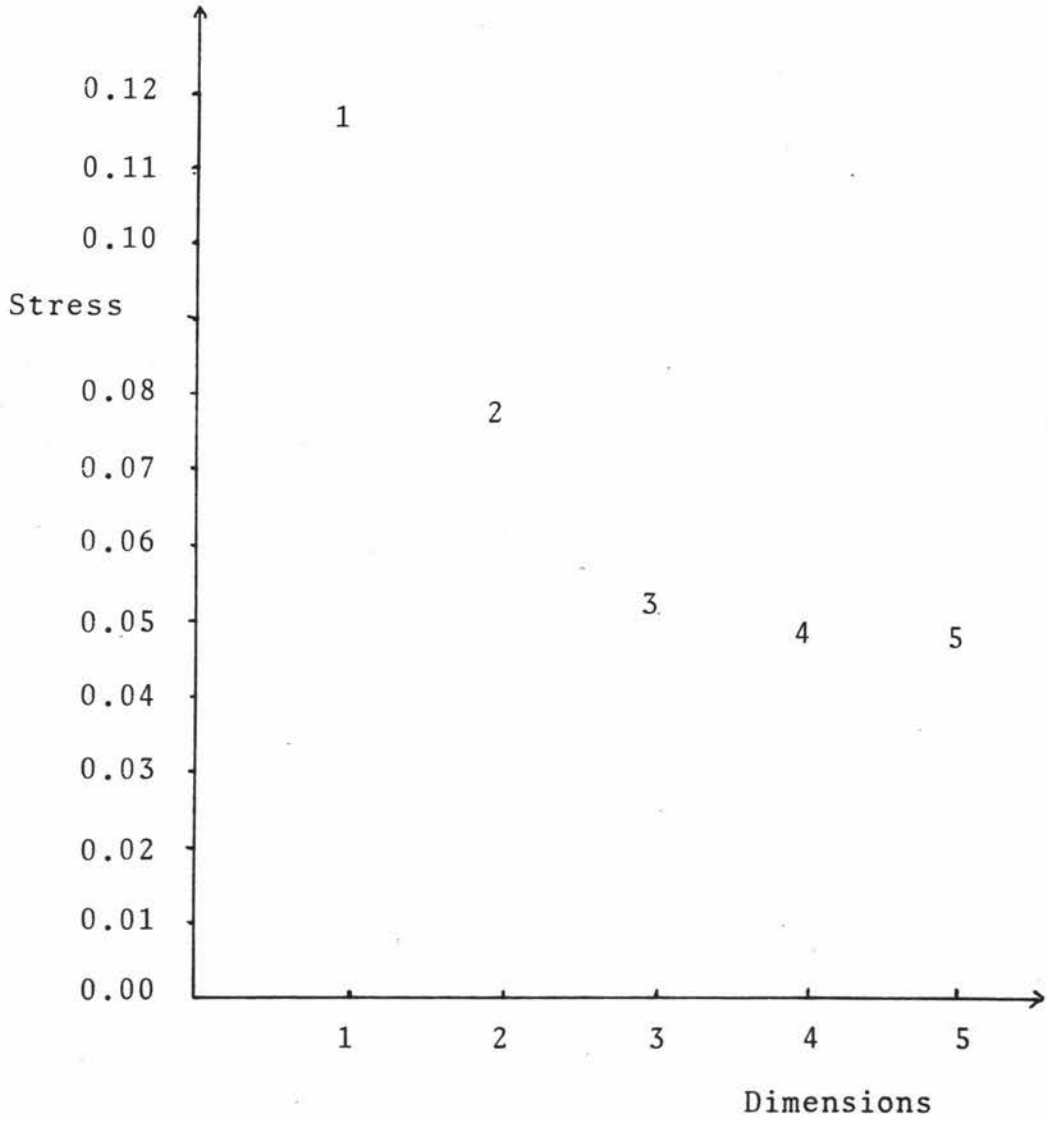

Fig.7.10a Stress versus Dimension Plot for the 15 Meat Percentage Difference Data.

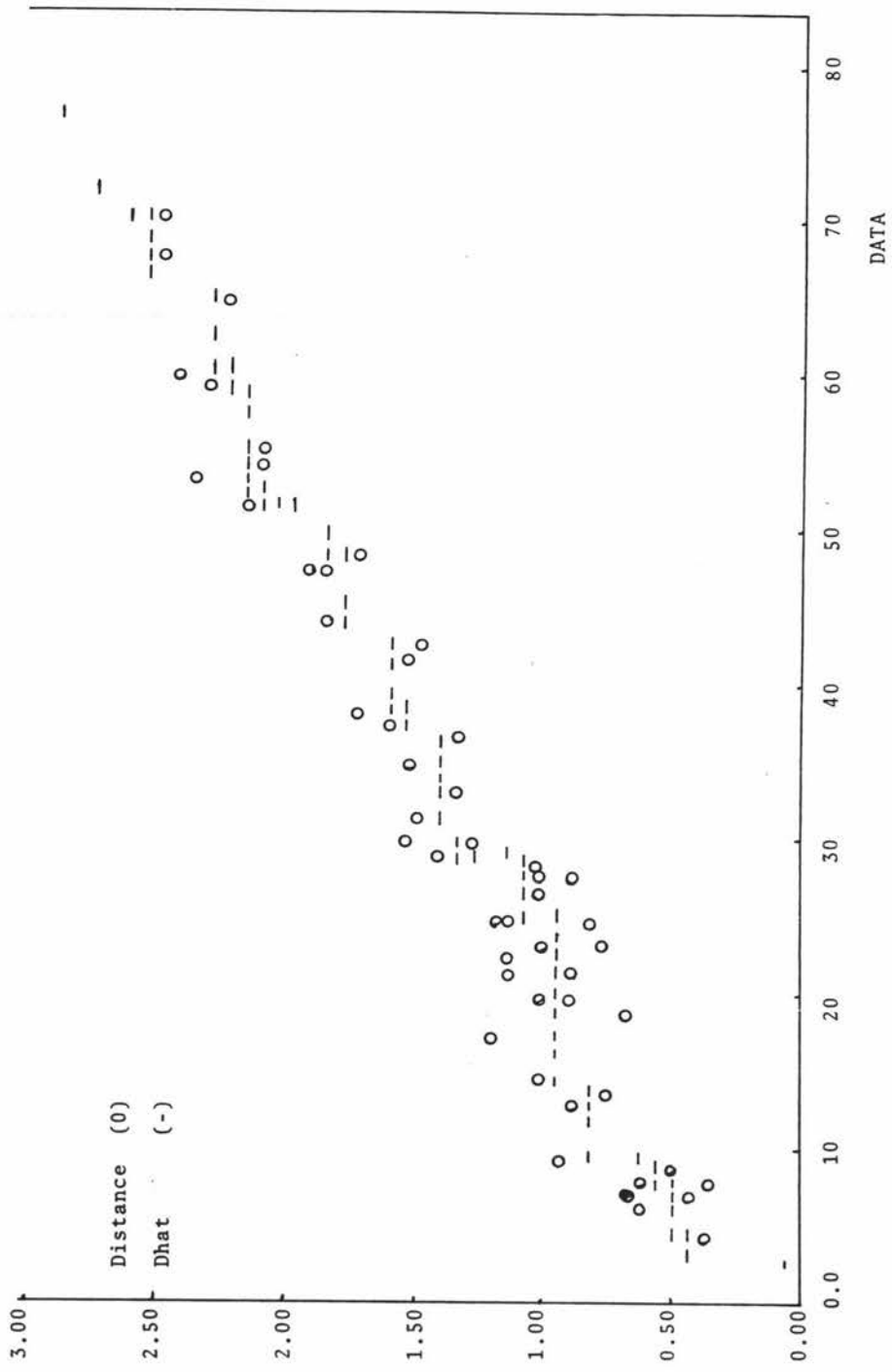

Fig. 7.10b Shepard Plot for the Percentage Difference Data.

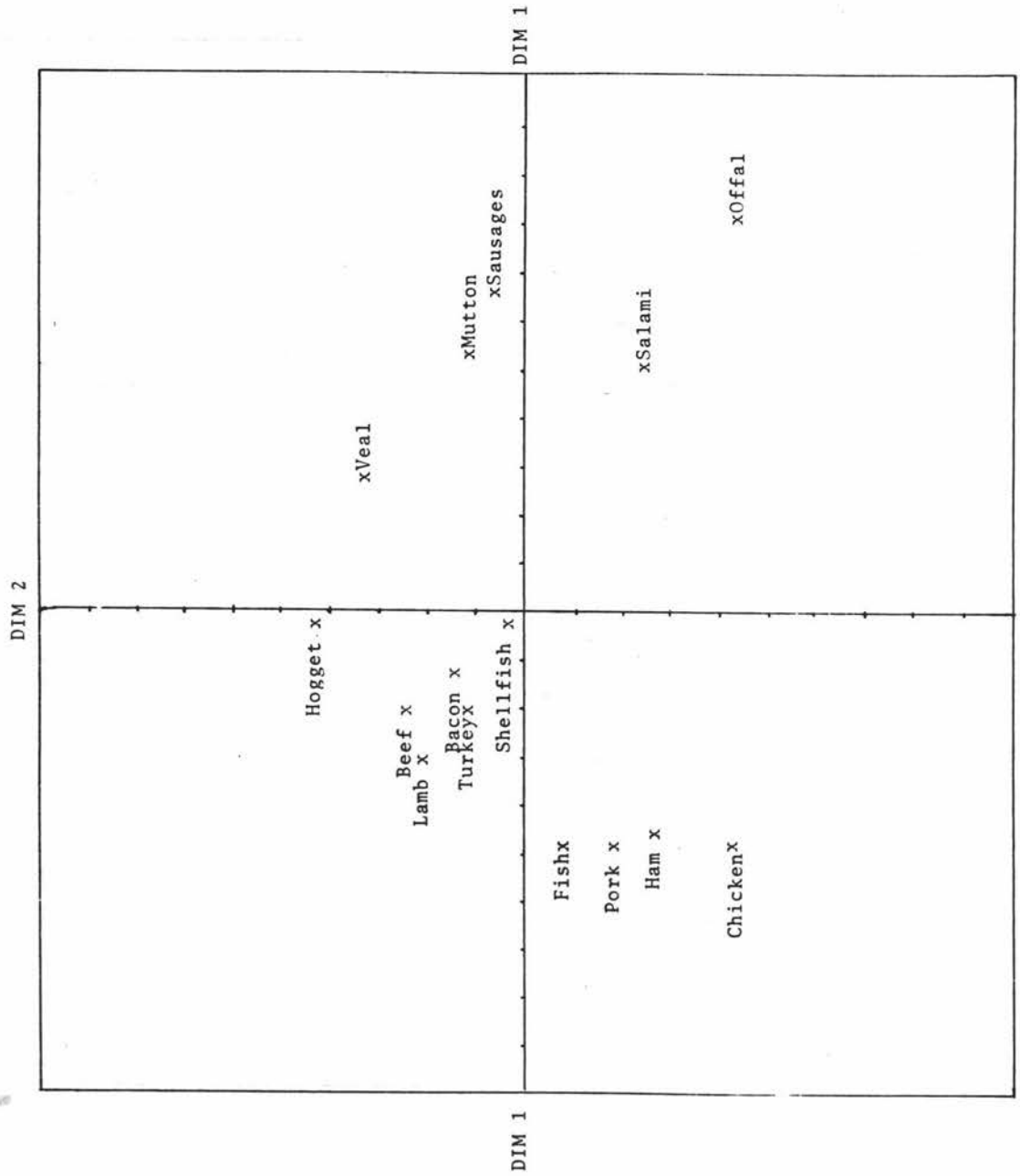

Fig. 7.11 2-Dimensional Configuration of the 15 Meats obtained from the Percentage Difference Data.

7.4.6 Recovery of Original Preference Rank Order - Comparison of Methods of Collecting Data

If preference is a unidimensional continuum and given all the ways in which the data was presented for MDS analysis it is important that the best method of presenting the preference data for MDS analysis should be elucidated - where best means greatest recovery of the original rank order of the data using MDS compared to the Thurstone Case V method.

The Thurstone Case V data were analysed in a number of ways: firstly as percentages, secondly as differences in the percentages between the a_{ij} and a_{ji} cells of the percentage matrix, thirdly as Z values with both negative and positive values and finally with the Z values in the lower half matrix being positive. The unidimensional rankings derived from the MDS of each of the data sets have been presented in Table 7.9 and these have been compared with the original rankings of the 15 meats that were obtained using Thurstone's Case V interval scale method.

The respective rank orders for the 15 meats were compared with the Thurstone Case V interval scale rank order by means of the Spearman rank correlation coefficient. The MDS unidimensional solution for the percentage differences matrix almost reproduced the rank order obtained from the Thurstone Case V Interval Scale as evidenced by the very high value of 0.996 for the Spearman Rank correlation coefficient. The MDS analysis of the 'dominance' matrix and in particular the percentage matrix showed a very poor recovery of the original rank order in the data as evidence by Spearman rank correlation coefficients of 0.777 and 0.639 respectively.

Table 7.9. Comparison of Unidimensional Rank Orders of the 15 Meats with Thurstone Case V Interval Scale Rank Order

Meat	Thurstone Case V Scale Rank Order	MDS UNIDIMENSIONAL RANK ORDER Percentage Preference	Percentage Difference	Dominance Z Values
a Chicken	1	2	1	1
b Ham	2	4	2	3
c Pork	3	5	3	4
d Fish	4	1	4	2
e Lamb	5	8	5	8
f Beef	6	12	6	10
g Bacon	7	9	7	9
h Turkey	8	3	8	5
i Shellfish	9	6	9	6
j Hogget	10	15	10	12
k Veal	11	13	11	14
l Mutton	12	14	13	15
m Salami	13	7	12	7
n Smallgoods	14	10	14	11
o Offal	15	11	15	13
Spearman Rank Correlation Coefficients		0.639	0.996	0.777

It would appear that the best way of recovering the original rank order present in the data when analysing paired comparison preference data by MDS is to take the difference between the X_{ij} and X_{ji} percentage entries i.e. to produce a symmetric difference matrix and then analyse this using KYST II or some other appropriate MDS package.

7.5 CLUSTER ANALYSIS OF PREFERENCE PROXIMITY DATA FOR 15 MEATS

An examination of the 2-dimensional configuration of the 15 meats shown in Figure 7.11 indicated that a dimensional interpretation of the

configuration was not practical and that a clustering approach was the better approach to the problem. The meats were clearly clustered in preference groupings with the 3 most-preferred meats ham, chicken and pork in one cluster, followed by fish on its own, followed then by a larger cluster consisting of lamb, beef, bacon, turkey and shellfish followed by a cluster consisting of veal and hogget, then another consisting of mutton and salami, with smallgoods and offal on their own.

In spite of the stress versus dimension plot clearly showing that a 2-dimensional configuration appeared to be the optimal dimensionality for the data, the existence of a horseshoe shape tended to indicate the possibility of a one-dimensional solution underlying the data (Shepard, 1974; Coxon, 1982).

Re-arrangement of the half matrix with the most-preferred meat being placed in column and row 1 through to the least-preferred meat in column and row 15 showed that the entries in the matrix tended to decrease monotonically with distance from the principal axis confirming that a single dimension underlay the data (Shepard, 1974).

7.5.1 Summary of 15 Meat Preference Analysis

It would appear that no matter how the preference data for each of the three methods was arranged and presented for analysis by Multidimensional Scaling using KYST II, that only a single dimension could be found that underlay the data, namely preference. It would therefore appear from the data analysis in this chapter at least, that preference is not a multidimensional continuum as Kendall (1975) would claim but a single dimension.

7.6 PREFERENCE FOR 41 CUTS OF MEAT

The analysis of the questionnaire relating to the 15 meats showed that it was possible to obtain two slighly different preference rankings depending on whether the data was analysed by the Thurstone Case V method or by Thurstone General method, i.e. utilising the scale scores. For reasons of time it was decided that the data would be analysed by the Thurstone Case V method rather than by the more time-consuming Thurstone's General method. The 41 x 41 meat cut matrix of Z values is

presented in Appendix 7.9 and the preference rankings derived from the matrix are shown in Table 7.10.

An examination of the meat preference rankings firstly showed an aggregation of the white, less strongly-flavoured meats such as chicken, ham, pork and fish at the top of people's meat preferences. Porterhouse and rump steaks and leg of lamb were the exceptions. Though beef was consumed by the greatest proportion of households in the survey and had the highest per capita consumption, the beef cuts were ranked only in the middle of people's meat preferences. The mutton cuts which were consumed by very few households (less than 30%) were ranked ahead of all the offals and all the sausage products. Some of these, such as lambs' fry, beef and pork sausages, were consumed by more households than the mutton cuts. Beef mince and stewing steak, cuts served by over 80% of the households, were given very lowly preference rankings, 24th and 25th respectively.

The larger cuts of meat such as leg of ham, leg of pork, chicken and leg of lamb, products which were usually served as roasts, were ranked at the head of the meat preference rankings in spite of the fact that most people served them on an infrequent basis, usually once every two months.

It was also interesting to observe the rankings of the sausage and offal products included in the survey. All of these products could be found at the bottom of the respondents' preference rankings. These products would appear to have a very poor image amongst consumers. Consumption of these products would appear to be due to reasons other than preference.

An examination of the preference rankings for the 41 meats; the per capita consumption of each meat and also the proportion of households serving each meat showed that people do not always consume the meats that are high in their preference ranking nor indeed consume large quantities of the meats that they prefer. Obviously preference is only one variable in the equation determining meat consumption and whilst important should not totally dictate the objectives of new meat product development.

Table 7.10 Consumer Preference Rankings for the 41 Cuts of Meat

Meat	Ranking of Meats	Thurstone Case V Interval Scale
Chicken	1	1.37
Leg of Ham	2	1.29
Leg of Pork	3	1.12
Porterhouse Steak	4	0.99
Sliced Ham	5	0.92
Leg of Lamb	6	0.87
Pork Chops	7	0.81
Rump Steak	8	0.76
Fish	9	0.74
Ham Steaks	10	0.72
Wienersnitzel	11	0.63
Leg of Hogget	12	0.52
Corned Beef	13	0.50
Pork Pieces	14	0.46
Lamb Loin Chops	15	0.41
Hogget Loin Chops	16	0.27
Mutton Loin Chops	17	0.26
Lamb Forequarter	18	0.24
Middle Bacon	18	0.25
Shoulder Bacon	20	0.18
Shellfish	21	0.13
Topside	22	0.07
Leg of Mutton	23	0.03
Beef Mince	24	-0.09
Stewing Steak	25	-0.14
Mutton Forequarter	26	-0.34
Lambs' Fry	27	-0.36
Beef Sausages	28	-0.41
Pork Sausages	29	-0.47
Kidney	30	-0.65
Salami	31	-0.68
Ham'n'chicken	32	-0.73
Luncheon	33	-0.79
Beef Tongue	34	-0.84
Saveloys	35	-0.89
Frankfurters	36	-1.07
Hamburgers	37	-1.09
Garlic Sausage	38	-1.10
Black Pudding	39	-1.26
Tripe	40	-1.33
Beef Hearts	41	-0.79

7.7 MDS ANALYSIS OF PREFERENCE DATA FOR 41 MEAT CUTS

In addition to providing paired comparison preference responses to the 15 meats, the respondents had also been asked to provide the same information for 41 meat cuts.

It was felt that a possible reason for a single dimension, namely preference, underlying each of the 15 meat data sets, rather than n-dimensions may have been due to the nature of the task, i.e. the respondents were asked to discriminate between quite clear meat categories and hence the likelihood of systematic preference ratings for each of the pairs was high. However, the 41 meat cuts, i.e. 820 pairs of meats, presented a quite different task and there appeared to be less likelihood that the respondents would be systematic in their ratings firstly because of the size of the task which meant that they would find it difficult to remember how they had scored an object previously and secondly because the differences between the cuts were not quite so clear-cut as the differences between the 15 meat categories, and so it was possible that the respondents would use a number of different criteria to make their preference assessments and hence the likelihood of uncovering an n-dimensional spatial arrangement for the 41 meat cuts was greater than for the 15 meats problem.

The lower half of the matrix presented in Appendix 7.10 was entered into the computer, the 'dominance' criteria were relaxed, i.e. all the negative values were removed from the matrix and the data were then analysed with the KYST II programme using both monotonic and linear regression functions. The stress versus dimensionality plot for the linear function is shown in Figure 7.12 a and the Shepard 2-dimensional plot is shown in Figure 7.12 b. The 2-dimensional arrangement of the 41 meats is presented in Figure 7.13.

An examination of the stress versus dimension plot together with the Shepard plot shows that the model provided a reasonable fit to the data. The elbow in the stress versus dimensions plot would tend to support the view of 2 and possibly 3-dimensional solutions. However, an examination of Figure 7.13 clearly shows the presence of a C-shaped curve with the most highly-preferred meats, i.e. chicken, leg of pork and ham at one end of the curve and the least-preferred meats i.e. tripe and beef

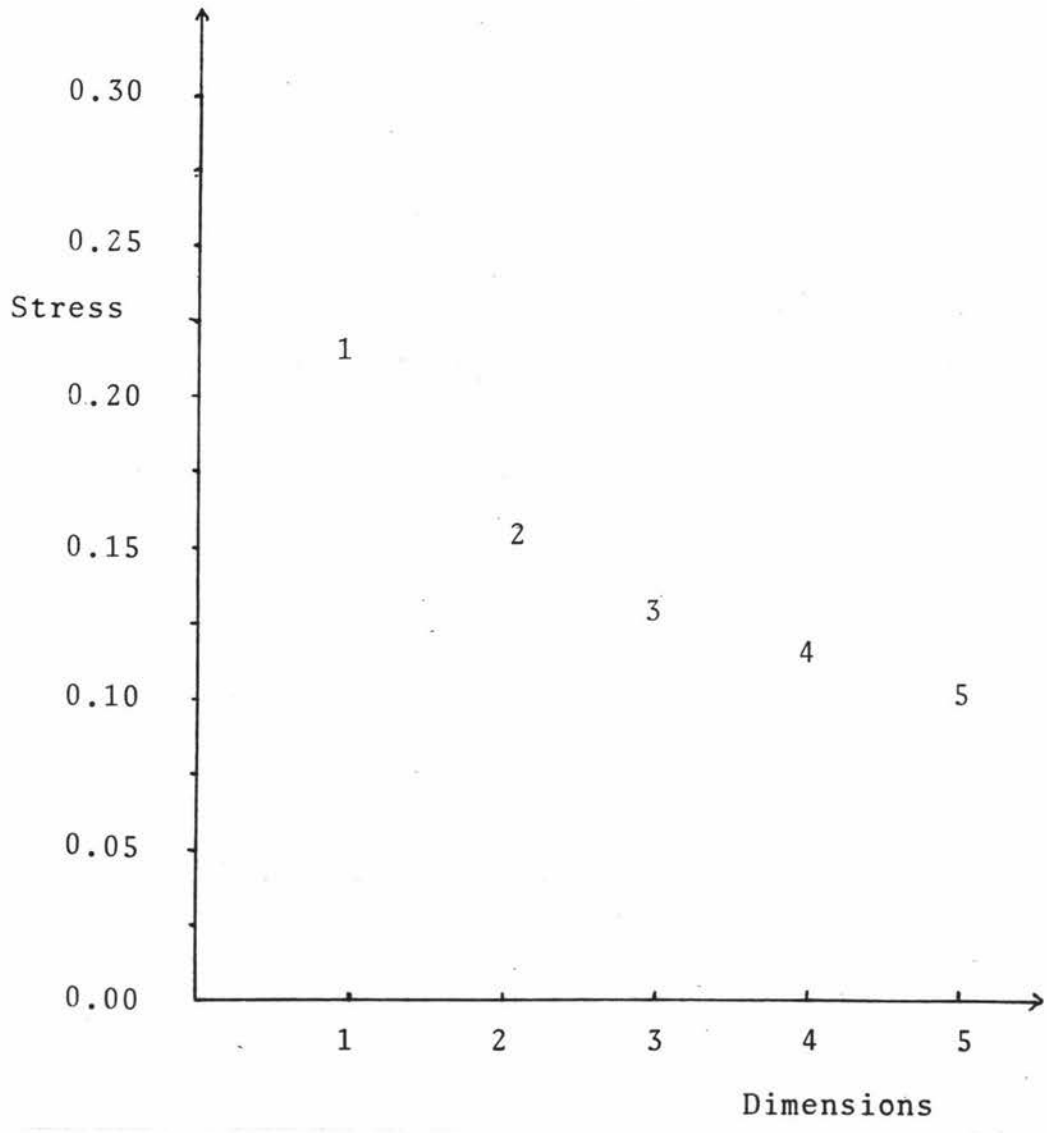

Fig. 7.12a Stress versus Dimension Plot for the 41 Meat Cuts Preference Data.

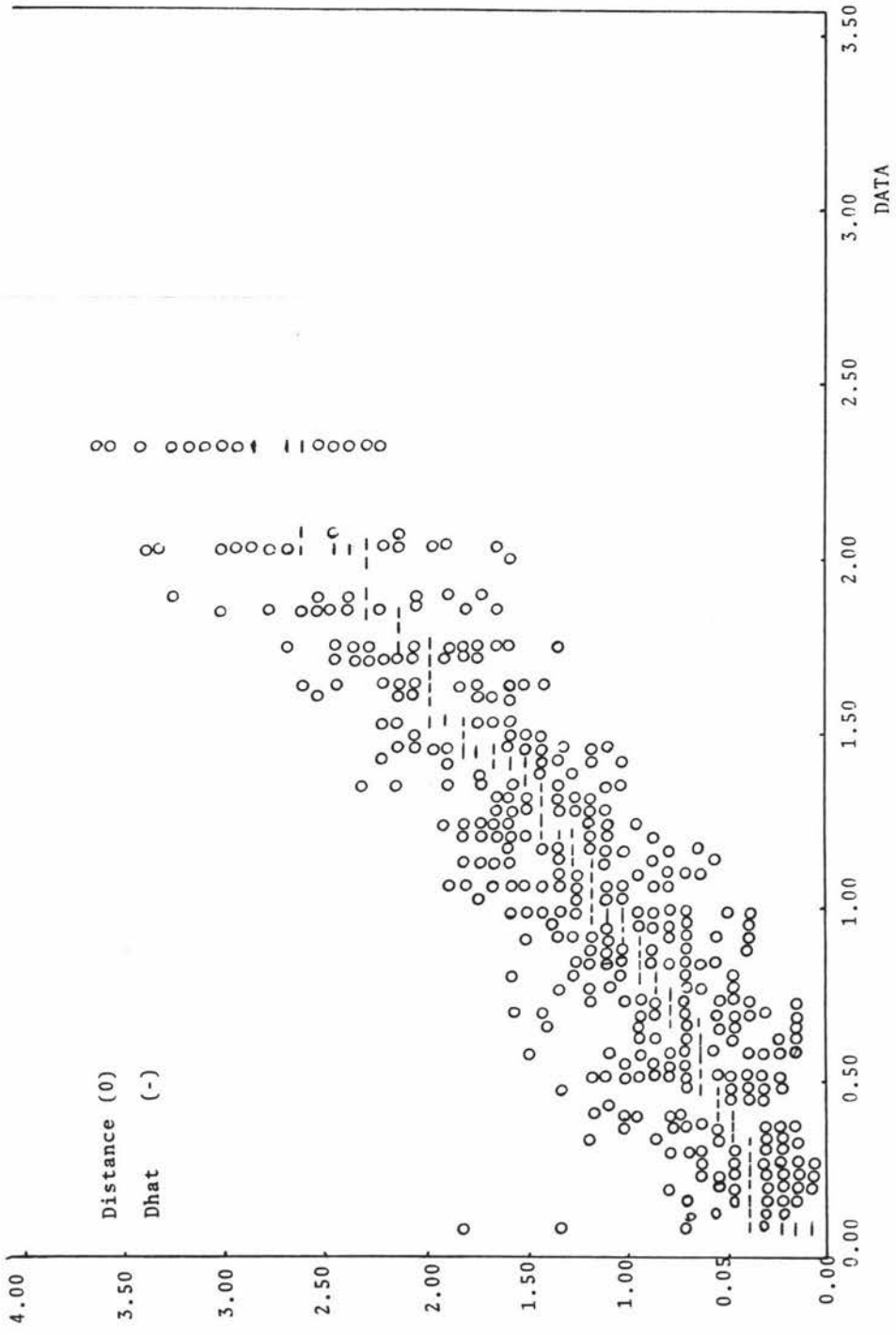

Fig 7.12b Shepard Plot for the 41 Meat Cuts Preference Data.

KEY

1. Wienersnitzel
2. Rump steak
3. Porterhouse steak
4. Stewing steak
5. Topside
6. Beef mince
7. Beef tongue
8. Beef hearts
9. Corned beef
10. Beef sausage
11. Lamb forequarter
12. Leg of hogget
13. Lamb loin chops
14. Leg of lamb
15. Mutton forequarter
16. Hogget loin chops
17. Mutton loin chops
18. Leg of mutton
19. Pork chops
20. Pork pieces
21. Leg of pork
22. Sliced ham
23. Leg of ham
24. Ham steaks
25. Middle bacon
26. Shoulder bacon
27. Fish
28. Chicken
29. Shellfish
30. Hamburger
31. Beef tripe
32. Lamb's fry
33. Lamb's kidney
34. Pork sausage
35. Luncheon
36. Ham nchicken
37. Salami
38. Frankfurters
39. Saveloys
40. Black pudding
41. Garlic sausage

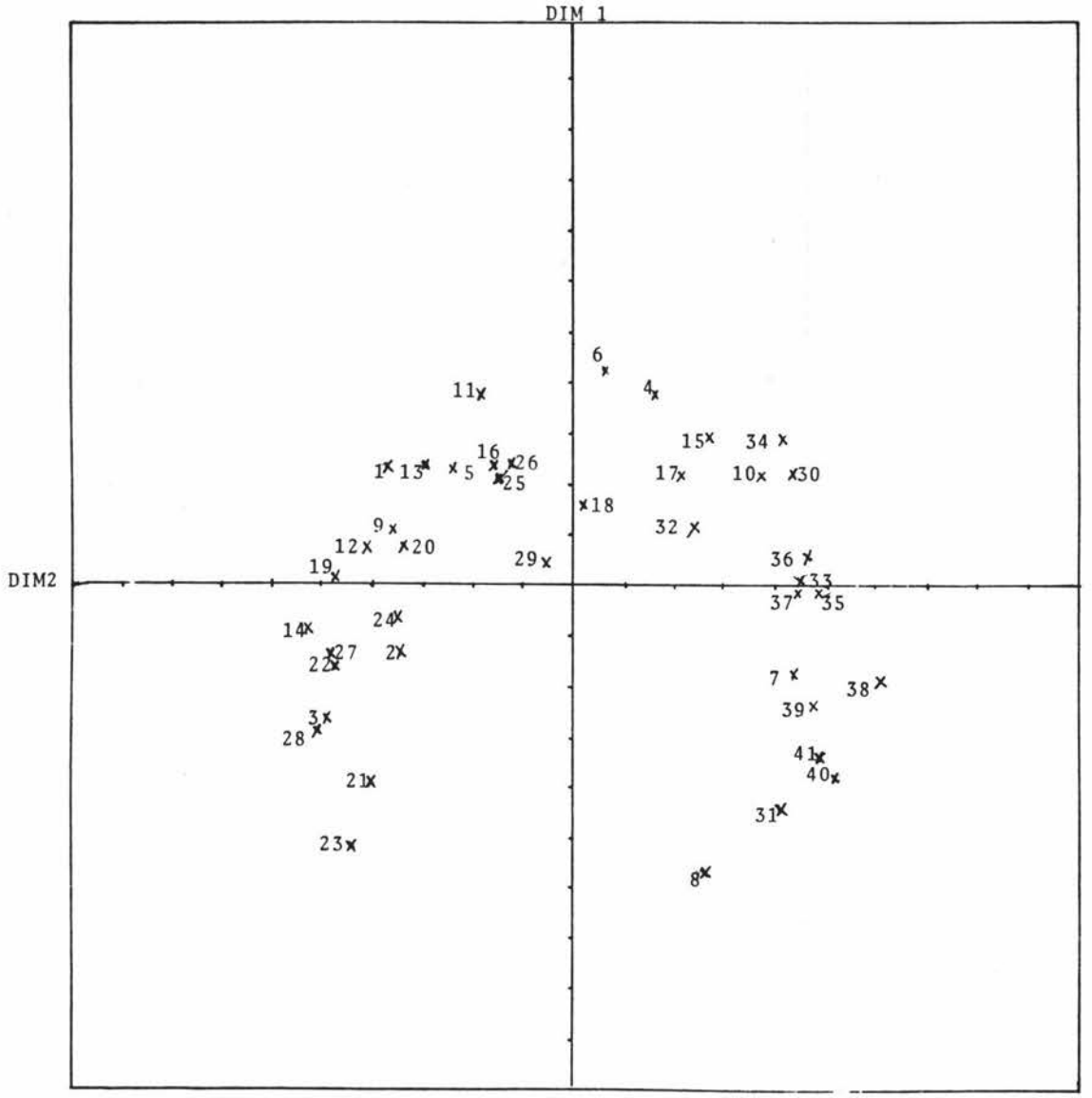

Fig. 7.13 2-Dimensional Configuration of the 41 Meat Cuts using the Preference Data.

hearts at the opposite end. According to Shepard (1974) and Coxon (1982), the presence of a C-shaped curve could possibly indicate a one-dimensional solution to the data.

Rearrangement of the 41 x 41 meat cut half matrix with the entries for the most-preferred cut, i.e. chicken, placed in the first row and column through to the least-preferred meat, namely beef hearts in row 41 and column 41 showed that the underlying structure to the data was a true one-dimensional solution (Shepard, 1974), i.e. "...the entries decreased monotonically with distance from the principal diagonal."

The separate MDS analyses on the 15 meat preference data sets together with the MDS analysis of the 41 meat cuts would tend to support the view that only a single dimension underlies the preference continuum.

7.8 CONCLUSIONS

7.8.1 Techniques

* Whilst the unidimensional rank order of the 15 meats was slightly different depending on whether Thurstone's Case V or Thurstone's General method or the semi-structured linear scale was used to derive the ranks, the methods according to Spearman's rank correlation coefficient produced a statistically similar rank order. The difference in rank order between the two Thurstone methods was less than the difference between the rank order derived from the semi-structured linear scale and the Thurstone Case V and the semi-structured linear scale and the Thurstone General method.

* The monotonic MDS regression of the Thurstone Case V, Thurstone General, linear 'dominance' data sets and the linear regression of the percentage matrix produced similar trivial 2-dimensional configurations for the 15 meats. However, the configurations were highly dependent on the order of presentation of the meats and finally collapsed into a unidimensional configuration when the meats were arranged in descending order of preference. As predicted by Shepard (1974), the unidimensional configuration was to be expected given that the entries in each diagonal decreased monotonically with distance from the principal diagonal.

* Linear MDS regression of all the 15 meat dominance data sets and preference similarity sets produced an S-shaped spatial arrangement of the meats when configured in 2 dimensions.

* Linear MDS regression of the percentage difference preference matrix appeared to produce a true 2-dimensional MDS solution as evidenced by the stress versus dimensionality plot and the Shepard plot for two dimensions. However, the presence of a horseshoe shape indicated that the solution was probably one-dimensional. Examination of the matrix with the meats ordered in decreasing order of preference indicated that the cell entries declined monotonically with distance from the principal diagonal - indicative of a one-dimensional solution.

* It would appear that the best way of recovering the original rank order present in the data when analysing paired comparison preference data by MDS is to take the differences between the X_{ij} and X_{ji} percentage entries, i.e. to produce a symmetric differences matrix and then analyse this using KYST II or some other appropriate MDS package.

* The 41 x 41 lower half matrix of Z values for the 41 meat cuts produced a C-shape in two dimensions when MDS analysed (linear). The C-shape indicated the existence of a unidimensional solution for the data. This was confirmed when the matrix was re-arranged so that the meats were placed in order of decreasing preference and it was found that the matrix entries decreased monotonically with distance from the principal diagonal (Shepard, 1974).

* The MDS analysis of all the 15 meat data sets together with the MDS analysis of the 41 meat cut data set indicated that at least for the data collected in the present survey meat preference was a unidimensional continuum and not a multi-dimensional continuum as claimed by Kendall (1975).

* If preference is indeed a unidimensional continuum then obtaining preference data by means of the semi-structured linear scale would appear to be a more appropriate method of determining an interval scale of preference given the high number of triads in the paired comparison preference data (79 out of a possible 140).

* MDS analysis of the percentage difference preference matrix recovered the highest proportion of rank order present in the paired comparison data as evidenced by the high Spearman rank correlation coefficient of 0.996 when compared with the rank order derived using the Thurstone Case V method.

7.8.2 Meats

* The consumers in Palmerston North would appear to prefer the pale, mild-flavoured meats such as chicken, ham, pork, fish and lamb in that order, followed by the stronger-flavoured and dark-coloured meats such as beef, bacon, turkey, hogget, veal and mutton with salami, sausage products and offal at the bottom of their preference list.

* The overall preference order for the 41 meat cuts followed a very similar pattern to that outlined for the 15 meats with chicken top of the preference list, followed by the ham cuts, pork cuts and fish and lamb cuts with the offal and sausage products at the bottom of their preference list. Interspersed amongst the pork and ham cuts were the more popular cuts of beef such as the steaks and the more popular cut of lamb, i.e. the leg.

* The Thurstone Case V Interval scale values for both the 15 meats and the 41 meat cuts were subsequently used in Chapter 10 for the ideal point estimation in the respective substitutability spaces and also in Chapter 14 in the models to predict per capita consumption of the 41 meat cuts, overall preference for the 41 meat cuts and the proportion of households that would consume each meat cut.

* The Thurstone General and Semi-structured Line Scale interval scores were also used in Chapter 10 to see whether the three different methods of measuring preference would result in different estimates of the ideals in the 15 meat substitutability space.

* Individual respondent scale scores for the 15 meats were used in Chapter 10 to estimate respondents' ideals using Kruskal et al.'s Method (1972).

CHAPTER 8

SUBSTITUTABILITY OF MEATS AND MEAT CUTS

Similarity data has been a recognised input for Multidimensional Scaling (MDS) for over 15 years. Kruskal and Wish (1978) provided a brief outline of the many fields in which similarity data has been used as input to MDS.

Reports of specific practical application of Multidimensional Scaling to product design are almost non-existent (Anderson, 1985). Stefflre (1972) and Morgan and Purnell (1969) both suggested the identification of 'holes' or 'gaps' in product attribute spaces as a means of locating potentially successful products. Shocker and Srinivasan (1974) and Pessemier and Root (1973) presented sophisticated models that employ MDS procedures for new product design and evaluation. Green and Rao (1972) used MDS to evaluate consumers' preferences for different breakfast foods given different occasions. Wind (1973) used MDS to the product concept testing stage. Six new drink concepts were positioned in the same conceptual space as 28 existing drink products so that potentially successful products could be identified. Anderson (1975) used non-metric MDS to provide the basis for the derivation of metric scale values for 40 raw materials and an ideal point. These values were then used to derive a linear function relating raw materials to food dish acceptability. This function was then used in a linear programming model together with the nutritional constraints to provide a systematic method of raw material selection for nutritious and acceptable Thai food dishes. Schiffman et al. (1982) used MDS to evaluate a range of foods and flavours. Poste (1980) used MDS to select and develop a new slimming food for the New Zealand market. Anderson and Kruse (1985) used MDS to define and develop a new ice cream novelty product to appeal to the New Zealand teen-age market. In Holland, Wierenga (1983) used MDS to define and charactise the important attributes of vegetables.

However, there do not appear to be any studies in the literature which report the use of MDS to either identify the important attributes of meats or meat products or indeed to identify potentially successful new meat products.

In this study, respondents indicated how one meat could be substituted for another. This was done with the 15 meats and also for the 41 meat cuts. The multi-dimensional spaces for the 15 meats and the 41 meat cuts were compared so as to establish whether the dimensions changed as the consumers went from a consideration of meats in general to the consideration of specific meat cuts.

8.1 INTRODUCTION

According to Coxon (1982) "a wide range of types of data and of measures of association can be interpreted as providing information about how similar or dissimilar objects are to each other. Similarity conveys the idea of the proximity of two objects. Whilst dissimilarity conversely conveys the idea of distance between two objects." With MDS distance and proximity are quite often used interchangeably, though it is more usual to use the term 'dissimilarity' to cover any distance measure and 'similarity' to cover proximity measures.

The large number of (dis)similarity measures can be categorised into two main types:

* Direct
* Indirect

8.1.1 Direct Data

Much attitudinal and survey data are of this form and a summary of the more commonly used direct data methods for obtaining similarity measurements is presented in Table 8.1.

According to Coxon (1982) "collecting similarity ratings of pairs of stimuli from a set of objects is a long-established pastime, especially among social scientists, but there is no guarantee that subjects' use of rating categories bears any resemblance to the arithmetic properties which are often ascribed to them." Coxon states further that researchers should take care to ensure that a sufficiently large number of categories is provided and that subjects use a sufficiently wide range of them. Miller (1956) suggested the magical 7 ± 2 as the optimum number of ratings and Green and Rao (1970) provided empirical support

Table 8.1 ***Some direct methods of collecting dissimilarities data***

Method	*Presentation*	*Question Instructions*	*Implied Information on Distances*	*References*
1 **PAIR COMPARISONS**	All pairs (j, k)	How dissimilar are j and k? e.g. on a 7-point rating scale from totally similar (1) to totally dissimilar (7)	δ_{jk} gives direct estimate of d_{jk}	•David 1963 •Spence and Domoney 1974 Green and Rao 1970
2 **PARTITIONS** (Sorting)	Subject divides stimuli into mutually exclusive and exhaustive categories or groups	Sort/divide stimuli into: (a) fixed number of categories (fixed sorting) (b) as many or as few categories as you wish (free sorting)	For any three stimuli, (j, k, l) $d(j, k) < d(j, l)$ if j and k are in the same category, and l is in a different category	Miller 1969 Anglin 1970 Jones and Ashmore 1973 Coxon and Jones 1978b, 1979
3 **HIERARCHIES**	Subject constructs hierarchical clustering of stimuli	(i) First choose the most similar (MS) pair, then (ii) Either add new stimulus, or begin new similar pair, then (iii) *Either* start new pair, *or* add stimulus, *or* merge existing cluster (see Coxon and Jones 1978b)	δ_{jk} is given by the level of hierarchy at which j and k are joined	Johnson 1967 Coxon and Jones 1978b, 1979 Fillenbaum and Rapoport 1971
4 **RANKING**	Subject i places stimuli $j, k, l \ldots m$ in rank order in terms of given criterion	What is your order of preference/similarity? Say: m, l, k, j	$d_{im} < d_{il} < d_{ik} < d_{ij}$	Coombs 1964 •Durbin 1951
5 **TRIADS**	All triads (j, k, l) of stimuli	(a) Which is the most similar pair? Say: (k, l) (b) Which is the most similar (MS) pair, and the least similar (LS) pair? Say: MS is (j, k) and LS is (k, l)	$d_{kl} < d_{jl}$ and $d_{kl} < d_{jk}$ $d_{jk} < d_{jl} < d_{kl}$	•Burton and Nerlove 1976 •Cochran and Cox 1951 Torgerson 1958
6 **TETRADS**	All pairs of pairs $((j, k)$ and $(l, m))$ of stimuli	Which pair is the more similar? Say: (l, m) MS than (j, k)	$d_{lm} < d_{jk}$	•Cochran and Cox 1951 Torgerson 1958

•References marked with asterisk contain information on incomplete designs to reduce number of presentations.

for this view. However, pairwise ratings are especially prone to 'response sets' or 'response styles' (Cronbach, 1946; Rorer, 1965) involving highly skewed distributions of ratings (Coxon and Jones 1978a, and 1979).

As was shown in the previous chapter 'dominance' judgement of pairs of stimuli is also fairly common, where the subject is presented with a pair of objects and asked to indicate which of the two possesses more of a given attribute (is heavier, louder, more prestigious, or more preferred).

8.1.2 Indirect Data

The most commonly encountered measures of similarity for interval (and higher) level data are the product moment (PM) family of coefficients (Coxon, 1982). Product moment measures are all basically vector measures where the similarity between two variables, objects, subjects is represented by the combination of:

* the length of the vectors; and
* the product (inner, or scalar product) of the two vectors, represented by the size of the angle separating them.

The most familiar and frequently-used product moment measures of similarity are covariance (where the scale units of the variables enter into the assessment of similarity) and the Pearson product moment correlation coefficient (where the variables are standardised to unit length, and only the angular separation is considered). In neither case does the measure represent distance between the variables, although it is possible to convert vector separation (product moment) measures into distances and vice versa. Since the correlation coefficient is a monotonic transformation of distance, it may be used directly in the basic non-metric MDS distance model (Coxon, 1982 p. 17).

There is a large number of indirect methods that have been used as data for non-metric MDS studies. These include:

* Ordinal measures of association such as Spearman's Method;
* Ordinal measures based on inversions in rankings, eg. Likert's scale:

* Kendall's (1962) tau measures, and
* Goodman and Kruskal's gamma (1954);
* Nominal level measures where a nominal scale consists simply of the division of a set of objects into a set of mutually exclusive and exhaustive categories. Included amongst these are:

  Chi-square based measures;
  Measure for dichotomies;
  Co-currence measures; and
  The index of dissimilarity between distributions (Coxon, 1982).

8.1.3 Summary

The indirect measures are practically all aggregated measures of (dis)-similarity (i.e. summed over individuals, replications, times, locations etc.). Coxon (1982) argues that if the individuals (or other units of analysis) differ systematically amongst themselves with respect to variables of interest, then such information is lost upon aggregation. With aggregated measures of similarity, one can never know whether or not such differences even exist. Moreover, if significantly different sub-groups do exist then any averaged information will be an artefact and will not reproduce the characteristics of either group accurately. There is always the danger of 'piecemeal distortion' as well. If the data referring to a given unit or individual is complex, then 'local structure' (interrelationships within parts of the data) can be lost entirely when the components are aggregated (Coxon, 1982). For the aforementioned reasons it was decided that 'direct' rather than 'indirect' measures of similarity would be used for the present study.

With 'direct' measures of collecting and scaling individual sets of data the most frequently encountered problems centre around the number of objects and the cognitive complexity of the data collection task. Usually a trading relationship exists between these two aspects: the more complex the task, the fewer the number of objects, although incomplete block designs are available for some methods to avoid too large a reduction in the number of objects.

The cognitive complexity of tasks poses rather different problems according to Coxon (1982). He argues that "experience shows that one's

presuppositions about the ease and speed with which a data collection method is completed can be misleading." According to him, ranking turns out to be a far more difficult task than rating, since constant re-ordering and comparison is necessary to yield an ordering, whereas a rating can be made easily, and each object can be judged separately and without repeated comparison.

Coxon and Jones (1979) showed that in a similar way, triadic judgement which seems very well suited to eliciting constructs (or bases of judgement) and to producing fairly complex (ordered metric) data in a simple format proved to be an extremely wearisome task, in which subjects tended to 'lock in' on a single construct. Whereas hierarchy construction - a very complex and time-consuming task - was found to be an interesting and rewarding task yielding rich and reliable data.

Rao and Katz (1971) provide more systematic evidence of such factors in a study of the effectiveness of seven data collection methods, evaluating each method by a simulation method using data from a known configuration. They found that ordering and selection (or 'pick k out of n': Coombs, 1964 Ch. 2) methods such as pair comparisons, triads and tetrads produced better recovery of the original configuration than sorting methods. Based on the evidence of Rao and Katz (1971) it was decided that the method of pair comparison would be used for the present survey. Moreover, the method offered the opportunity of comparing the MDS solutions resulting from the preference measurements for the meats and meat cuts which had also been obtained by the method of pair or paired comparisons with those obtained from the similarity or substitutability measurements for the meats and meat cuts.

8.1.4 Cluster Analysis

A whole family of models, as extensive as those of MDS, exists for identifying and relating clusters of similar objects (Everitt, 1978). Though two varieties of clustering are extensively used in conjunction with MDS analysis, according to Coxon (1982) - hierarchical clustering schemes (Johnson, 1967, implemented as HICLUS in the MDS[X] series) and overlapping or additive clustering (Shepard and Arabie, 1979, implented as MACPLUS), HICLUS was the only programme available at Massey. Consequently the 41 meat cut matrix of similarities was analysed by this

programme in order to explore the clusters of meats which were existent in the 41 meat cut similarities data. Johnson's (1967) HICLUS clustering programme examines the data in two contrasting ways which essentially differ in the way that the distance between objects is treated.

The maximum method or diameter method picks out the largest distance within a cluster as 'the' distance and seeks to minimise the diameter (largest distance between the objects) within a cluster. This tends to produce a fairly small number of compact clusters according to Coxon (1982).

The minimum method (also known as the connectedness or single-link method), by contrast, selects the smallest distance as the 'the' distance and seeks to minimise the largest link needed to produce a chain or connected path between the objects. This method, according to Coxon (1982), tends to produce rather a large number of broken clusters and is often marked by chaining - the continued addition of a single element to a cluster.

8.2 RESEARCH PROCEDURE

The objective of the present study was to examine the respondents' assessments of the substitutability of one meat for another. This was done with the 15 meats and also for the 41 meat cuts. The intention was to determine whether respondents used the same criteria to assess the 15 meats as they used in their assessment of the substitutability of the 41 meat cuts. Gendall (1978) had argued that one of the drawbacks with MDS in the similarity assessment of products at least, was that it gave rather predictable results and so a secondary intention of the study was to examine MDS in the light of Gendall' criticism.

8.2.1 The Sample

The sample for this third and final questionnaire consisted of 80 respondents who had answered the previous two questionnaires. Twelve of the original respondents were eliminated because they had failed to complete the questionnaire or had answered sections incorrectly.

8.2.2 The Questionnaire

The final format of the questionnaire was determined after extensive pilot testing and redrafting. A copy of the survey form can be found in Appendix 8.1. It was divided into three sections.

SECTION 1: The intention of this section was to determine the similarities between the same 15 meats that were presented to the respondents in Chapter 7, i.e. Salami, beef, veal, mutton, hogget, lamb, pork, bacon, ham, smallgoods, offal, fish, chicken, turkey and shellfish.

The respondents were presented with a list of 105 meat pairs. Adjacent to each meat pair was a semi-structured linear scale with the phrases "complete substitute" at the end nearest the meat pairs and "cannot be a substitute" at the other end of the line.

Eg. Beef Veal A complete substitute _____x_____ Cannot be substituted

The respondents were asked to place a mark on the line at a point along the line that represented their assessment of the similarity or substitutability between the two meats. The order of the meats in each pair and indeed the order of the pairs should have been randomised. However, the sheer size and costs involved in typing, photocopying and decoding the questionnaire precluded such a procedure. Only the second and third pages of the section were randomised.

The respondents were asked to imagine that they had gone to the refrigerator to get the meat presented first in each pair for the intended meal, only to find the second meat in each pair. They were then asked to assess how substitutable the second meat in the pair was for the first for the intended meal and to place a mark on the line adjacent to each pair which reflected the degree of substitutability of the meats one for the other.

SECTION 2: The intention of this section was to examine the similarities between 41 meat cuts which were seen commonly in butcher shops and supermarkets. The respondents were presented with a list of 800 meat pairs. The format of this section was identical to that of the previous section.

As with the previous section the position of each meat in each pair should have been randomised to avoid presentation bias and indeed the order of the pairs should have been randomised to avoid positional bias but this was not possible. The only concession to the problem of bias was the randomisation of the pages for the section, i.e. respondents received a different page order.

As the intention of this part of the study was to see whether the respondents were using similar criteria to evaluate both the 15 meats and the 41 meat cuts it was important to have a number of anchor points that were common to each of the configurations so that the configurations could be compared on a reasonably satisfactory basis. It was decided that the meat names: fish; chicken: shellfish and salami would be used for both the 15 meat substitutability space and the 41 meat cuts substitutability space to act as the anchor points in each of the configurations.

8.2.3 The Interviews

As was explained in Chapter 3, a time and venue for each questionnaire was pre-arranged for the eight groups that were participating in the survey. A short discussion was held at the start of each meeting to discuss the problems and views that the respondents had of the previous questionnaire. The respondents were then presented with the new questionnaire and allowed 10 minutes to read it over. A further 10 minutes, or longer if necessary, was set aside for questions before the respondents were asked to complete Section 1. Once they had completed Section 1 they were allowed to go home. A pre-test of the survey had shown that at least 4 hours were needed by the respondents to complete the questionnaire and so they were given the week to complete the questionnaire. As this was the last questionnaire of the series the group leaders collected their group's survey forms at the end of the week and returned them to Massey University.

8.2.4 The Analysis

The collected data were coded, edited, transferred to general purpose card punching forms and then entered into the computer.

The data in each section were initially analysed by the SPSS Frequencies subprogramme in order to examine the distribution of the responses.

The means for each meat pair were then entered into the appropriate cell of a lower half matrix and analysed by KYST II from 5 through to 1 dimensions to discover the dimensionality underlying the similarity of both meats and meat cuts.

The GENSTAT (1977) Procrustes programme was used to compare the n-dimensional similarities configuration derived from the 15 meats and the n-dimensional similarities configuration derived from 15 meat cuts selected to represent the 15 meats. The aim was to see whether the respondents used different dimensions, i.e. variables to assess firstly meats and secondly specific meat cuts or whether the same variables were used in the assessment of both meats and meat cuts.

Kruskal and Wish (1978) and Coxon (1982) suggest that some form of clustering be carried out on the data, in addition to MDS analysis to aid in the interpretation of the n-dimensional configurations that are obtained from MDS analysis. The technique should mainly be used on 2-dimensional (Coxon, 1982) configurations. The 41 x 41 lower half matrix of similarity proximity measurements (see Appendix 8.2) was analysed by S.C. Johnson's Hierarchical Clustering Programme (Version 1) which was available on the MDS X series of programmes. The programme provides both 'single' linkage and complete linkage analysis of the data. A comparison was made between the n-dimensional spatial arrangement of groupings of cuts extracted from the 41 meat cut n-dimensional MDS solution obtained from the non-metric MDS analysis of the 41 meat cut similarity data and the spatial arrangement derived from the relevant averaged similarity data for the same group of meat cuts analysed non-metrically using the KYST II MDS programme.

8.3 SUBSTITUTABILITY OF THE 15 MEATS

The half matrix of proximity measurements (see Appendix 8.1) was analysed by the KYST II programme in 5 through to 1 dimensions using monotonic regression. The stress versus dimension plot is shown in Figure 8.1a.

A clearly defined 'elbow' did not occur in the stress versus dimension plot; however, Spence and Graef's (1974) graphical method suggested that

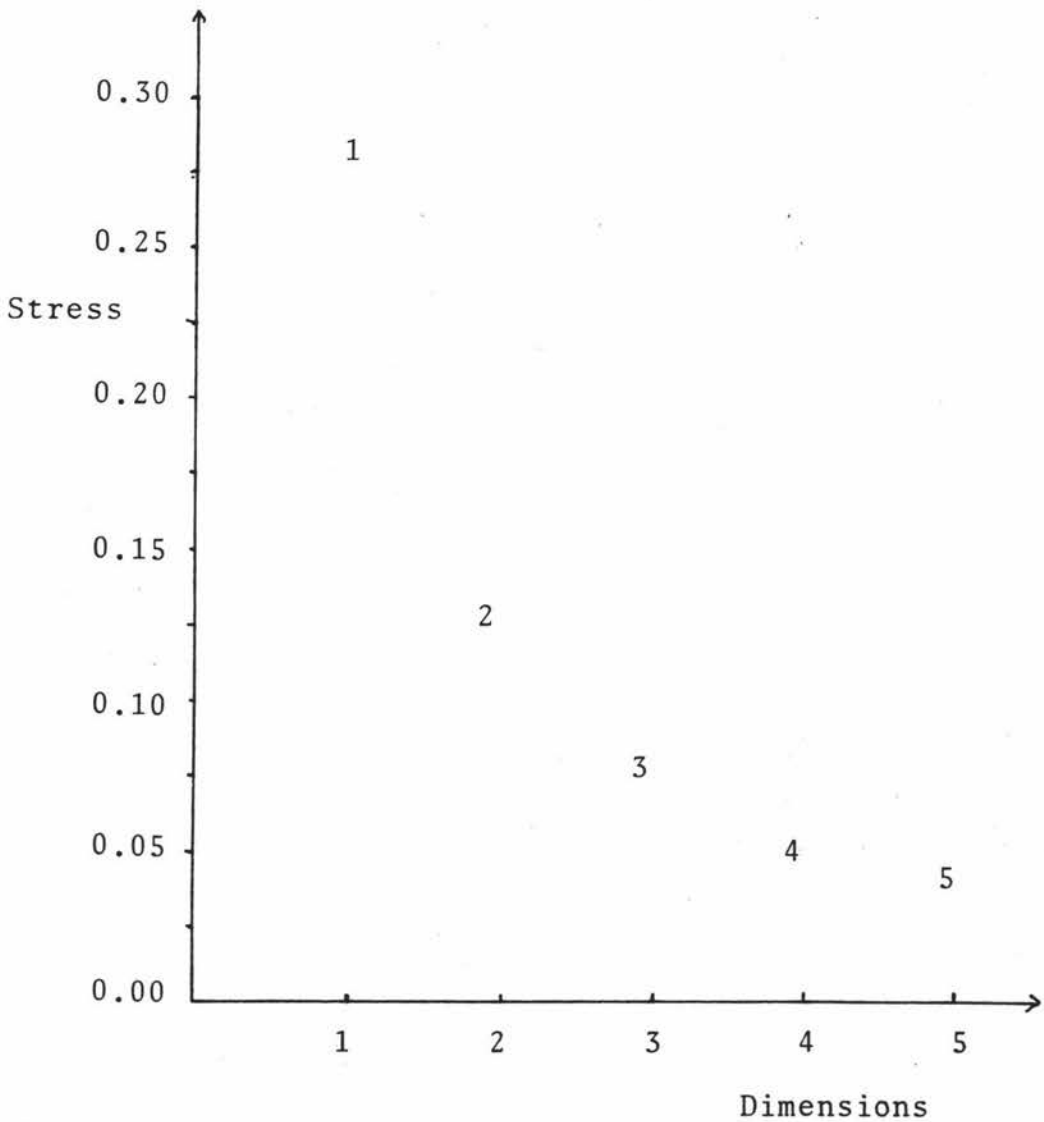

Fig. 8.1a Stress versus Dimension Plot for the 15 Meats Substitutability Data

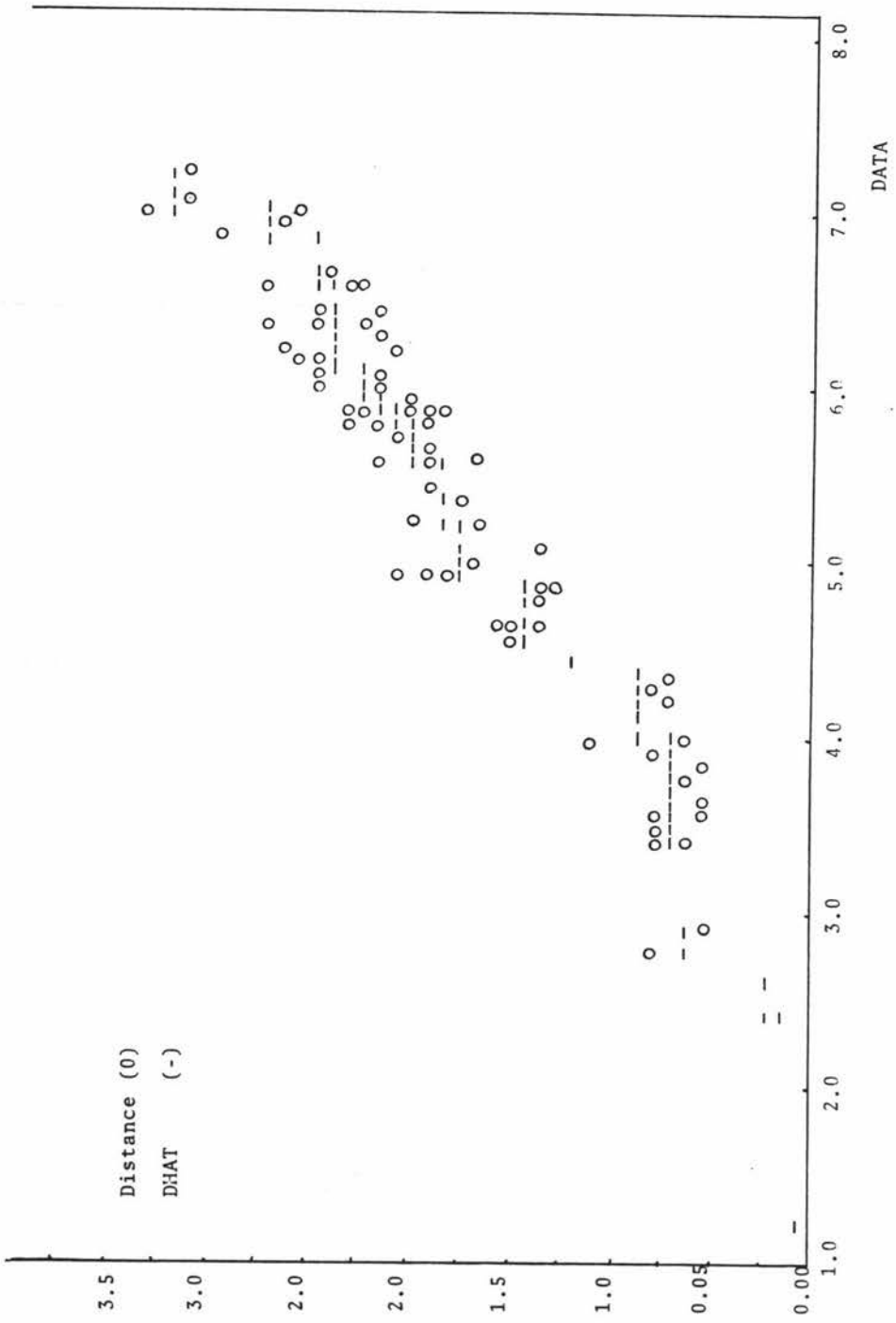

Fig. 8.1b Shepard Plot for the 15 Meats Substitutability Data.

3 dimensions could be used to satisfactorily describe the data. As a result a 3-dimensional configuration of the 15 meats was therefore obtained and the scale values are presented in Appendix 8.1 and the plots are shown in Figure 8.2 a,b,c.

As can be seen from Figure 8.2 the data did not produce any unexpected groupings of the meats. The sheep meats were grouped together, as were beef and veal and pork and these together formed a grouping of the traditional red meats. The processed meats, i.e. salami, smallgoods, ham and bacon formed a grouping of their own as did fish and shellfish and also chicken and turkey.

Whilst the groupings were predictable, the relative positions of each of the meats on the x-, y- and z-axes of the 3-dimensional configuration were not predictable. The x-axis would appear to be fresh-delicatessen or fresh-processed with veal, beef, lamb, hogget, mutton, pork, - the fresh meats - at one end and ham, fish, salami, shellfish, smallgoods, bacon and offal, items traditionally sold in delicatessens, at the other end of the x-axis. The dimensions underlying the y- and z-axes were not readily apparent.

8.4 41 MEAT CUTS SUBSTITUTABILITIES ANALYSIS

The respondents were provided with a list of 800 meat pairs. The responses of the 80 respondents were averaged and these values were placed in a lowerhalf matrix which was analysed in the KYST II programme. Scaled solutions were obtained in 6 through to 1 dimensions with a stress versus dimension plot as shown in Figure 8.3. An 'elbow' in this plot occurred at 4-dimensions. Spence and Graef's (1974) graphical method for determining underlying dimensionality, instead recommended the choice of 3-dimensions. A 3-dimensional configuration of the 41 meat cuts is presented in Figure 8.4 and the associated scale values are shown in Appendix 8.4. The matrix of proximity measurement for the analysis is given in Appendix 8.3.

An examination of Figure 8.4, the 3-dimensional substitutabilities configuration of the 41 meat cuts shows a far more complex spatial arrangement of the meats compared with the 3-dimensional substitutabilities

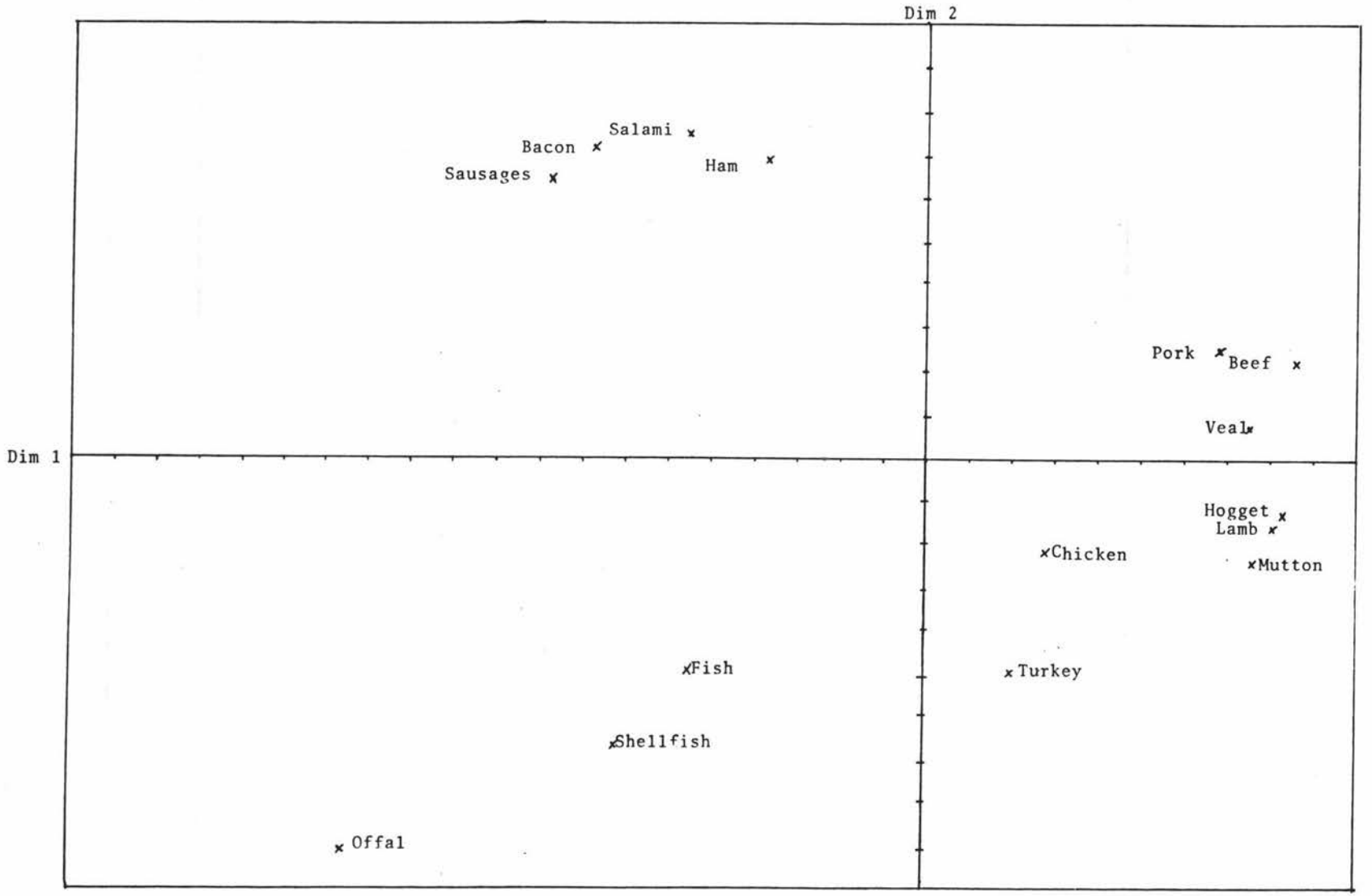

Fig. 8.2a 3-Dimensional Configuration of the 15 Meats in the Substitutability Space.

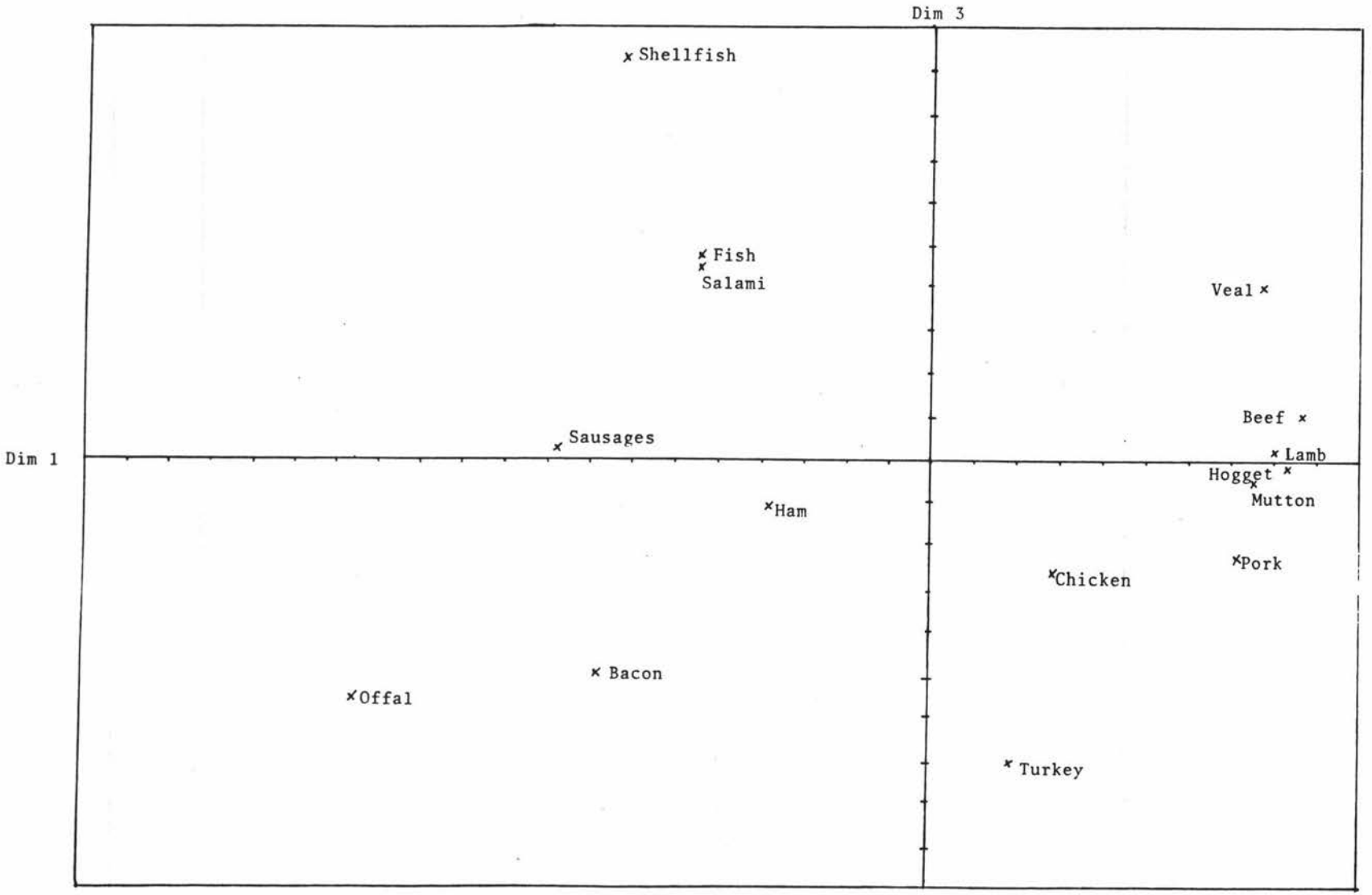

Fig 8.2b 3-Dimensional Configuration of the 15 Meats in the Substitutability Space.

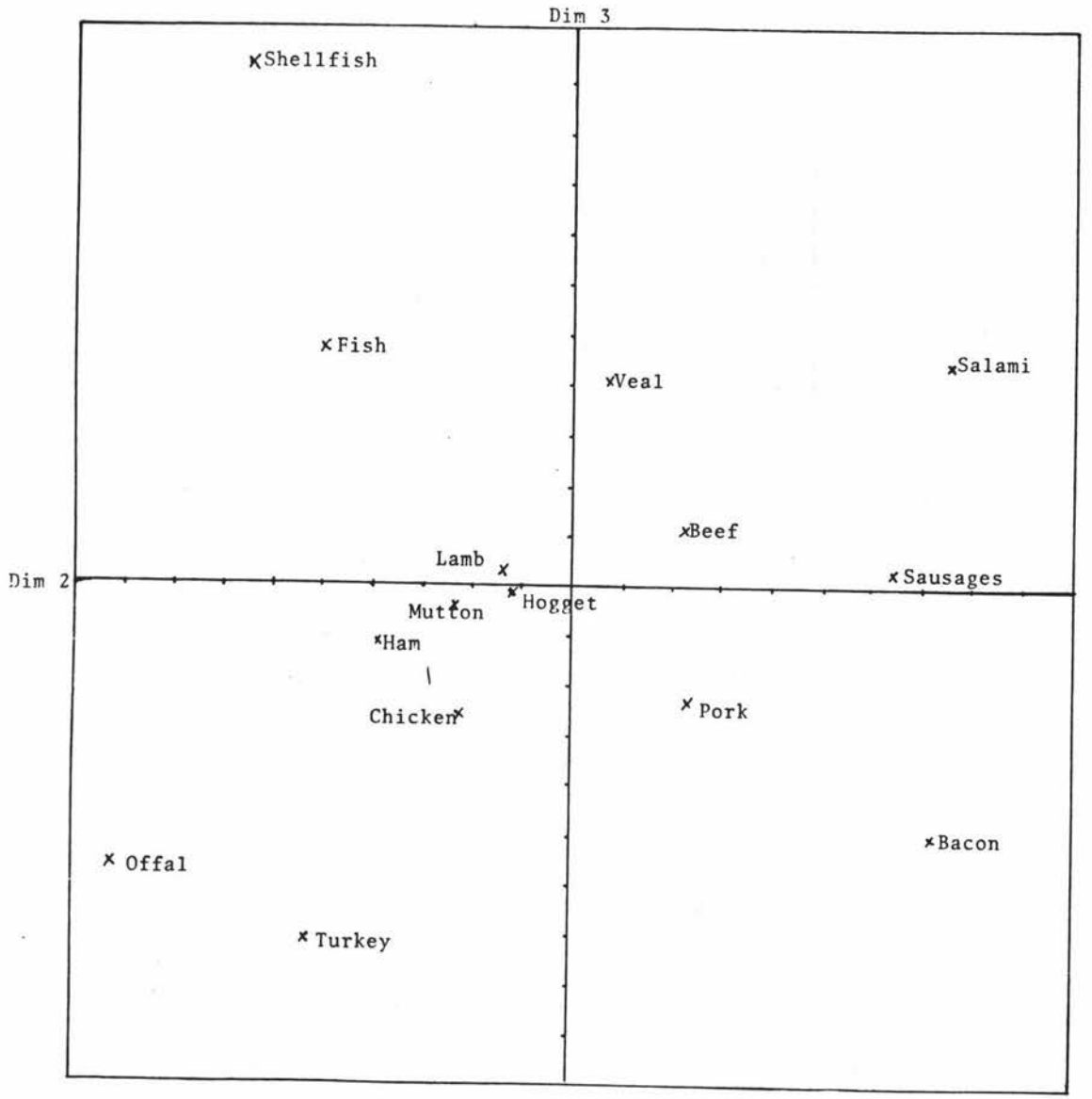

Fig. 8.2c 3-Dimensional Configuration of the 15 Meats in the Substitutability Space.

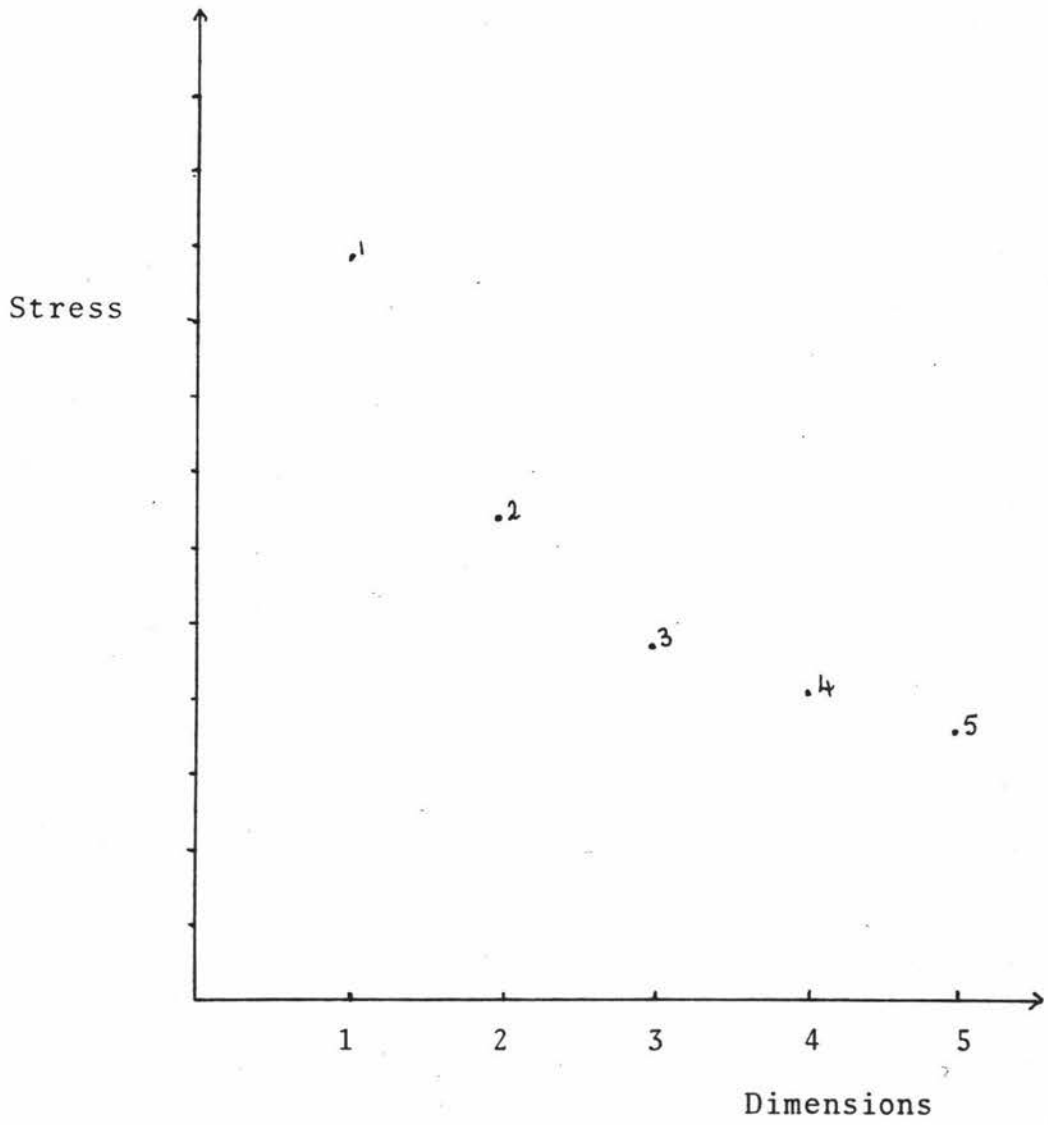

Fig. 8.3a Stress versus Dimension Plot for the 41 Meat Cut Substitutability Data.

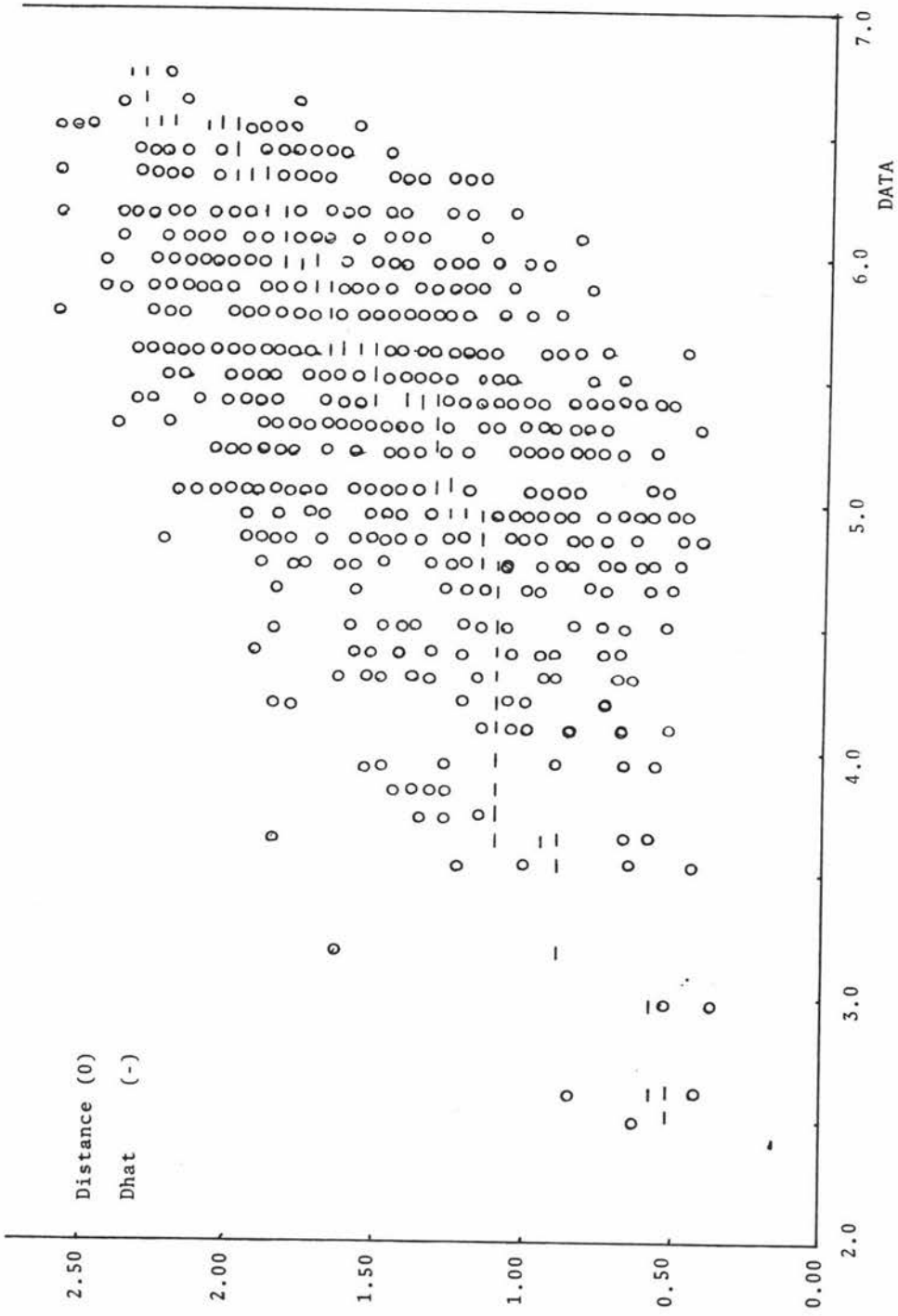

Fig. 8.3b Shepard Plot for the 41 Meat Cuts Substitutability Data.

KEY

1. Wienersnitzel
2. Rump steak
3. Porterhouse steak
4. Stewing steak
5. Topside
6. Beef mince
7. Beef tongue
8. Beef hearts
9. Beef tripe
10. Corned beef
11. Beef sausages
12. Lamb forequarter
13. Lamb loin chops
14. Leg of lamb
15. Lamb's fry
16. Lamb's kidney
17. Hogget loin chops
18. Leg of hogget
19. Mutton forequarter
20. Mutton loin chops
21. Leg of mutton
22. Pork chops
23. Pork pieces
24. Leg of pork
25. Sliced ham
26. Leg of ham
27. Ham steaks
28. Middle bacon
29. Shoulder bacon
30. Fish
31. Chicken
32. Shellfish
33. Hamburger
34. Pork sausages
35. Luncheon
36. Ham n chicken
37. Salami
38. Frankfurters
39. Saveloys
40. Black pudding
41. Garlic sausage

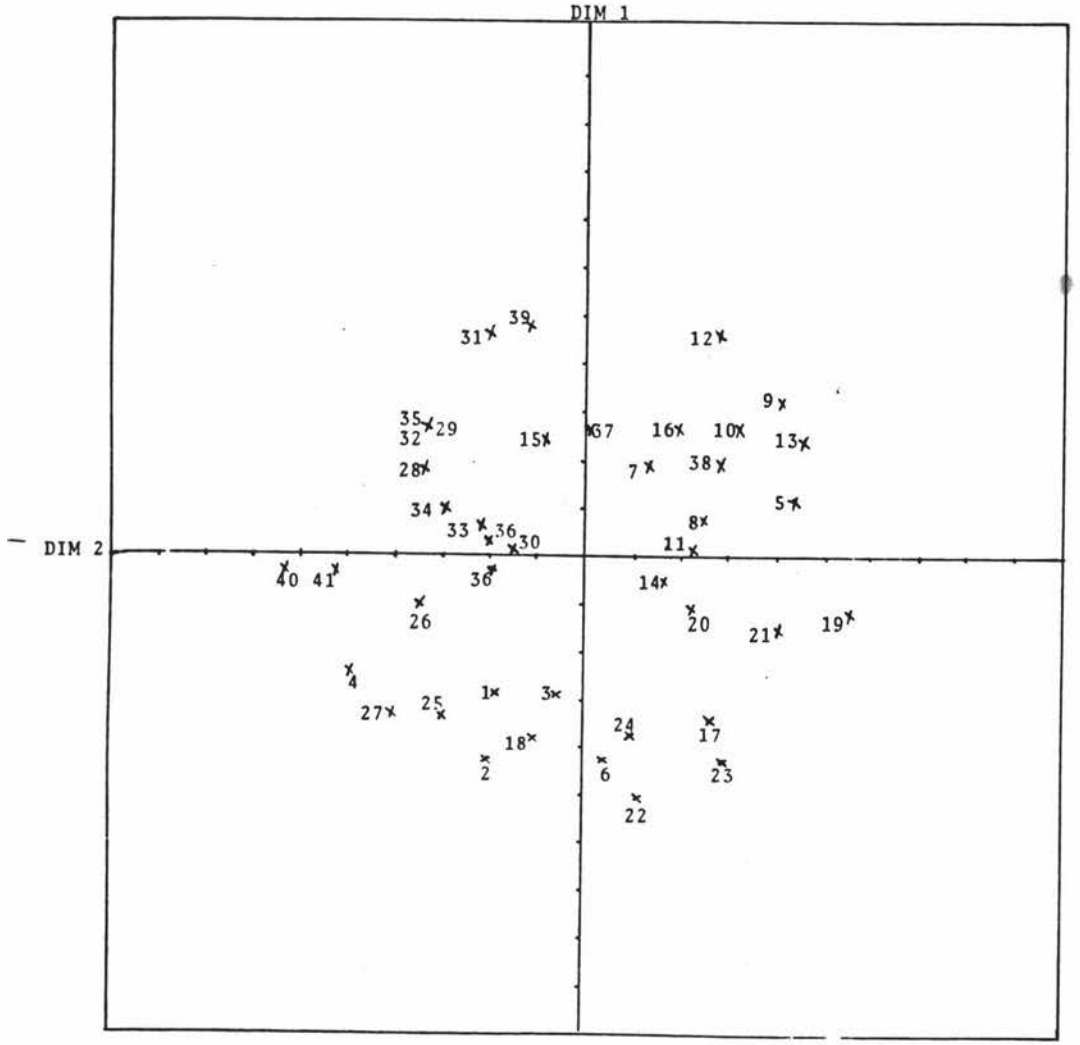

Fig. 8.4a 3-Dimensional Configuration of the 41 Meat Cuts in the Substitutability Space

KEY	KEY
1. Wienersnitzel	22.Pork chop
2. Rump steak	23.Pork pieces
3. Porterhouse steak	24.Leg of pork
4. Stewing steak	25.Sliced ham
5. Topside	26.Leg of ham
6. Beef mince	27.Ham steak
7. Beef tongue	28.Middle bacon
8. Beef hearts	29.Shoulder bacon
9. Beef tripe	30.Fish
10.Corned beef	31.Chicken
11.Beef sausage	32.Shellfish
12.Lamb forequarter	33.Hamburger
13.Lamb loin chop	34.Pork sausage
14.Leg of lamb	35.Luncheon
15.Lamb's fry	36.Ham'n'chicken
16.Lamb's kidney	37.Salami
17.Hogget loin chop	38.Frankfurters
18.Leg of hogget	39.Saveloy
19.Mutton forequarter	40.Black pudding
20.Mutton loin chop	41.Garlic sausage
21.Leg of mutton	

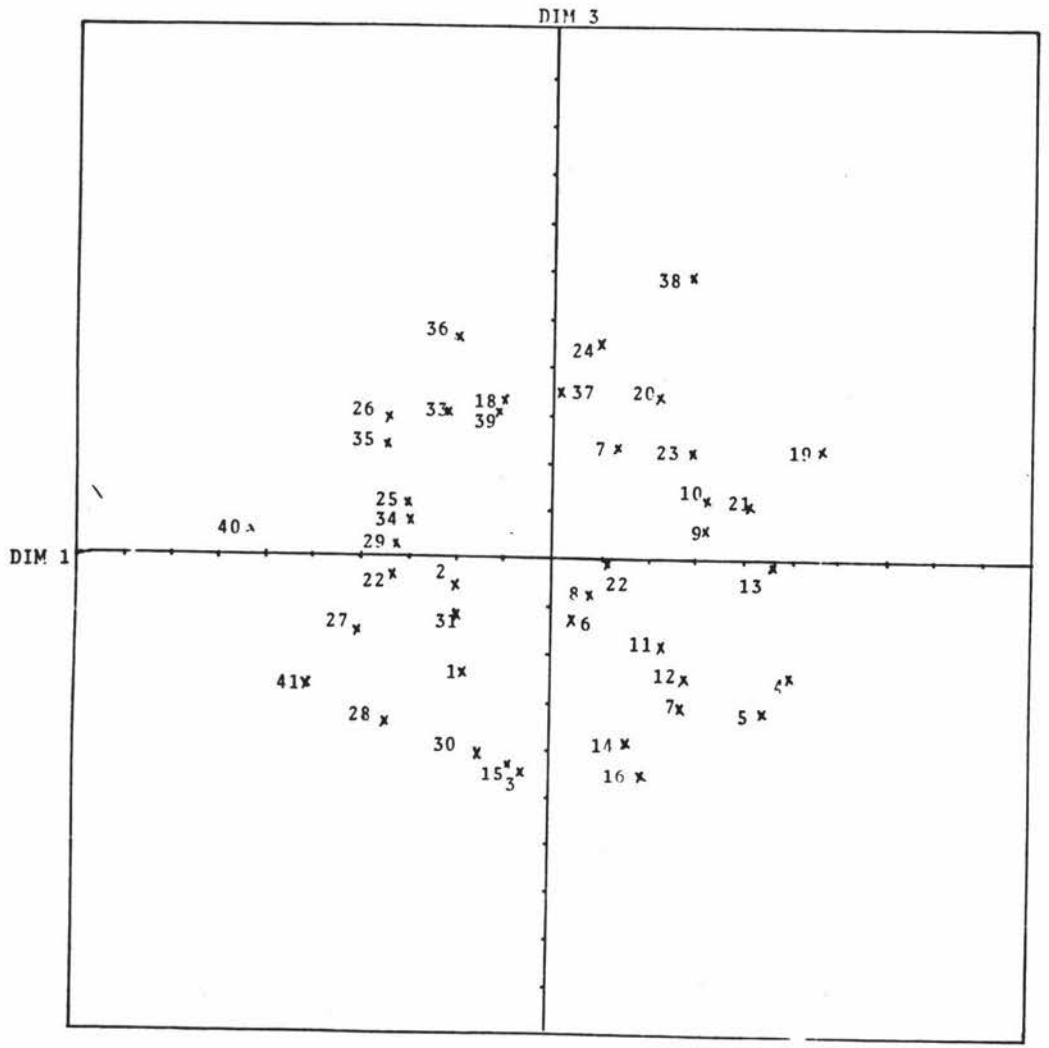

Fig 8.4b 3-Dimensional Configuration of the 41 Meat Cuts in the Substitutability Space.

KEY

1. Wienersnitzel
2. Rump steak
3. Porterhouse steak
4. Stewing steak
5. Topside
6. Beef mince
7. Beef tongue
8. Beef hearts
9. Beef tripe
10. Corned beef
11. Beef sausage
12. Lamb forequarter
13. Lamb loin chop
14. Leg of lamb
15. Lamb's fry
16. Lamb's kidney
17. Hogget loin chop
18. Leg of hogget
19. Mutton forequarter
20. Mutton loin chop
21. Leg of mutton
22. Pork chop
23. Pork pieces
24. Leg of pork
25. Sliced ham
26. Leg of ham
27. Ham steak
28. Middle bacon
29. Shoulder bacon
30. Fish
31. Chicken
32. Shellfish
33. Hamburger
34. Pork sausage
35. Luncheon
36. Ham'n'chicken
37. Salami
38. Frankfurter
39. Saveloy
40. Black pudding
41. Garlic sausage

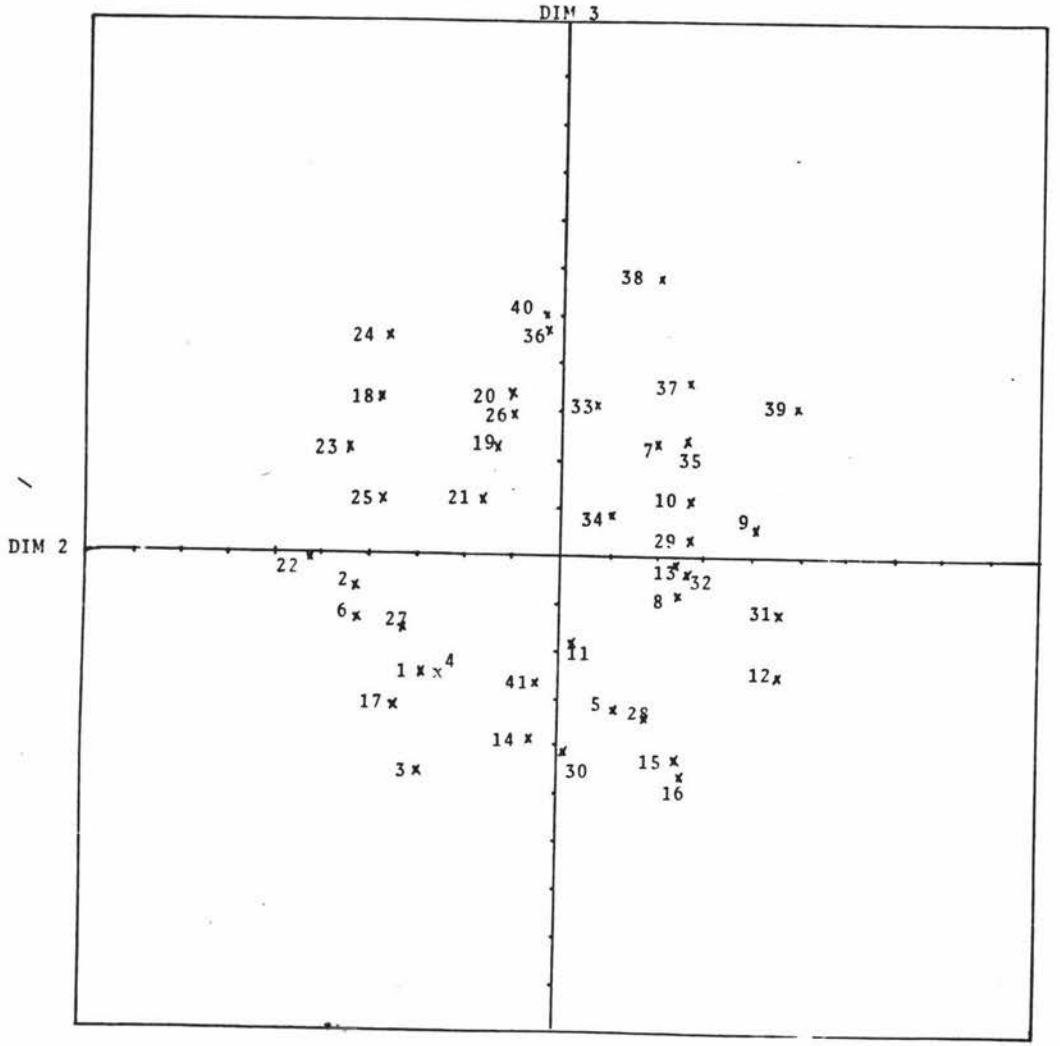

Fig. 8.4c 3-Dimensional Configuration of the 41 Meat Cuts in the Substitutability Space.

configuration for the 15 meats. Whilst the groupings of the beef steaks, i.e. wienersnitzel, rump and porterhouse steaks, and some of the sausage products on the x versus y, x versus z and y versus z configurations were predictable, the overall arrangement of the meats on each of the dimensions was not predictable. For instance the positioning of chicken in amongst the sausage products on the x versus y configuration and the spread of the 4 chop cuts, i.e. lamb, hogget, mutton and pork chops in three of the four quadrants of the x versus z configuration complicated the interpretation of the meat cut similarities space. The interpretation of the dimensions is dealt with in Chapters 10 and 14.

8.5 COMPARISON OF THE MEAT CUT SUBSTITUTABILITIES CONFIGURATION WITH THE MEAT SPECIES CONFIGURATION

It would appear that the respondents used different factors or variables to assess the 15 meat categories or species than they used to assess the meat cuts. A Procrustes comparison was made of the 3-dimensional meat species substitutability configuration with the 3-dimensional meat cuts substitutability configuration to see whether in fact people were using different variables to assess the two substitutability spaces. As neither veal nor turkey was included in the meat cut portion of the questionnaire a 13-meat 3-dimensional configuration was produced from the meat cut species substitutability data and this was compared with a 13-meat cut 3-dimensional similarity configuration which included the following meat cuts: salami, rump steak, mutton chops, hogget chops, pork chops, middle bacon, sliced ham, beef sausages, lambs' fry, fish, chicken and shellfish. The meat cuts were selected to represent the 13 meat species used in the meat species similarity space. Convenience-type meats were selected rather than a mixture of cuts to eliminate any possible variations in the configuration due to differences in cooking method and size of cut. The 13 meat cuts were selected also because they had been consumed by a relatively high proportion of the respondents on a regular basis, mutton chops being the exception. The non-descriptive meat words, salami, chicken and shellfish were included in the meat cut survey rather than say Hungarian salami, chicken breasts, or oysters because it was hoped that these non-specific meat cuts would act as anchor points in the 3-dimensional meat cut space and hence allow easy comparison of the meat cut space with meat species similarity

KEY

1. Denotes configuration obtained from analysis of convenience meats substitutability data by separate MDS.

2. Denotes configuration obtained from 41 meat cut substitutability data.

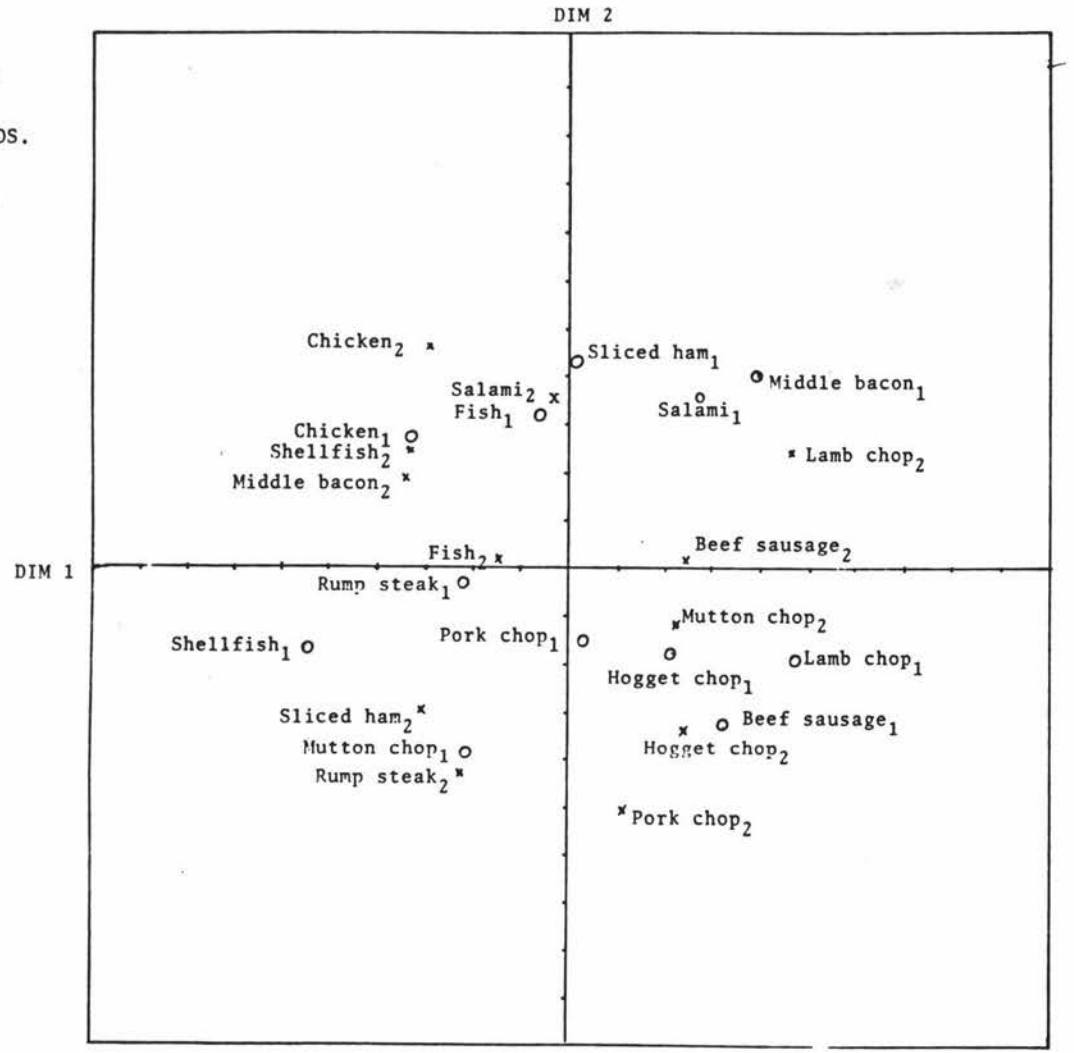

Fig. 8.5 2-Dimensional Comparison of the Positions Occupied by the Anchor Meats in the 15 Meats and the 41 Meat Cuts Substitutabilities Spaces.

space. The assumption was that the respondents used the same variables to assess both the meat species and meat cuts spaces and hence it would be expected that the anchor meats could be found in roughly the same positions in both the meat cuts and meat species substitutability spaces.

The relatively large value for the Procrustes statistic of 1.179 together with an examination of the spatial distribution of some of the meats (see Figure 8.5) indicated that the two substitutability configurations were different. Fish and shellfish which were 'key meats' were in similar positions in the two matrices but chicken had moved in its relationship with fish and shellfish. Salami was located in quite different positions in each of the 3-dimensional configurations. When names were added such as "middle" bacon and "sliced" ham there was a significant movement in the spaces. This would suggest that the respondents were in fact using different variables to assess firstly the similarities between the meat species and secondly the substitutabilities of the meat cuts.

The comparison also highlights the need to specify the level at which the researcher ought to work. If the researcher operates at a general level then he or she is likely to find rather predictable associations between products. However, at a more specific product level the associations are likely to be less predictable and hence, hopefully, of more value to the researcher.

8.6 SUBSTITUTABILITIES ANALYSIS OF CUTS FROM SPECIFIC SPECIES OF ANIMALS

The objective of this section was to examine the relative positions of specific groupings of meat cuts in their own 2-dimensional space and to compare the positions of the same groupings of meat cuts in the 2-dimensional 41 meat cut substitutabilities space to see whether the meats occupied the same relative spatial positions in each of the substitutabilities space. If the meat cuts did in fact occupy the same spatial positions in the 41 meat cut space and their own specific meat space then it could be argued that the respondents were using the same evaluative criteria to assess the 41 meat cuts and the specific meat

groupings. If the respondents were, however, using different criteria to assess the 41 meat cuts and the specific meat cuts then it could be expected that the meats would not be in the same spatial positions for the 41 meat cut substitutabilities space and the groups of meat cuts substitutabilities space. Comparisons were made with the following meats:

* Eight beef cuts
* Eight sheep meat cuts
* Eight pork cuts
* Nine sausage products
* Six offal cuts
* Ten roasting cuts and
* Eleven convenience cuts

The comparisons were made for a number of groupings of meat to ensure that the results were indicative of some general trend and not merely due to chance.

The relevant averaged similarity data for the specific meat cuts, say the sausage products, were extracted from the half matrix of 41 meat cuts substitutability data and analysed non-metrically using KYST II. The 2-dimensional solution from this analysis was compared with the spatial arrangement of the 9 sausage products in the 41 meat cut 2-dimensional substitutability solution by two procedures: a visual inspection and a Procrustes comparison.

It is appreciated that 8 products represent the lowest level of stimuli which should be analysed by MDS (Coxon, 1982).

The 2-dimensional comparisons for the 8 beef cuts obtained from a separate MDS analysis of the similarity data for the 8 beef cuts and the spatial arrangement of the 8 beef cuts from the 41 meat cut substitutabilities solution have been presented in Figure 8.6a. The 2-dimensional comparison for the 8 sheep meat cuts can be found in Figure 8.6b, for the 8 pig meats in Figure 8.6c, for the 9 sausage products in Figure 8.6d, for the 6 offal cuts in Figure 8.6e , the 10 roasting cuts in Figure 8.6f and the 2-dimensional comparison of the 11 convenience cuts

1. 0 Denotes configuration obtained from analysis of beef cuts substitutability data by separate MDS.

2. x Denotes configuration obtained from 41 meat cut substitutability space.

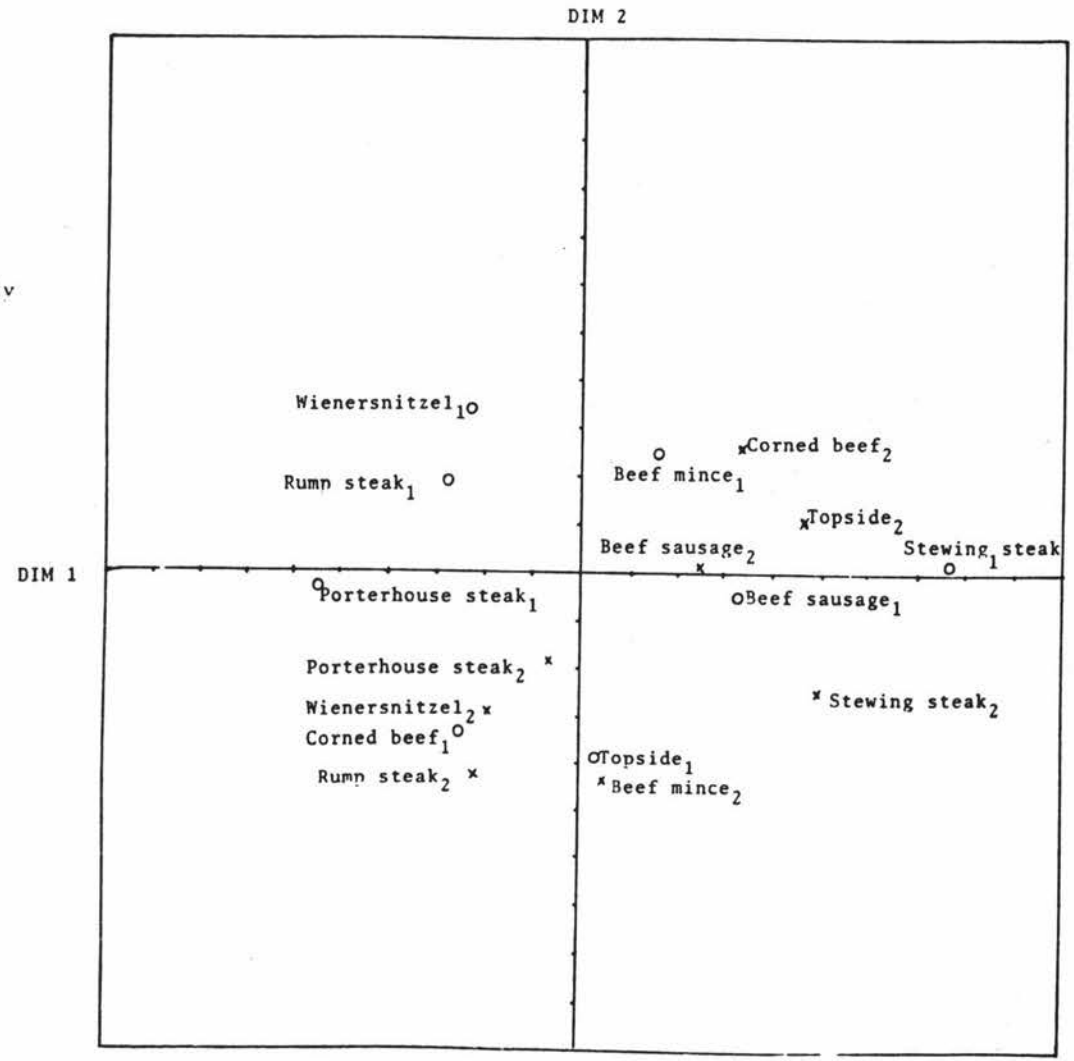

Fig. 8.6a Comparison of the 2-Dimensional Cofigurations of the Beef Cuts.

1. 0 Denotes configuration obtained from analysis of sheep meat cuts substitutability data by separate MDS.

2. x Denotes configuration obtained from 41 meat cut substitutability space.

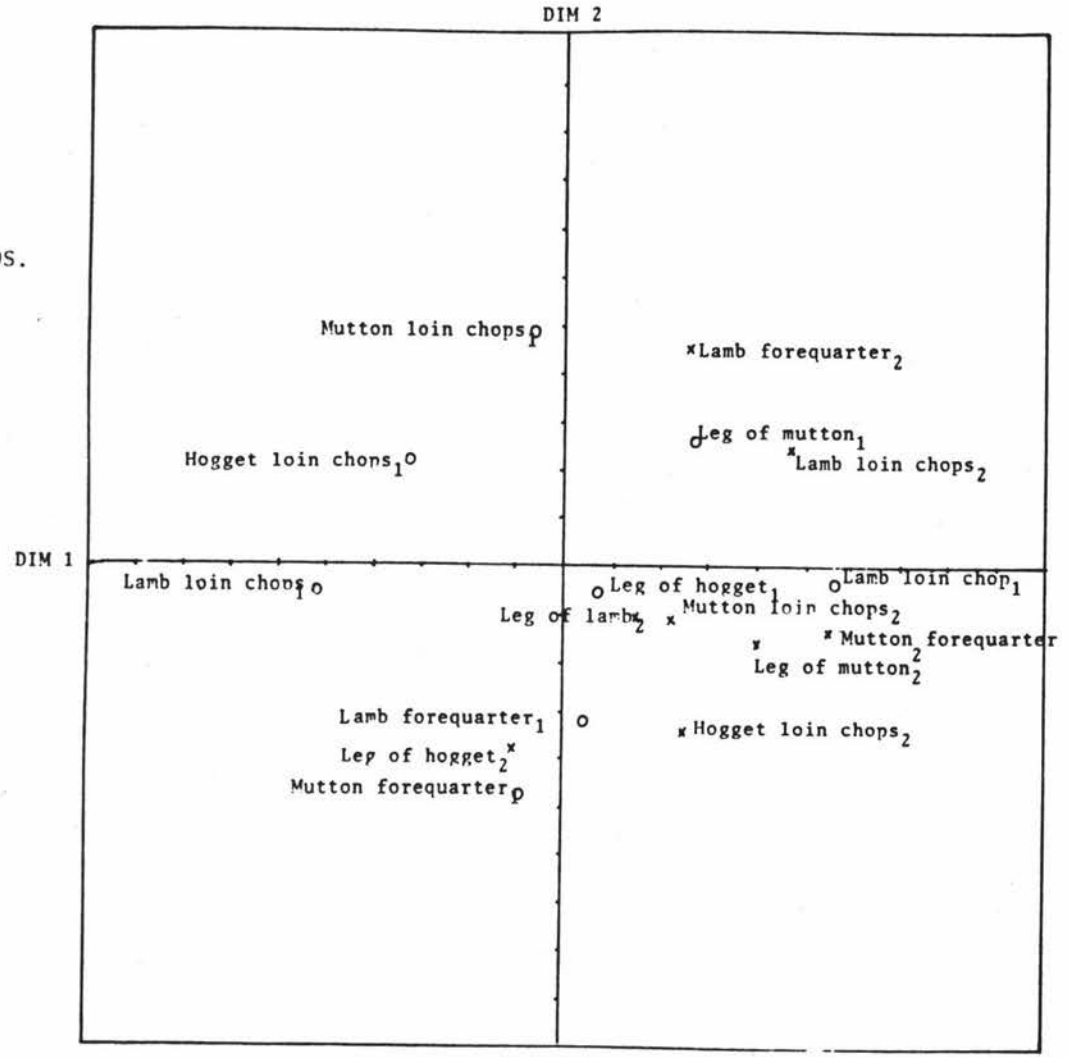

Fig 8.6b Comparison of the 2-Dimensional Configurations of the Sheep Meat Cuts.

1. 0 Denotes configuration obtained from separate analysis of pig meat cuts substitutability data.

2. x Denotes configuration obtained from 41 meat cut substtitutability space.

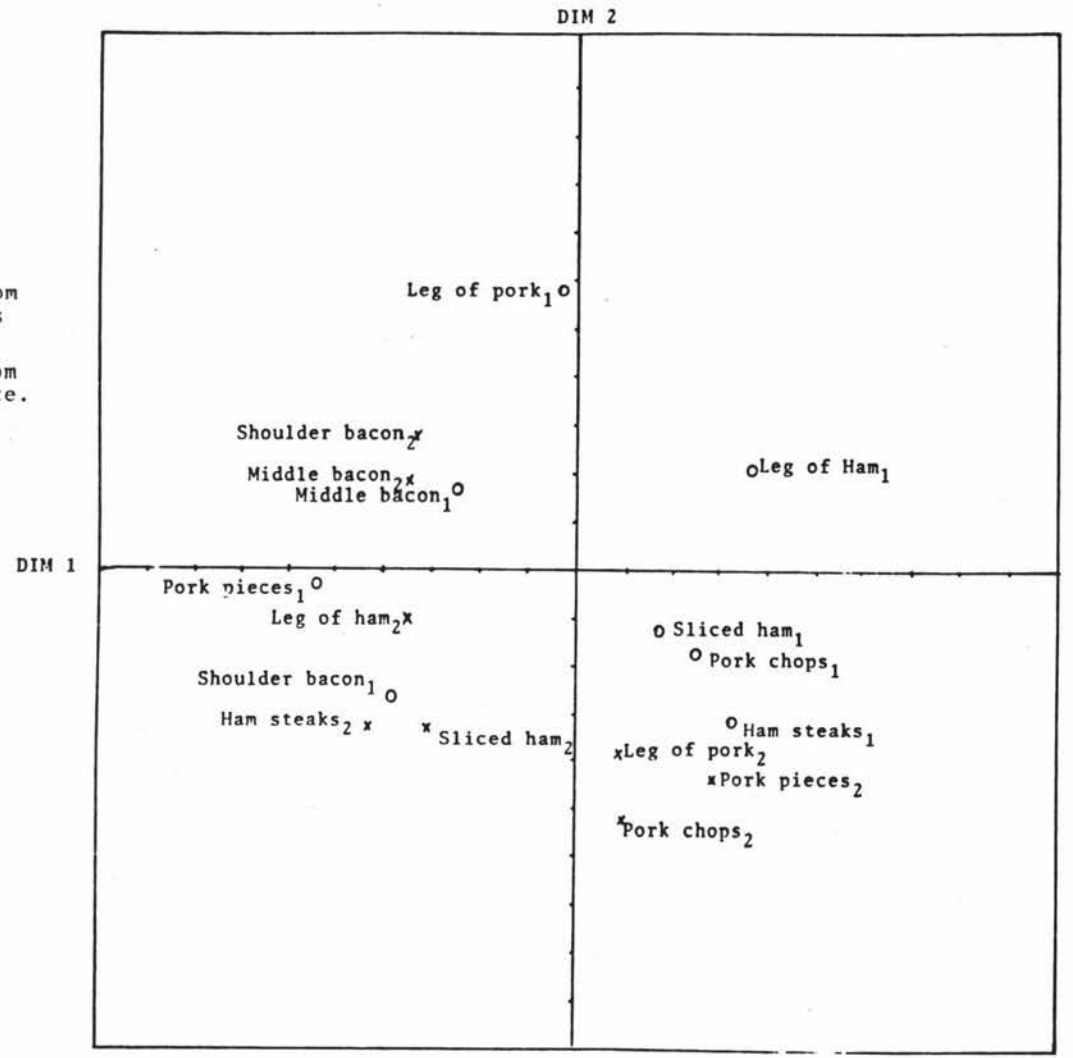

Fig. 8.6c Comparison of the 2-Dimensional Cofigurations of the Pig Meat Cuts.

KEY

1. o Denotes configuration obtained from analysis of sausage products substitutability data by separate MDS.

2. x Denotes configuration obtained from 41 meat cut substitutability space.

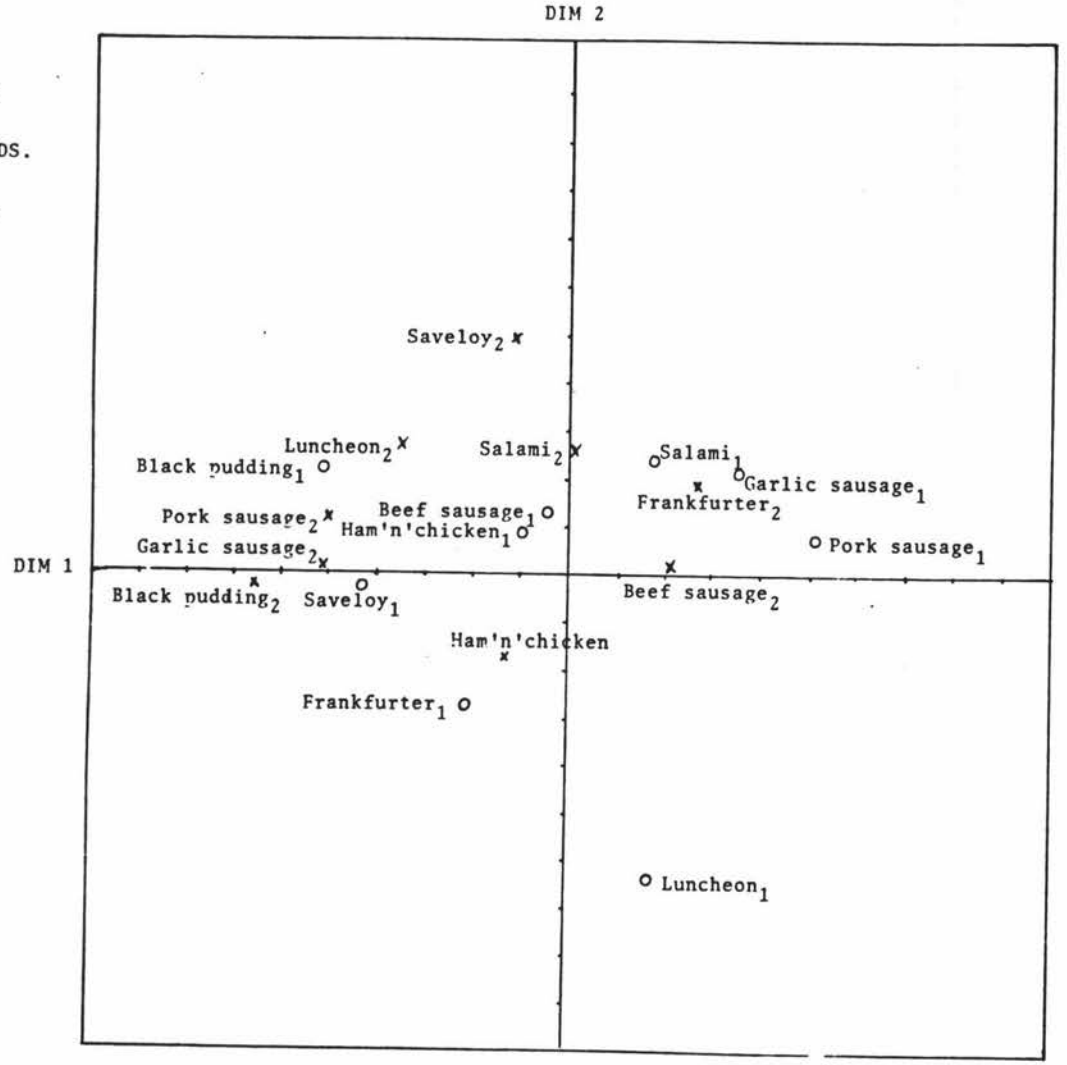

Fig. 8.6d Comparison of the 2-Dimensional Configurations of the Sausage Products.

KEY

1. Denotes configuration obtained from analysis of offal meats substitutability data by separate MDS.

2. Denotes configuration obtained from 41 meat cut substitutability space

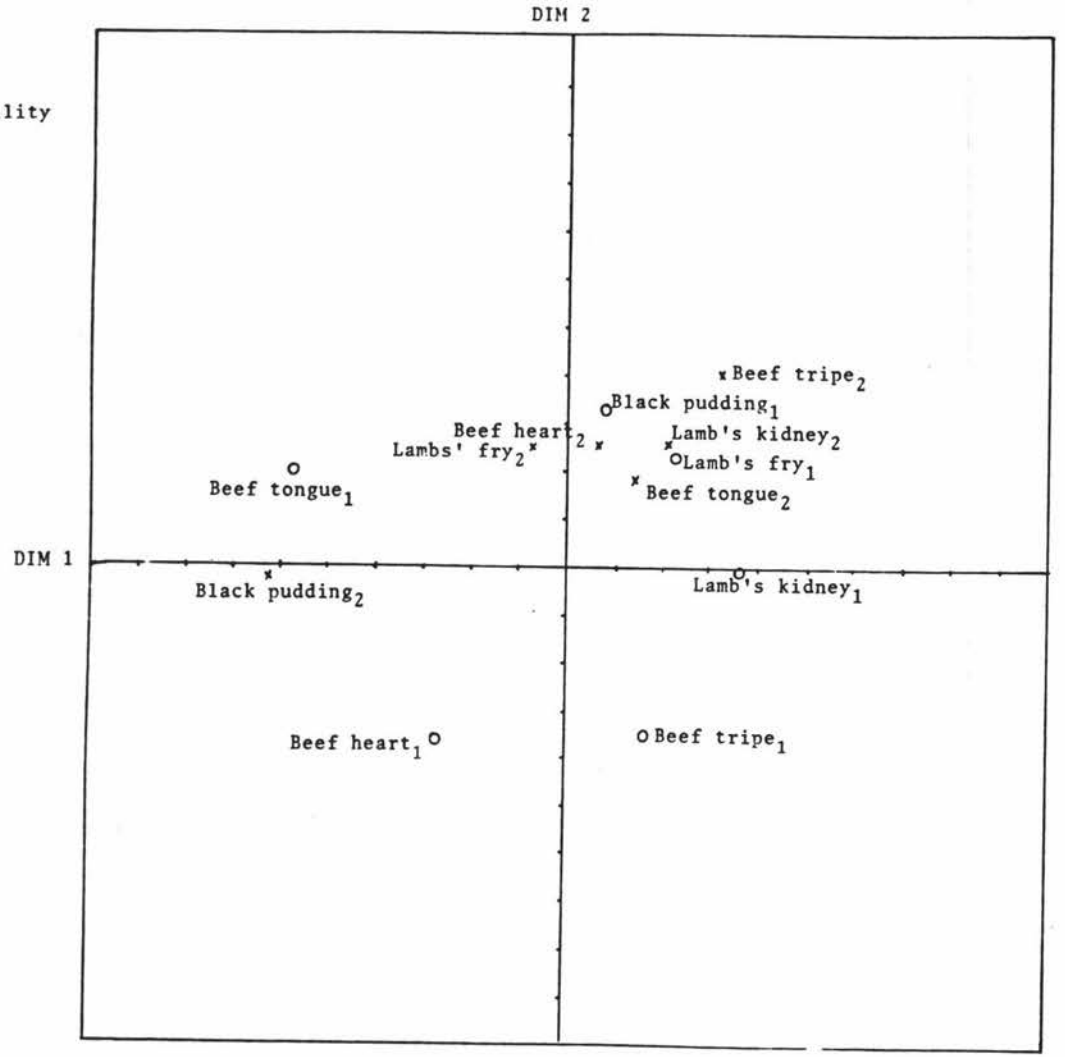

Fig 8.6e Comparison of the 2-Dimensional Configurations of the Offal Cuts.

KEY

1. Denotes configuration obtained from analysis of roast meats similarity data, i.e. by themselves

2. Denotes configuration obtained from the 41 meat cut space.

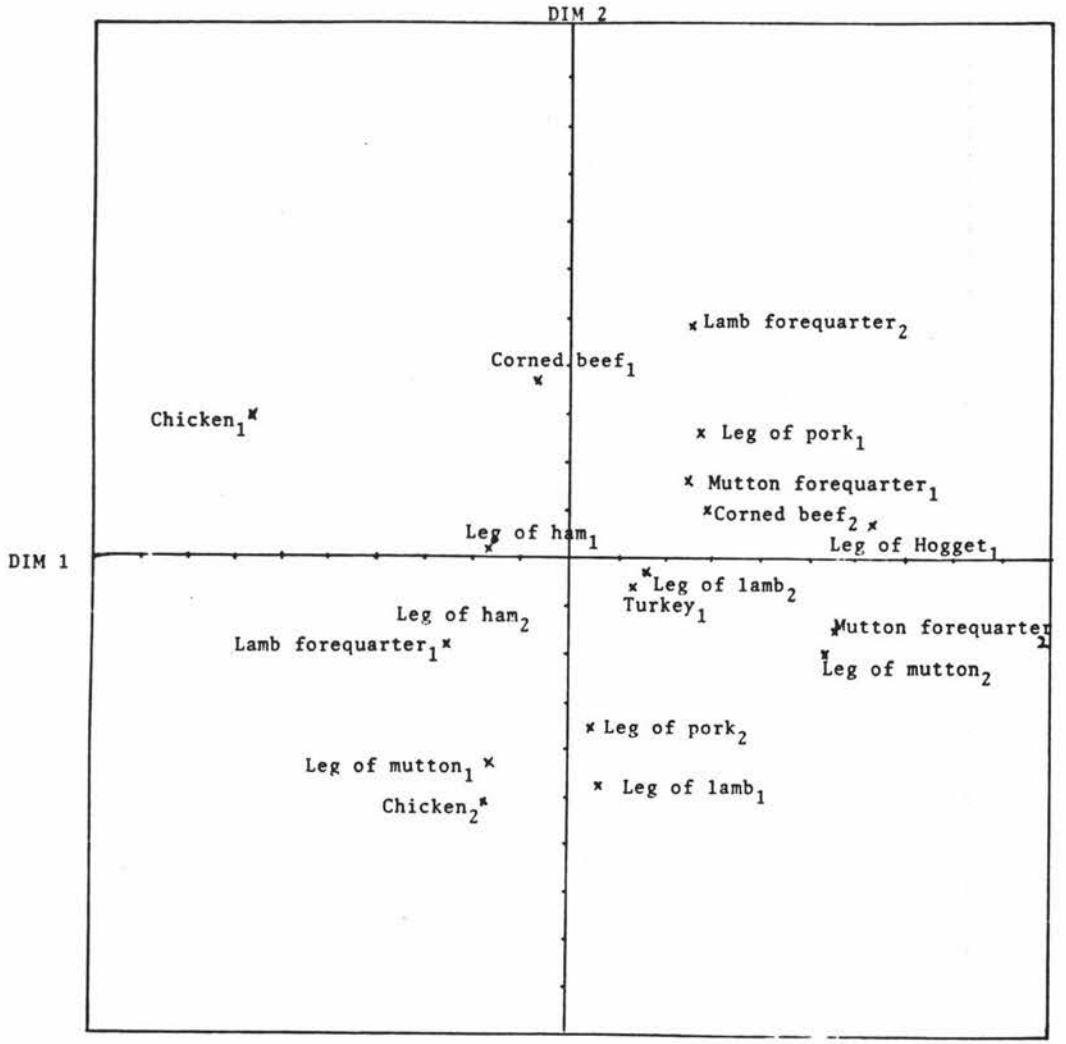

Fig.8.6f Comparison of the 2-Dimensional Configurations of the Roasting Cuts.

KEY

1. Denotes configuration obtained from analysis of convenience meats substitutability data by separate MDS.

2. Denotes configuration obtained from 41 meat cut substitutability data.

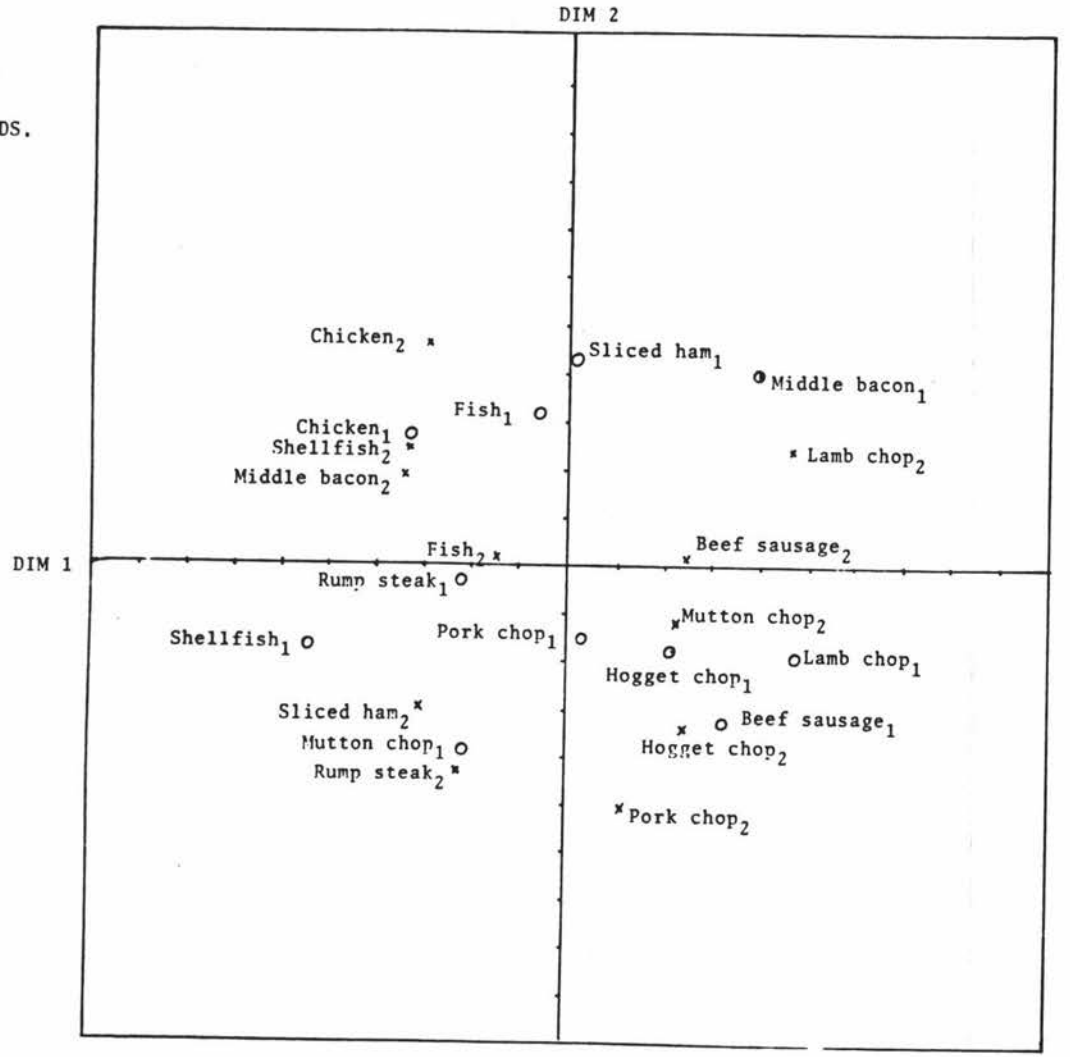

Fig. 8.6g Comparison of the 2-Dimensional Configurations of the 11 Convenience Cuts.

in Figure 8.6g. The scale values for each meat sub-group are presented in Appendices 8.5 - 8.11.

The respective 2-dimensional comparisons of the MDS solutions for the 8 beef cuts, the 8 sheep meat cuts, 8 pig meat cuts, 9 sausage products, 6 offal cuts, 10 roasting cuts and the 11 convenience meat cuts all showed the same results as the 8 beef cuts, namely, that the relative positions of the respective meat cuts in their own 2-dimensional space tended to be different to their positions in the 2-dimensional 41 meat cut substitutability space. The Procrustes statistic for the respective comparisons all exceeded a value of 1.40 confirming the conclusions drawn from the visual assessments which showed that the meats did in fact occupy different positions in their own 2-dimensional space compared to the positions they occupied in the 41 meat cuts substitutability space. The fact that the results held for all 8 meat cut groupings would tend to suggest that the results did not arise from chance and that some other factors were responsible for the spatial differences, such as the respondents using different criteria to assess the substitutability between the 41 meat cuts to that used to assess the substitutability between cuts derived from a single animal.

8.6.1 Discussion

The MDS analysis of all the meat groupings and the subsequent comparison of the respective 2-dimensional solutions with the relevant spatial positions of the meats in the 2-dimensional 41 meat cut space all showed the same thing, that the meats did in fact occupy different positions in their own substitutability space compared to the positions they occupied in the 41 meat cut 2-dimensional space. Now these positional differences could have been due to:

a) Expression of different criteria in the 41-meat cut space compared to the meat group spaces;

b) Less constraint on the meat group space than the 41 meat cuts hence more freedom to occupy different positions;

c) The presence of a local minimum solution.

The likelihood of a local minimum solution can be dismissed because different starting configurations produced the same spatial configuration of the meats.

As to whether the changes in spatial arrangements occurred either because of the expression of different underlying criteria in the 41-meat cut space compared with the smaller meat cut sub-group spaces or whether the changes were simply due to the increased freedom of the smaller meat cut sub-groups to occupy different spatial positions compared to the 41 meats was not easily answered. The fact that the respondents openly admitted that they changed their evaluative criteria with each meat pair would tend to support the view that part of the positional changes in the 41-meat cut space and the smaller meat sub-group spaces was due to the fact that different dimensions underlay the 41-meat space to those underlying the smaller meat cut sub-group spaces.

However, the dimensions in each space would need to be conclusively identified to prove the above hypothesis. The original respondents who participated in the 1979 survey could have been used to identify the dimensions, but this was not possible firstly because the analysis was completed a number of years after the survey and secondly because many of the respondents had left Palmerston North.

It is also likely that some of the differences in the spatial arrangement of the meats were due to the increased freedom of the meats in the 8-11 meat cut space compared with the 41 meat cut space. To see whether this was a factor in the observed configurational differences would require an analysis to be made where more products were progressively added to a substitutability matrix while at the same time observing the effects of such additions on the spatial positions of the products in successive solutions. However, in view of the fact that the substitutability data for the 15 meats and 41 meat cuts was of an unknown quality it would be more appropriate if the suggested analysis was conducted on data of known quality such as the inter-city distances of cities in New Zealand. This data has the additional advantage compared to the meat substitutability data in that the dimensionality of the problem is known, i.e. 2.

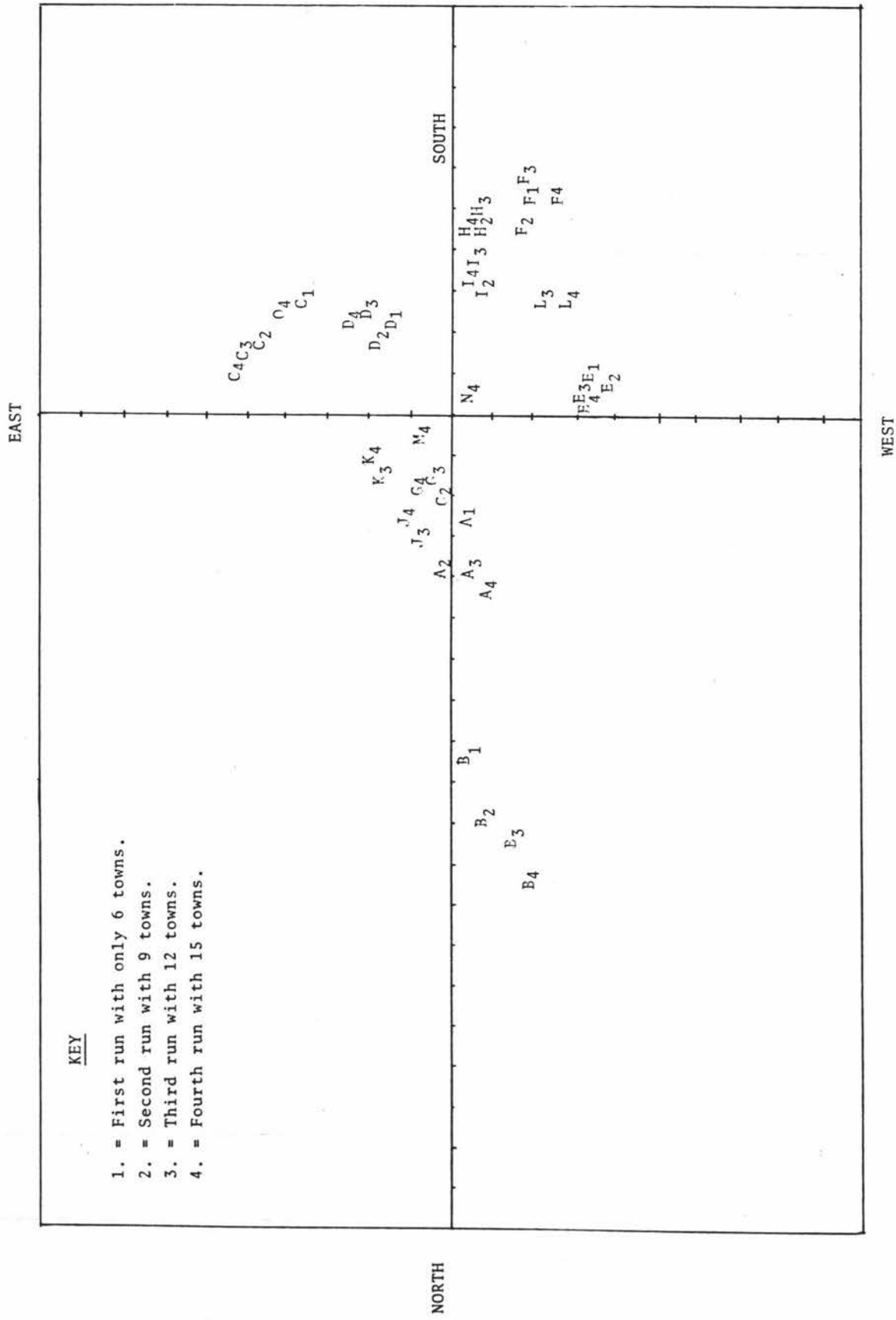

Fig. 8.7 2-Dimensional Configuration of the New Zealand Inter-city Distances

Multi-dimensional Scaling Analysis of the inter-city distances of the towns and cities of the North Island of New Zealand showed that whilst the number of points did have an effect on the position of a city, the positions did not jump quadrants as the meats had (see Figure 8.7 for the MDS of inter-city distances). This would tend to substantiate the hypothesis that consumers did in fact use different criteria firstly to assess the substitutability of the 15 meat species, secondly to assess the substitutability of the 41 meat cuts and finally to assess the substitutability of the meats in the specific meat groups.

8.7 CLUSTER ANALYSIS OF THE 41 MEAT CUTS

The results of the cluster analysis of the 41 meat cuts by Johnson's (1967) two procedures: the diameter (maximum method) and the connectedness or minimum method, are presented in Figures 8.8 and 8.9 respectively.

As can be seen from the two Figures the two clustering procedures gave quite different results. According to Coxon (1982) this can often happen, since it is rare to find data that perfectly satisfy the ultrametric inequality and hence produce two identical hierarchical clusterings. Holman (1972) has shown that a set of errorless data will never perfectly satisfy both the Euclidean distance model and the hierarchical model, but will always satisfy one of the models to some extent.

An examination of the clusterings provided by the diameter and the connectedness methods did not follow Coxon's (1982) generalisation that the diameter method produces a fairly small number of compact clusters whilst the minimum or connectedness method produces a rather large number of broken clusters. The results for the present survey were the complete opposite. The diameter method produced a large number of broken clusters whilst the connectedness method produced a fairly small number of compact clusters.

The actual clusterings of cuts resulting from both clustering methods were totally unexpected and quite different. For instance with the 'diameter' method leg of pork was clustered with garlic sausage; mutton

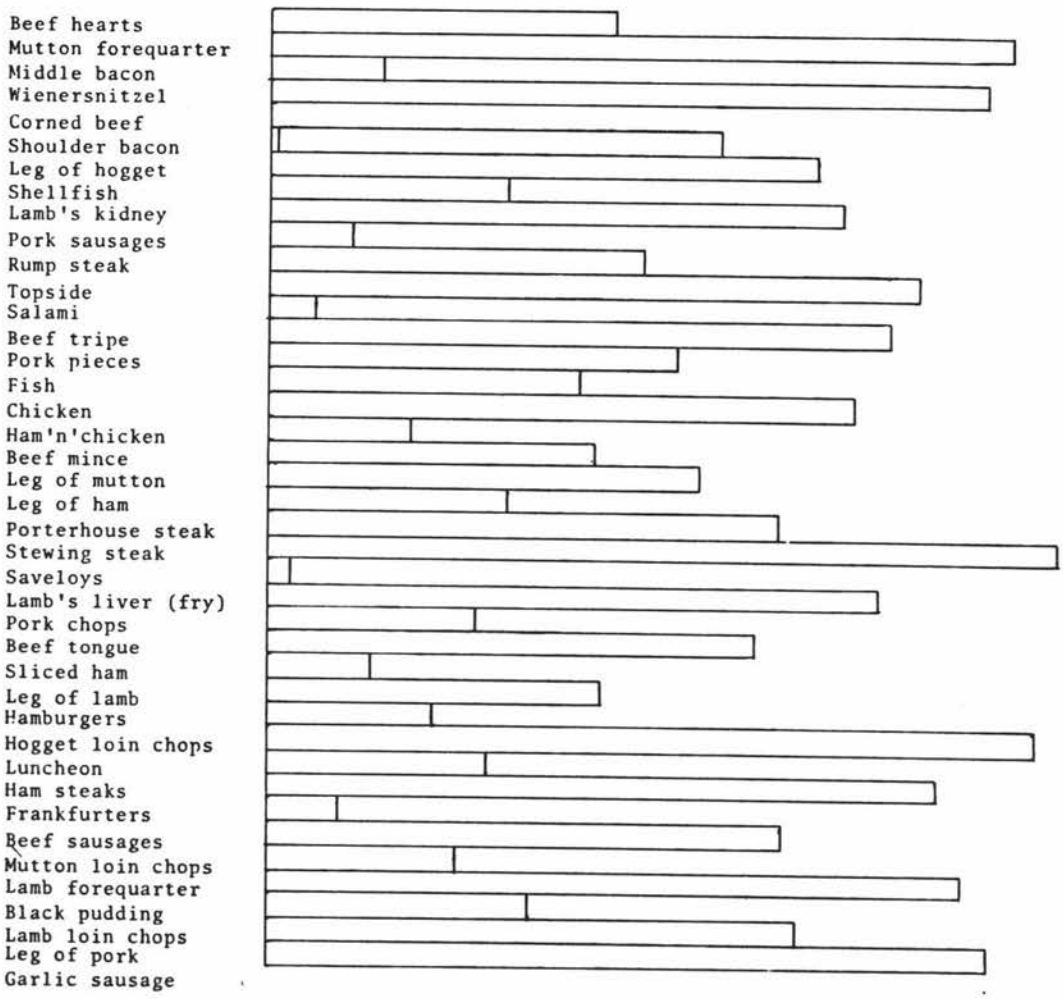

Fig. 8.8 Johnson's Single Linkage Hierarchical Clustering of the 41 Meat Cuts. (Minimum)

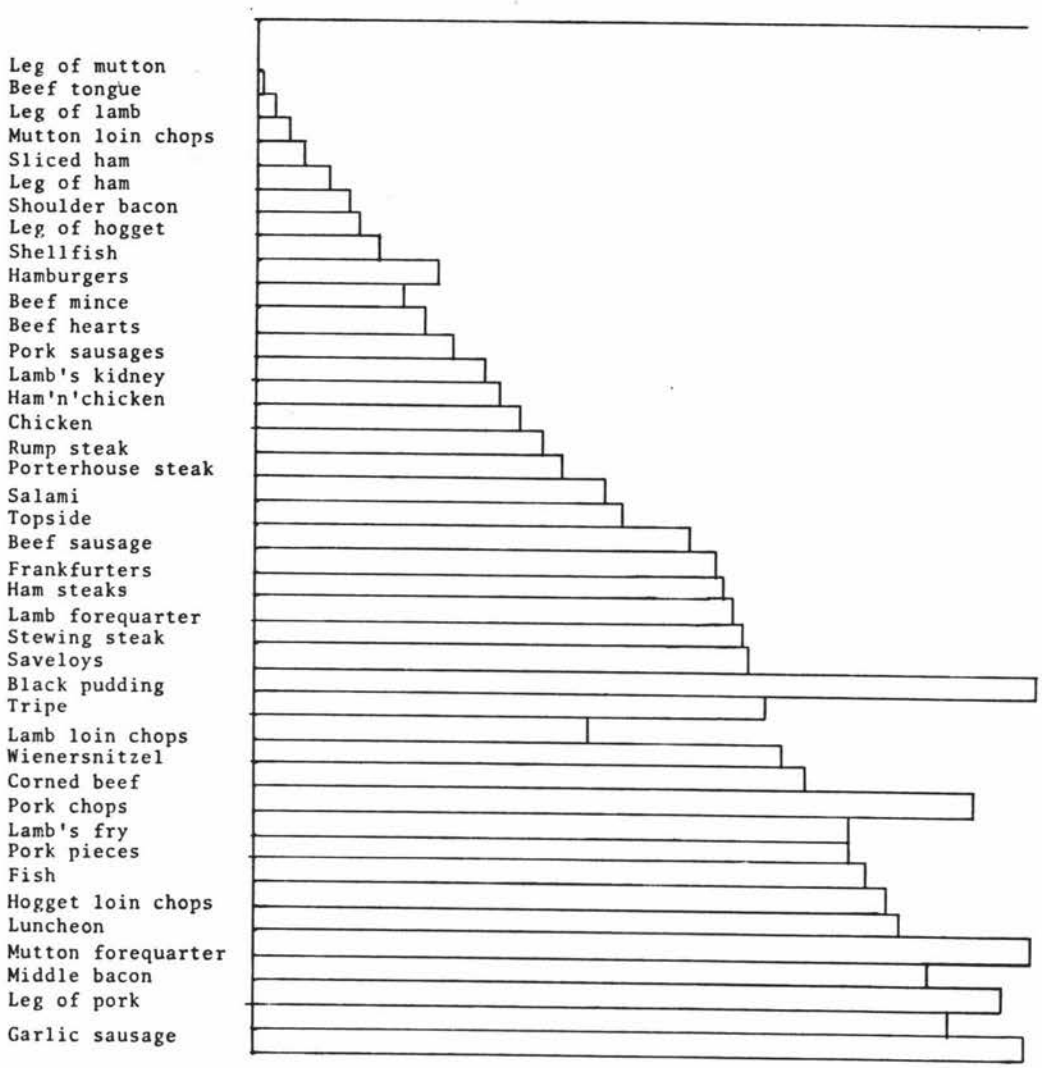

Fig. 8.9 Johnson's Complete Linkage Hierarchical Clustering of the 41 Meat Cuts. (Diameter)

forequarter with middle bacon; wienersnitzel with corned beef; leg of hogget with shellfish; lambs' kidney with pork sausage; topside with salami; beef tripe with pork pieces; chicken with ham-and-chicken (a sausage product); stewing steak with saveloys; lambs' fry with pork chops; beef tongue with sliced ham; leg of lamb with hamburgers; hogget loin chops with luncheon; ham steaks with frankfurters; beef sausage, mutton loin chops and lamb forequarters with black pudding. It would appear that the clustering was made partly on the basis of cooking time, as one cut requiring a large amount of cooking was clustered with one requiring little or no cooking. It was interesting to observe the clustering of chicken with ham-and-chicken where the clustering was seemingly based on the word 'chicken' even though the sausage product only contains a chicken flavour and usually consists of mutton as the base meat ingredient.

With the connectedness method there were four main clusters, i.e. leg of pork with garlic sausage, hogget loin chops with luncheon, wienersnitzel with corned beef, stewing steak with saveloys. The remaining cuts were joined to each other with the chaining phenomenon - i.e. the continued addition of a single element to a cluster. Leg of mutton was clearly quite different to leg of pork according to the connectedness method of clustering, i.e. related only at a very high level to one another.

According to Everitt (1978) and Coxon (1982) the minimum or connectedness method of clustering is usually the preferred method of exploring hierarchical structure of a set of data. However, with the present study neither method supplied the expected rationale for the clustering of the meats.

8.8 RECOMMENDATIONS FOR FUTURE WORK

With the present study, the MDS substitutability spaces for both the 15 and 41 meat cut spaces could have been determined for each respondent who answered the questionnaire. However, the data was actually aggregated and a single substitutability space was determined for the group of respondents for the 15 meats and 41 meat cuts. Coxon (1982) has argued that if the individuals differ systematically amongst themselves with respect to variables of interest, then such information is lost

upon aggregation. It was shown in an earlier chapter that a number of socio-economic variables had some bearing on the per capita consumption of meat. It was also shown further that it was possible to sub-divide the sample of respondents into three groupings based on their per capita consumption of meat i.e. high, medium and low meat-consuming groups. It could be argued that the various meat-consuming groups and indeed socio-economic groups may have different perceptions regarding the similarity of the respective meats and cuts. This is something that should be studied in a further study and the present data, since it was 'direct' data could be used for this further study.

It was argued in the text that the respondents assessed the substitutability of the 15 meats using different criteria to that used for their assessment of the 41 meat cuts. However, this is a matter that requires further study. One possible way of studying the problem would be to ask the respondents to assess firstly the substitutability of 8 meats, eg. lamb, mutton, hogget, veal, beef, pork, deer and goat, and secondly to assess a range of similar cuts derived from the above 8 meats, i.e. the rump cut, chops, chump etc. The resulting data matrices would be analysed using KYST II and the n-dimensional spaces would be compared to substantiate the theory that respondents change their assessment criteria when going from the general to the specific. To further substantiate the theory, respondents should be asked to identify the relevant dimensions for the respective n-dimensional solutions.

In the present study the respondents were told to imagine that they had gone to the refrigerator to get the meat listed first in each pair for dinner, only to find the second cut of meat in each pair. They were asked to assess how substitutable the second cut of meat was for the first. The above scenario allowed the respondents a tremendous amount of freedom in the choice of criteria that they could use to assess the substitutability of the meat cuts. The respondents themselves admitted that they changed their assessment criteria when moving from one pair of meats to the next. Recent literature is noticeable for the restrictions that researchers have placed on their respondents, i.e. the scenarios selected by the researchers tend to be more specific and hence the respondents are only able to use a limited number of criteria in their similarity assessments. The same approach could be adopted for meat

product development. MDS should be used to study more restricted similarity areas such as:

* Meat flavour;
* Meat colour;
* Meat texture;
* Fat content of meats and cuts;
* Appearance of meats and meat cuts;
* Preparation time;
* Cooking time;
* Prestige rating;
* Use as a main meal, weekend meal, snack meal etc.

The data should be looked at at various levels, i.e. aggregated, sub-group aggregation (socio-economic, meat per capita, and life style) and at the individual level to see whether there are different perceptions of the respondents from the various groupings. The aim of the work should be to more clearly define the impressions that respondents have about meats, meat cuts and meat products and the assessments of the various groupings so that a target market for new meat product development can be readily and clearly defined.

8.9 CONCLUSIONS

* The MDS analysis of the 15 meat substitutability proximities measurements gave rather predictable results with the meats being in expected groupings, i.e. fish and turkey together; bacon, ham, salami, smallgoods together; fish and shellfish together; and pork, beef, veal, hogget, lamb and mutton, the main red meats, in another group. With the exception of ham, the meats could have been grouped together without resorting to MDS analysis.

However, the MDS analysis of the 41 meat cut substitutability proximity measurements did not give predictable groupings of the meats. The results were quite unexpected. The use of cluster analysis helped to clarify some of the groupings.

The 41 meat cut results illustrated the need for the researcher to specify the level at which research should be carried out. One of the many criticisms of MDS is that it gives predictable results and this was indeed borne out by the 15 meat MDS analysis. However, the 41 meat cut results illustrate the need to operate at the specific product level rather than the more general meat groups such as beef, fish, pork.

* The comparison of the positions that were occupied by 13 of the meats in the 15 meat substitutability space with the positions of 13 meat cuts derived from these 13 meats in the 41 meat cut substitutability space showed that the meats occupied different positions and therefore the configurations were different to one another. The high Procrustes statistic (1.179) confirmed the visual inspection. The key meat names: salami, chicken, shellfish and fish were included in the analysis to act as anchor points. With the exception of fish and shellfish all the meats occupied different spatial positions in the 13 cut meat space compared with the 13 meat species space.

The study showed that the meats all changed position when the meat groups were analysed separately by MDS to the positions they each occupied in the 41 meat cut space. This was true not only for the 2-dimensional comparison, but also for the 3-dimensional comparison.

* The changes in spatial arrangement when the meat sub-groups were MDSed separately to the positions occupied in the 41-meat space could have been due to either the identification of a local minimum solution rather than a global solution, or to the fact that smaller numbers of product have greater freedom to move in the configurations than larger numbers, or finally to the fact that different dimensions actually did underly the different configurations.

The likelihood of a minimum solution being rsponsible for the differences in the spatial configuration of the meats in the 41-meat cut space and in their own sub-group configurational space could be ruled out because with each sub-group almost the same configuration was produced from a number of starting configurations.

The inter-city MDS analysis of the cities of the North Island where more cities were successively added to the half matrix showed that the posi-

tion of the cities was constrained by the addition of additional cities but that the positions did not vary greatly as was the case for the meats in each sub-group. This would tend to suggest that the positional changes of the meats in their own sub-space compared to their respective positions in the 41-meat cut space was due in the main to the expression of different criteria used by the respondents in their assessment of the substitutability of the meats.

* It would appear that people used different criteria to assess firstly the substitutability of the 15 meat species, secondly, the substitutability of the 41 cuts one for another, and finally the substitutability of one meat for another within a meat sub-group, eg. sheep meats, pig meats etc. In other words, people appeared to use a hierarchy of criteria in their assessment of products as in taxonomy. With meat species or meat in general there were certain attributes by which the respondents were able to gauge the similarity or dissimilarity of the meats, an additional set of more specific criteria when gauging the similarity of the 41 meat cuts and an even more specific set of criteria when assessing the similarity of meats within a specific sub-group.

* The 15 meat and 41 meat cut substitutabiity spaces were subsequently used in Chapter 10 to identify new meat product opportunities using Fenker's (1972) and Kruskal et al.'s (1972) methods of identifying 'ideal points' in MDS spaces, plus a method developed by the author.

* The scale values for the 41 meat cut substitutability space is also used in Chapter 14 to identify the key determinants of preference, per capita consumption and the number of households that will consume each meat cut.

CHAPTER 9

COMPARISON OF SIMILARITIES FROM PREFERENCE AND SUBSTITUTABILITY DATA IN MULTIDIMENSIONAL SCALING

The preference data from the different scaling methods were converted into preference similarity data by relaxing the dominance restrictions and using the data as first ordered metric data. The three multidimensional spaces obtained using the three scaling methods - Semi-structured Linear Scale and the two Thurstone methods - were compared with each other and with the multidimensional space obtained in the last chapter using the substitution data; to see if there were any differences between the dimensions underlying preference and those underlying similarity.

These comparisons were made using the 15 meats and also the 41 meat cuts, to establish whether the dimensions changed as consumers went from a consideration of meats in general to a consideration of specific meat cuts.

9.1 RESEARCH PROCEDURE

The objective of the present chapter was to see whether the dimensions underlying the substitutability measurements were the same for the respective configurations as those that were responsible for the preference similarity measurements.

To achieve the above objective, the Thurstone Case V, Thurstone General and Semi-structured Linear Scale matrices reported in Chapter 7 were all modified to ensure that the 'dominance' criteria were relaxed, i.e. all the negatives were removed from the matrices. The respective matrices were then analysed by KYST II to give 3-dimensional configurations of the 15 meats in a preference similarity space.

The 3-dimensional configurations from the Thurstone Case V, Thurstone General and Semi-structured Linear Scale preference similarity data were then compared by a visual inspection as well as by Procrustes Analysis to see whether the three data sets resulted in similar configurations for the 15 meats.

The 3-dimensional configurations for the Thurstone Case V, Thurstone General and Semi-structured Linear preference similarity data were also compared with the 3-dimensional 15 meat substitutability configuration to see whether any or all of the preference similarity configurations were similar to the substitutability configuration. The aim was to establish whether the dimensions underlying the preference similarity measurements were either the same or different to those underlying the 15 meat substitutability measurements. The comparisons were made by both a visual inspection and by Procrustes Analysis.

In Chapter 8 it was shown that the dimensions underlying each of the meat sub-groups were different to the dimensions underlying the 41 meat cuts. To complete the comparisons between the substitutability measurements and the preference similarity measurements, the reference similarity measurements for each of the the meat sub-groups were analysed by KYST II and the respective 3-dimensional configurations for the preference similarity and substitutability data were compared using a visual inspection as well as a Procrustes Analysis.

9.2 PREFERENCE DATA FOR THE 15 MEATS

The preference data was treated as similarity data based on preference and analysed using KYST II to obtain the dimensions underlying similarities based on preference.

9.2.1 Similarities derived from Thurstone Case V Data for 15 Meats

The half matrix of standardised Z values of preference data derived from the proportion of people preferring each meat in a pair was analysed using KYST II. Scaled solutions were obtained in 5 through to 1 dimensions with a stress versus dimension plot shown in Figure 9.1. An 'elbow' in the plot occurred at 3-dimensions and the choice of 3-dimensions was supported by Spence and Graef's (1974) graphical method for determining underlying dimensionality. A 3-dimensional configuration of the 15 meats was therefore obtained and the scale values are presented in Appendix 9.1 and the 2-dimensional plot is shown in Figure 9.2.

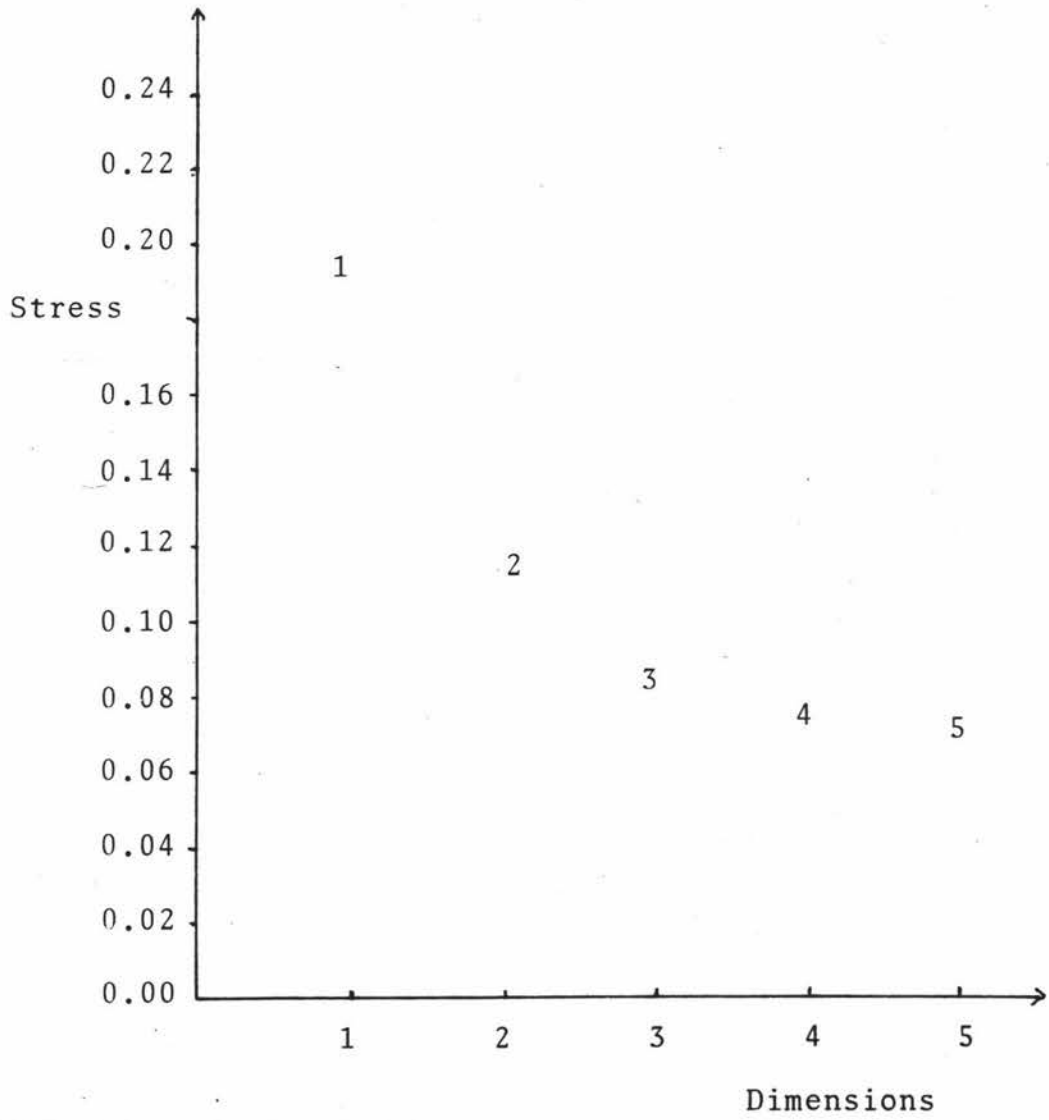

Fig. 9.1 Stress versus Dimension Plot for the Thurstone Case V Similarity Preference Data.

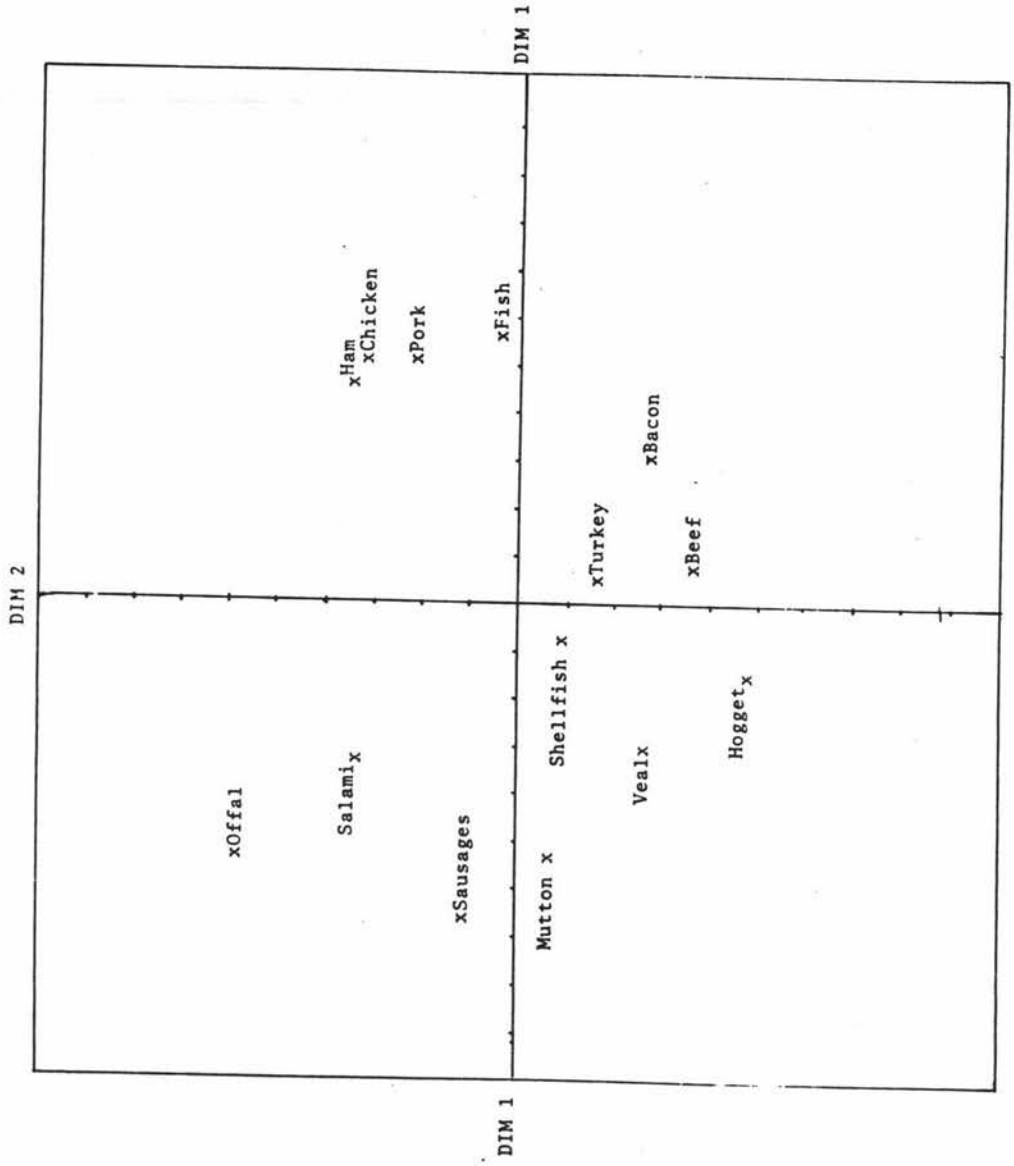

Fig.9.2 2-Dimensional Configuration of the 15 Meats Using the Thurstone Case V Similarity Preference Data.

The similarities data derived from Thurstone Case V preference data showed a far better fit to the model compared with the 'dominance' data as evidenced by the low stress of 0.0775 for the 3-dimensional solution, the relatively large decreases in stress with increasing dimensionality and by the excellent Shepard plot.

The ranks for the 15 meats obtained from the 1-dimensional MDS condiguration exactly matched the original rank order of the meat preferences obtained from Thurstone's Case V method as evidenced by the value of the Spearman rank correlation coefficient of 1.0. It would appear that dimension 1 of the 3-dimensional configuration represented the underlying order of preference for the 15 meats with chicken, pork, fish and ham, the more preferred meats at one end and mutton, smallgoods and offal, the least preferred meats at the opposite end of the scale with the moderately preferred meats lying between the two extremes.

9.2.2 Similarities of the 15 Meats Derived from the Thurstone General Data

The half matrix of preference data derived from the the Thurstone General data, was analysed using KYST II. Scaled solutions were obtained in 5 through to 1 dimensions. Whilst the Shepard diagram showed a smooth, continuous curve, the plot (FIgure 9.3) of stress versus dimensionality showed the expected decrease in stress from 1 to 3 dimensions.

An examination of the 3-dimensional configurations (see Figure 9.4), showed a sinusoidal distribution of the 15 meats, for the dimension-2 and dimension-1 configurations, and also for the dimension-3 and dimension-1 configurations, with very little separation of the 15 meats in each of the configurations except along dimension-1 (x-axis) of each configuration, which would appear to have been the dimension of preference. The only configurations to show any separation along both the x- and y-axes was dimension-3 versus dimension-2 where the meats were separated into the 4 quadrants.

9.2.3 Similarities of the 15 Meats Derived from the Semi-structured Linear Preference Scale

The half matrix of preference data derived from the averaged positions of each of the meats on the semi-structured linear scale was analysed

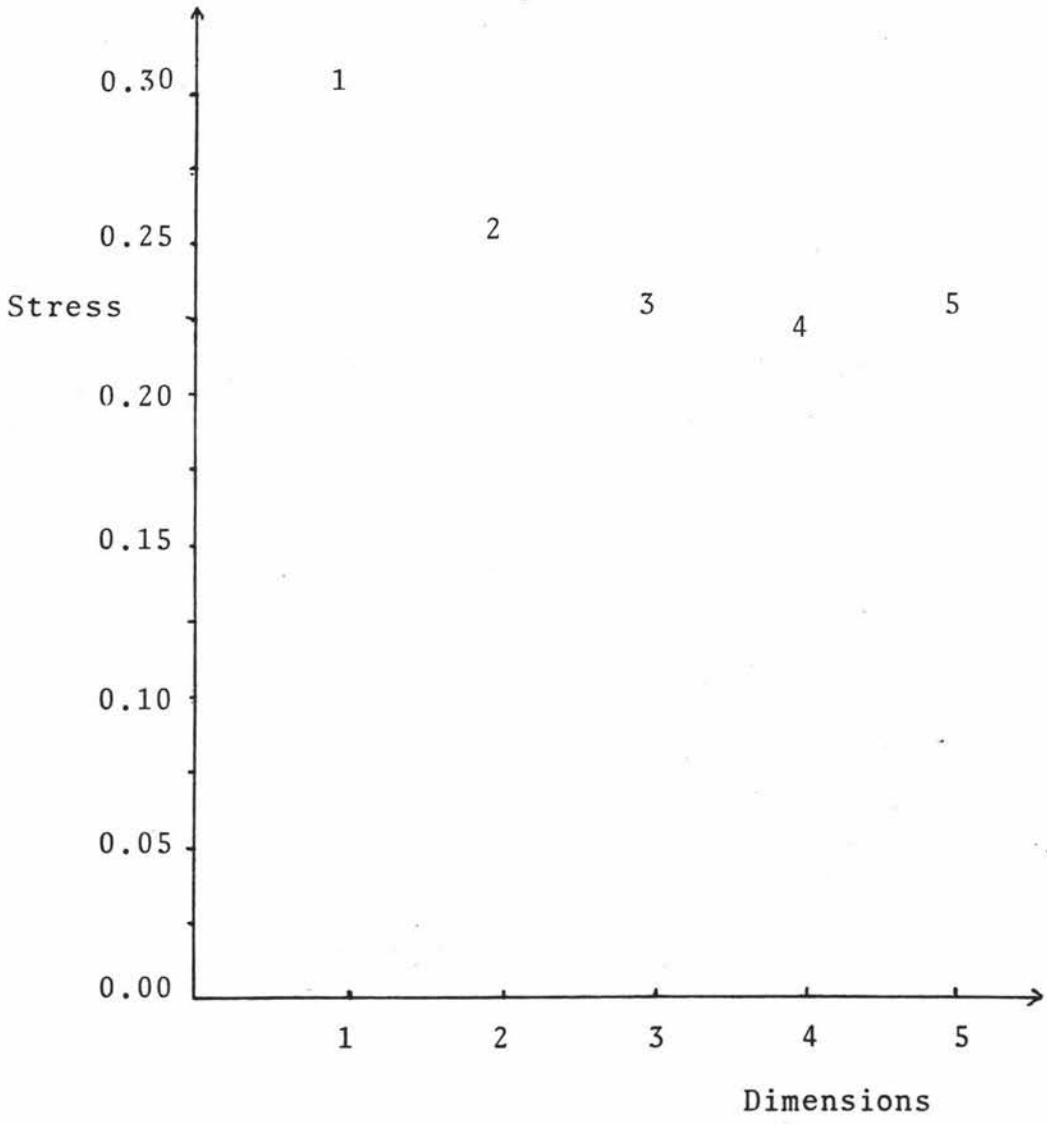

Fig. 9.3 Stress versus Dimension Plot for the Thurstone General Similarity Preference Data.

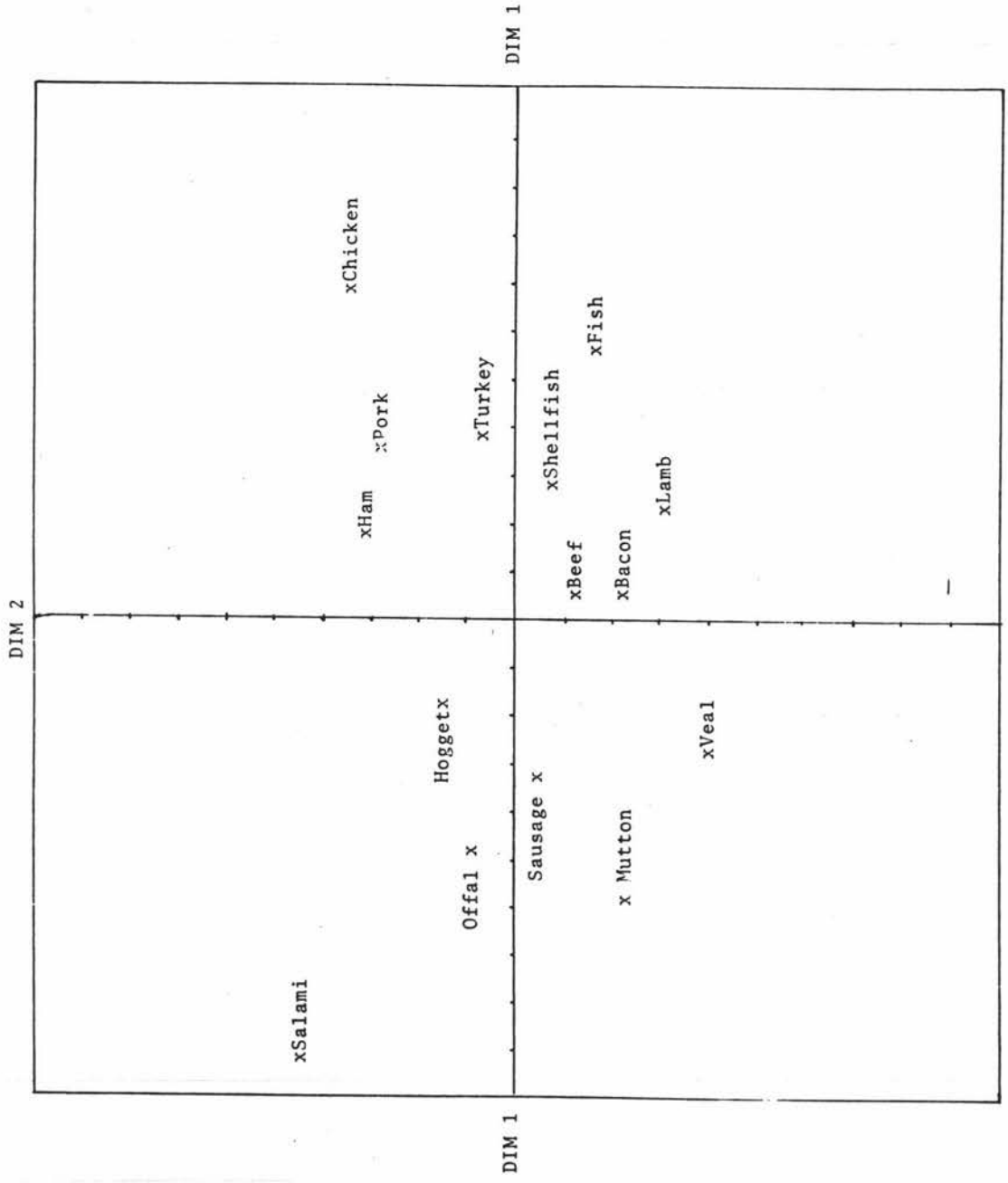

Fig 9.4 2-Dimensional Configuration of the 15 Meats Using the Thurstone General Similarity Preference Data.

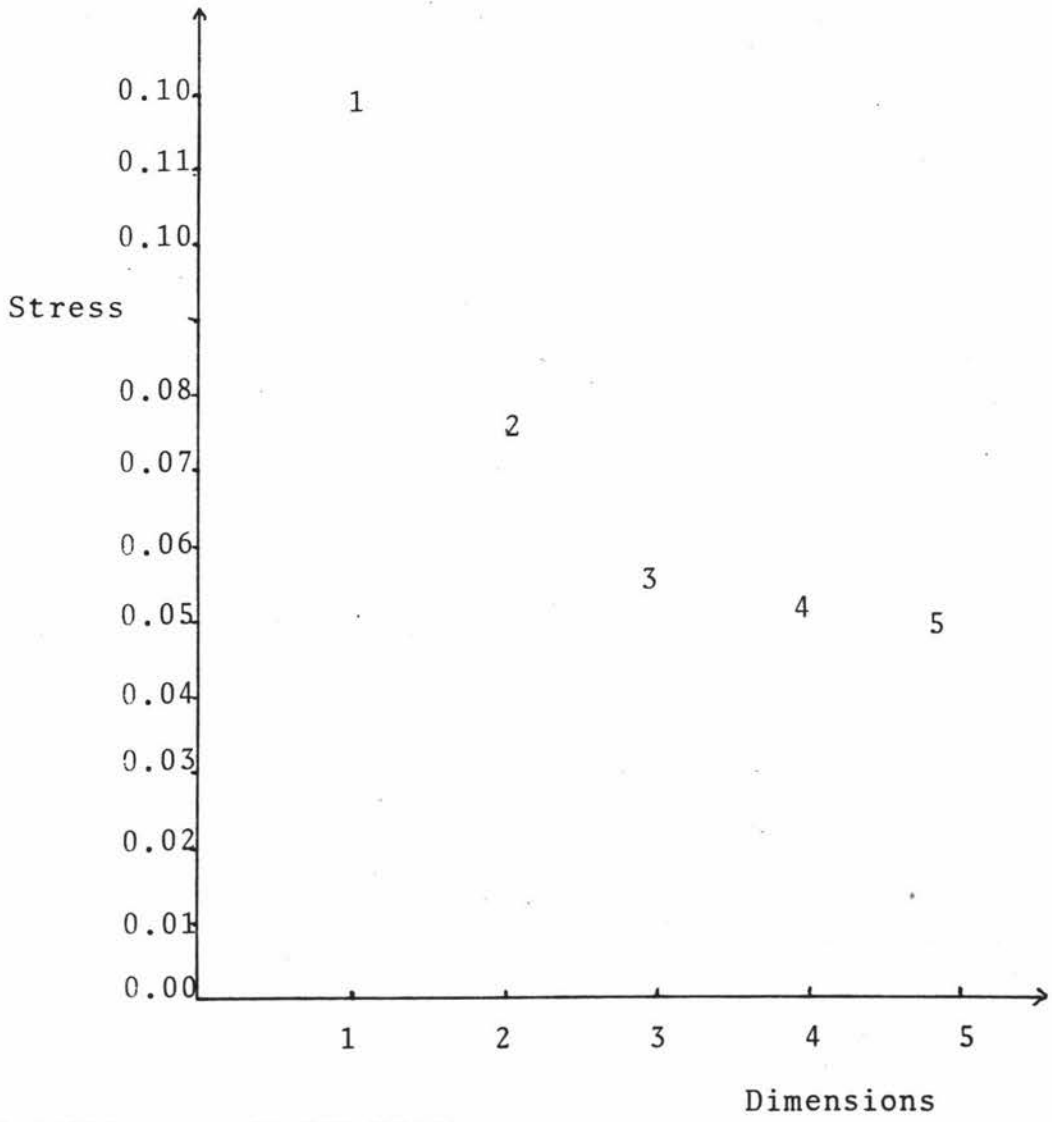

Fig. 9.5 Stress versus Dimension Plot for the Semi-structured Linear Scale Similarity Preference Data.

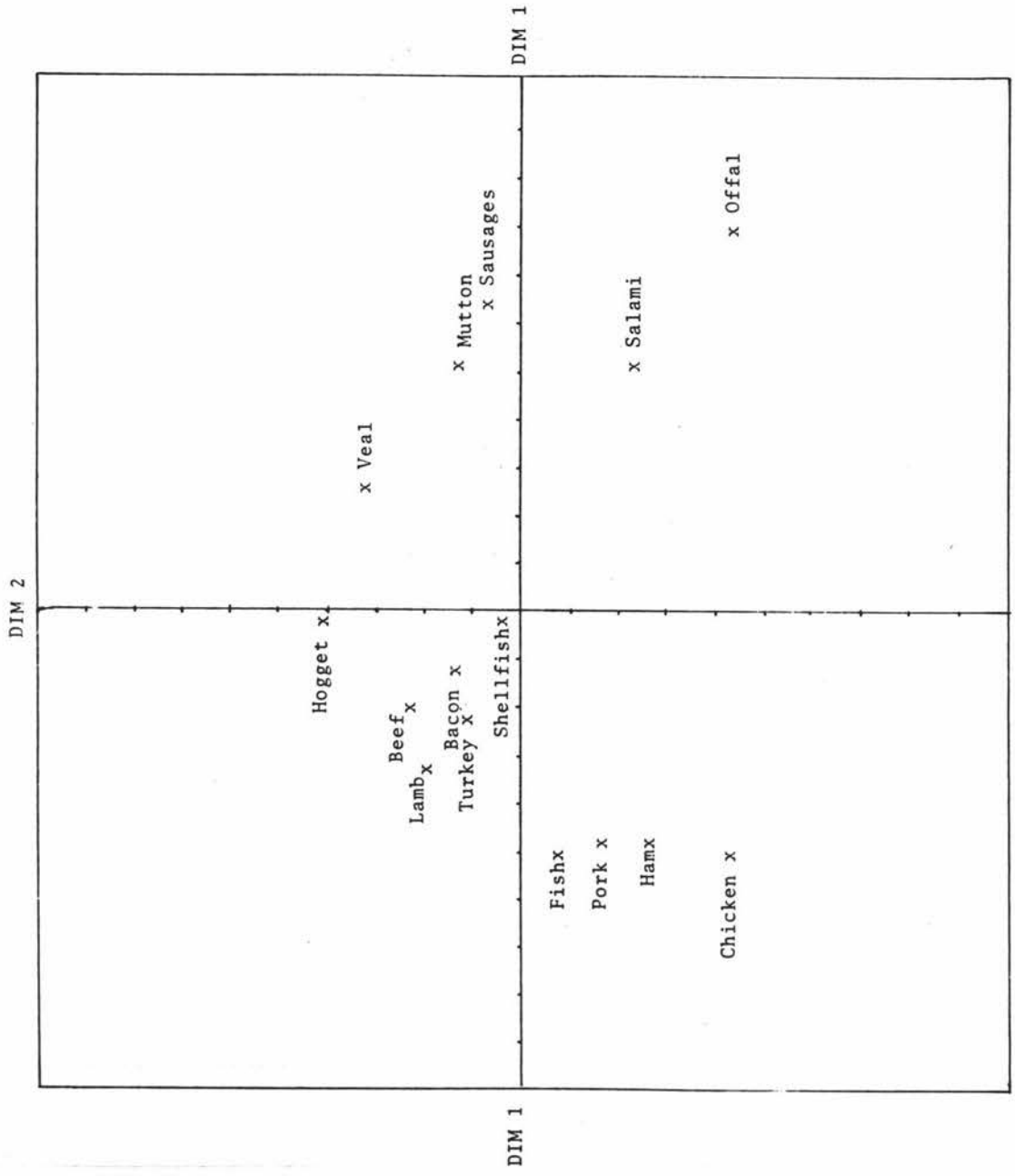

Fig 9.6 2-Dimensional Configuration of the 15 Meats Using the Semi-structured Linear Scale Similarity Preference Data

using KYST II. Scaled solutions were obtained in 5 through to 1 dimensions with a stress versus dimension plot shown in Figure 9.5. An 'elbow' in the plot occurred at 3-dimensions and this, together with Spence and Graef's (1974) graphical method indicated that 3-dimensions could be used to provide an adequate description of the data. A 3-dimensional configuration of the 15 meats was therefore obtained and the scale values are presented in Appendix 9.2 and the plots are shown in Figure 9.6. The stress plot versus dimensionality, together with the Shepard diagram and the 3-dimensional configurations indicated that the data provided a reasonable fit to the model.

The ranks for the 15 meats obtained from the 1-dimensional MDS configuration did not exactly match the original rank order of the meats as indicated by a Spearman's rank correlation coefficient of 0.89. The rank order of the 15 meats obtained from the 1-dimensional MDS configuration of the linear scale data more closely matched the rank order of the 15 meats obtained from the Thurstone Case V interval scale as indicated by the value of 0.985 for the Spearman rank correlation coefficient.

As with the other data sets the 1-dimensional configuration appeared as the x-axis of the two-dimensional configuration and also as the x-axis of the dimension-1 versus both dimension-2 and dimension-3 of the 3-dimensional configurations. It would appear that the dimension of preference was the major dimension for the 1, 2 and 3-dimensional MDS solutions for all three data sets indicating firstly that the use of first order metric rather than ordered metric data is a more appropriate method of determining the underlying rank order for a number of items and secondly that the use of KYST II to analyse the first order metric data, i.e. similarities based on preference, uncovers the major dimensions that underly preference of meats.

9.2.4 Comparison of the 3-Dimensional Preference Similarity Configurations for the 15 Meats Obtained from Thurstone Case V, Thurstone's General Method, and the Semi-Structured Linear Scale Data

The 3-dimensional configurations obtained from the analysis of the similarity data for each of the preference data sets, i.e. the Thurstone Case V method data, the Thurstone General method and the semi-structured

linear scale were compared with one another using the Procrustes programme GENSTAT (1977) software package, as described in Chapter 8, to see if the 3 methods of determining preference produced the same 3-dimensional configurations.

The Procrustes statistic for the various 3-dimensional configurational comparisons is shown in Table 9.1.

Table 9.1 Comparison of 3-Dimensional Similarity Configurations using Procrustes Analysis.

Fixed Configuration	Configuration being compared with fixed Configuration	Procrustes Statistic
Thurstone Case V Preference Similarity Data	Thurstone General Preference Similarity Data	1.36
Thurstone Case V Preference Similarity Data	Semi-structured Linear Scale Preference Similarity Data	1.46
Thurstone General Preference Similarity Data	Semi-structured Linear Scale Preference Similarity Data	1.63

It would appear from the above Procrustean comparisons that none of the 3-dimensional configurations for the 15 meats matched each other as evidenced by the high Procrustes statistic for each configurational comparison. The closest match was provided by the Procrustes comparison of the two Thurstone data sets, followed by the comparison of the Thurstone Case V and the semi-structured linear scale and the worst configurational match was provided by the Thurstone General preference similarity data and the semi-structured linear scale similarity data.

The x-axis in the 1, 2 and 3-dimensional configurations for all three data sets appeared to be one of preference. For instance the 1

dimensional MDS ranks for the semi-structured linear scale data was almost identical with the ranking obtained from the Thurstone Case V interval scale (see Chapter 7) as evidenced by the very high value of 0.996 for the Spearman rank correlation coefficient; also the ranks obtained from the 1 dimensional configuration of the Thurstone General data exactly matched the rankings obtained from the semi-structured linear scale.

The lack of fit between the configurations, whilst in part due to the arrangement of the 15 meats along the x-axis of the 3-dimensional configurations of the 3 data sets, would appear to be due in the main to the arrangement of the meats along the y and z axes in the respective 3-dimensional configurations.

9.3 COMPARISON OF THE 3-DIMENSIONAL CONFIGURATIONS OF THE 15 MEATS DERIVED FROM SUBSTITUTABILITY MEASUREMENTS AND SIMILARITY MEASUREMENTS BASED ON PREFERENCE

The 3-dimensional configuration of the 15 meats which was derived from the substitutabiity data was compared using Procrustes Analysis (1977) with the 3-dimensional configurations obtained from each of the preference similarity data sets, i.e. the Thurstone Case V, Thurstone General and semi-structured linear scale data, and also with each of the 3-dimensional configurations obtained from the dominance, preference data. The objective of the comparisons was to determine the differences between the data sets and to see whether the dimensions underlying substitutability measurements were the same as those underlying similarity measurements based on preference and 'dominance' preference measurements. The Procrustes statistics for each of the comparisons are shown in Table 9.2.

Table 9.2 Comparison of 3-dimensional Substitutability, Similarity and Preference Dominance Configurations for the 15 Meats.

Fixed Configuration	Configuration Being Compared with Fixed Configuration	Procrustes Statistic
Substitutability Data	Thurstone Case V Preference Similarity Data	1.45
Substitutability Data	Thurstone General Preference Similarity Data	0.90
Substitutability Data	Semi-structured Linear Scale Preference Similarity Data	0.87
Substitutability Data	Thurstone Case V 'Dominance' Data	0.83
Substitutability Data	Thurstone General 'Dominance' Data	1.01
Substitutability Data	Semi-structured Linear Scale 'Dominance' Data	0.93
Thurstone Case V Preference Similarity Data	Thurstone Case V 'Dominance' Data	1.22
Thurstone General Preference Similarity Data	Thurstone General 'Dominance' Data	1.31
Semi-structured Linear Scale Similarity Preference Data	Semi-structured Linear Scale 'Dominance' Data	1.49

Firstly, an examination of the comparisons made on the respective 'dominance' and similarity 3-dimensional MDS configurations of each preference data set showed that the 'dominance' data produced quite different 3-dimensional MDS configurations to the similarity data as evidenced by the high Procrustes statistic valus of 1.22 for the Thurstone Case V data, 1.31 for the Thurstone General data, and 1.49 for the semi-structured linear scale data.

Moreover, an examination of the comparisons made on the 3-dimensional MDS configuration obtained from the substitutability data and each of the 3-dimensional MDS configurations obtained from the preference data were quite different though the difference was not quite as large as thata between the 'dominance' and preference similarity configurations. It would appear then that the dimensions obtained from the substitutability measurements between the 15 meats were different to those obtained from either 'dominance' preference measurements or indeed 'similarity' measurements based on preference. Furthermore, it would appear that the dimensions underlying 'dominance' preference measurements were different to those underlying 'similarity' preference measurements.

To eliminate data variations as a cause for the differences between the configurations would necessitate the same respondents repeating the assessments of the same data a number of times to check the repeatability of their assessments.

9.4 COMPARISON OF THE SUBSTITUTABILITY AND PREFERENCE SIMILARITY 3-DIMENSIONAL CONFIGURATIONS FOR EACH OF THE MEAT CUT SUB-GROUPS

A similar comparison was made between the meat substitutability and preference similarity 3-dimensional configurations for the 41 different meat cuts and the value of the Procrustes statistic (Table 9.3) together with a visual comparison of the configurations tended to support the view that the configurations were indeed quite different and it could possibly be assumed that the dimensions underlying the direct similarities space were different to the preference similarities space.

It was decided, therefore, to compare the substitutabilities 3-dimensional configurations obtained from the 41 meat cut substitut-

abilities data with the respective preference similarities 3-dimensional configuration using Procrustes analysis to see whether the same differences between substitutability measurements and preference similarity measurements could also be found for the additional data sets. The results of the respective comparisons are shown in Table 9.3.

Table 9.3 Comparison of 3-dimensional substitutabilities and preference similarities configurations by Procrustes analysis

Fixed Configuration	Configuration Being Compared with Fixed Configuration	Procrustes Statistic
41 Meat Cut Substitutability Configuration	41 Meat Cut Preference Similarity Configuration	1.66
8 Beef Cut Substitutability Configuration	8 Beef Cut Preference Similarity Configuration	1.32
8 Sheep Meat Cut Substitutability Configuration	8 Sheep Meat Cut Preferenced Similarity Configuration	1.09
8 Pork Cut Substitutability Configuration	8 Pork Cut Preference Similarity Configuration	0.96
6 Offal Cut Substitutability Configuration	6 Offal Cut Preference Similarity Configuration	1.14
10 Roast Meat Cut Substitutability Configuration	10 Roast Meat Cut Preference Similarity Configuration	0.77
11 Convenience Meat Cut Substitutability Configuration	11 Convenience Meat Cut Similarity Configuration	1.24
9 Sausage Product Substitutability Configuration	9 Sausage Product Preference Similarity Configuration	1.36

9.5 DISCUSSION OF RESULTS

9.5.1 Similarity MDS Spaces Derived from Preference Measurements

Treating the preference data from the Thurstone Case V, Thurstone General and the Linear Preference Scale as similarity data was not entirely successful. The MDS analysis of the Thurstone Case V and linear preference scale similarity data resulted in solutions which showed a very good fit to the non-metric model as evidenced by the Shepard, stress and 3-dimensional solutions. However, the Thurstone General data when analysed by KYST II did not result in a solution that exhibited a good fit to the non-metric model as evidenced by the stress and 3-dimensional plots. In the case of the 3-dimensional plots of the Thurstone General data the meats were arranged in preference order along a sigmoid shape in the plots Dimension 1 versus Dimension 2 and Dimension 1 versus Dimension 3. According to Kruskal and Wish (1978) and Coxon (1983) the presence of a sigmoid shape is indicative of a uni-dimensional solution.

However, if the meats in the Thurstone Case V, and Linear Preference Scale matrices were arranged in descending order of preference from the left-hand side through to the right-hand side of the matrix and reanalysed by KYST II the resulting 3-dimensional solutions exhibited the same sigmoid shape as appeared when the ordered metric data was analysed by KYST II.

It would appear that the 3-dimensional solutions of the Thurstone Case V and Linear Preference similarity data were unstable, being dependent on the relative order of the meats in the lower half matrices. The data appeared to have a tendency to degenerate into a uni-dimensional solution. It would appear from the MDS analyses conducted on each of the data sets in Chapter 7 together with the results from the present chapter that the MDS analysis of Preference data produces unstable n-dimensional solutions which have a tendency to degenerate into a stable uni-dimensional solution which tends to reflect the rank order of the underlying data, i.e. the relatave preference order underlying the data. The results of this chapter together with those from Chapter 7 tend to bring into question MDS analyses of Preference data reported in the literature which claim to have obtained stable n-dimensional solutions

from the MDS analysis of preference data (Whipple, 1976 and Wierenga, 1980a and b).

9.5.2 Stability of Substitutability Measurements

The MDS analysis of the Thurstone Case V, Thurstone General and Linear Scale Preference data had shown that the results were highly dependent on the relative positions of the meats in the lower half matrix with an overall tendency to generate a uni-dimensional solution when the meats were arranged in preference order in the lower half matrix.

It was decided that the substitutability data for the 15 meats (Chapter 8) would be analysed by MDS with the meats occupying various positions in the matrix to assess the stability of 3-dimensional solutions of direct substitutable or similarity measurements. MDS analysis of 5 different rearrangements of the 15 meats resulted in the same 3-dimensional solution, indicating that substitutability measurements would appear to be far more stable than preference measurements to changes in relative positions occupied by objects in the lower half matrix being position independent unlike preference measurements.

9.5.3 Comparison of Preference Similarity MDS Solutions with the Substitutability MDS Solution for the 15 Meats

The unstable 3-dimensional solutions obtained from the analysis of the Thurstone Case V, Thurstone General and Linear Preference Scale similarity data were compared with the substitutability MDS solution for the 15 meats using both a visual assessment and Procrustes analysis to see whether the two measurement methods, i.e. preference and substitutability, resulted in similar 3-dimensional solutions. The high Procrustes statistics for the respective comparisons together with the visual comparisons showed that direct substitutability measurements for the 15 meats resulted in quite a different 3-dimensional solution to that obtained for the Thurstone Case V, Thurstone General and Linear Scale Preference similarity solutions. As was shown in Chapter 8 the meats in the direct substitutability measurements tended to occupy predictable positions with the sheep meats grouped together, the fish products together, the poultry products together and so on, which was certainly not the case with the preference solutions where the meats tended to be arranged in some order of preference along Dimension 1 which, as a result, established the arrangement of meats in the

Dimension 1 versus Dimension 2 and Dimension 1 versus Dimension 3 plots. However, even the Dimension 2 versus Dimension 3 plots for each preference data set bore little or no resemblance to the substitutable Dimension 2 versus Dimension 3 plot. The results would tend to indicate that substitutability or similarity measurements produced quite different n-dimensional solutions to similarity measurements derived from preference. With the 15 meat preference similarity measurements the meats were arranged in order of preference with chicken, ham, pork at one end of the solution and offal, sausages and mutton at the opposite end. With the 15 meat substitutability solution the meats were grouped according to species with ham, pork and bacon in one cluster, beef and veal in another, chicken and turkey, fish and shellfish, and salami and sausages in a separate cluster. Offal was separated from the remaining cuts. Preference, because it is a dominance measurement, tends to force the resulting MDS solutions into 1-dimensional solutions whereas with substitutability measurements a number of criteria appears to operate in the assessment and no single variable seems to dominate the assessment as is the case with preference measurements.

As a result of the inherent instability of n-dimensional preference solutions, direct substitutability measurements would appear to be the better method of obtaining similarity measurements as they cannot be broken down, whereas with preference similarity measurements where, a single dimension, namely preference, appears to dominate the solution.

9.5.4 Comparison of Preference Similarity with Substitutability Solutions for Individual Meat Groupings

The comparison of the substitutability 3-dimensional MDS solutions with preference similarity 3-dimensional solutions had suggested that for the 15 meats at least substitutability measurements were the better method of determining the multi-dimensional inter-relationship between the 15 meats.

As a consequence a visual and Procrustes comparison was made between 3-dimensional solutions resulting from both preference and substitutability measurements for specific meat cut groupings, namely: the beef cuts; sheep meat cuts; pig meat cuts; sausage products; offal cuts; convenience cuts and roat cuts. All eight comparisons showed firstly that the preference measurements produced different 3-dimensional solu-

tions to the substitutability measurements for each of the meat sub-groupings and secondly, that the meats for each of the preference solutions tended to be arranged in preference order along Dimension 1, and thirdly that the 3-dimensional solutions of each of the preference meat groupings were susceptible to the order of arrangement of the meats in each of the matrices tending in each case to degenerate into a uni-dimensional solution.

Clearly, the results showed that the dimensions underlying direct substitutable measurements for the 15 meats and the specific meat groupings were not the same as shown by the high Procrustes statistics and visual inspections. Moreover, preference tended to dominate Dimension 1 of all the preference data sets whereas preference did not appear to underly any one dimension of the substitutability meat sub-grouping solutions.

9.6 CONCLUSIONS

* Similarity MDS solutions derived from paired comparison preference measurements appeared to be unstable, being dependent on the position of the meats within the data half-matrix and generally degenerating into uni-dimensional solutions. Whereas substitutability MDS solutions tended to be position independent and stable.

It would therefore appear that substitutability measurements are a better method for determining the multi-dimensional inter-relationships between meat cuts or products, objects etc. than similarity measurements derived from preference measurements.

* Substitutability measurements for the 15 meats and each of the specific meat sub-groups produced a different 3-dimensional MDS solution to the respective preference meat sub-groupings indicating that different dimensions underlay the substitutability solutions to the respective preference solutions.

Preference tended to be the main dimension underlying each of the preference similarity solutions with the meats ordered along Dimension 1 of each solution according to the rank order of preference determined for the 15 meats and 41 meat cuts in Chapter 7.

CHAPTER 10

"IDEAL" MODELS TO IDENTIFY PRODUCT OPPORTUNITIES

To a consumer, a product represents a bundle of attributes - physical (eg. shape, colour, size and smell), sensory (texture, flavour, mouthfeel and aroma), as well as psychological (associations with safety, health, status and prestige), i.e. it is a multidimensional quantity. In choosing a product from a set of alternative products a consumer compares the alternative products on the various dimensions that the consumer thinks are relevant to the particular products.

Multidimensional preference models have been developed to evaluate the process by which a consumer weighs the alternatives against each other and arrives at a preferred choice.

Not only has there been great academic interest in the subject (which is illustrated by the great number of publications, especially in the latter half of the 1970's), but a considerable number of applications demonstrate that these models can be extremely useful in the areas of product development, market segmentation and communications (Wierenga, 1983; Shocker and Srinivasan, 1979; Green and Srinivasan, 1978; and Lunn and Blackston, 1978).

The objective of this study was to use one of these preference models to identify new, high-preferred meat product ideas using the 15 meat and 41 meat cut substitutability spaces.

10.1 PREFERENCE MODELS

Usually the trading-off of product attributes against each other is not done explicitly by consumers (Engel et al., 1982). But somehow, to arrive at a choice, such a trading-off must take place. Several models have been developed to describe this trading-off process.

A review of the various models can be found in Green and Wind (1973, Ch. 2). A taxonomy of the various models is provided in Figure 10.1.

DOMINANCE

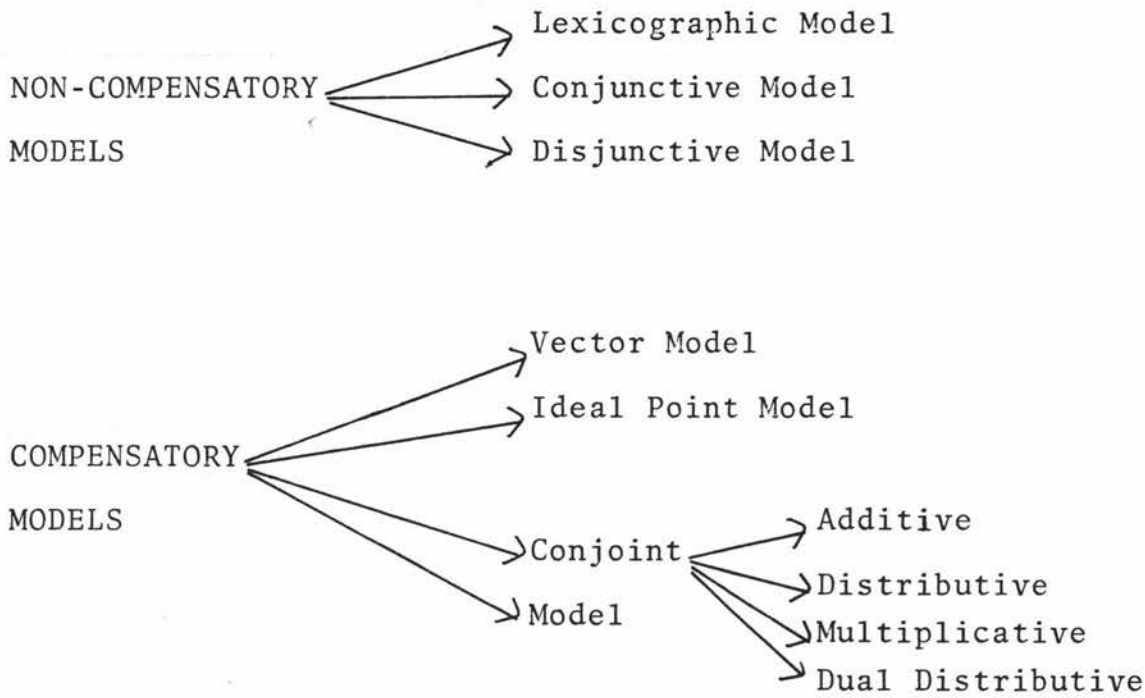

Fig.10.1 A Taxonomy of Preference Models.
(Green and Wind, 1973, Ch.2).

It is assumed that a consumer has to make a choice from n different product alternatives and that these alternatives are judged on d different attributes. Each alternative product j can then be described by a d-dimensional vector of attributes : $(y_{j1}, y_{j2}, \ldots y_{jd})$.

10.1.1 Dominance Model

The dominance model arises when there is one product which on every attribute is better than or least equal to all the other alternative products. In this case the consumer can readily select a product which is termed the dominant alternative. When, for example, k is the dominant alternative this implies:

$$y_{kt} \geq y_{jt}$$

for all j not equal to k and t=1,2,...,d.

In the taxonomy of preference models given in Figure 10.1, this situation is indicated as a separate case. In fact in such a situation, no preference model is required for the consumer at all.

Generally, however, one alternative product is best on some attribute and a second alternative product is best on some other attribute and so on. In this case, the consumer has to follow some strategy to arrive at a preferred choice. Figure 10.1 gives a taxonomy of non-compensatory and compensatory models for this strategy.

Green and Wind (1973) make a major distinction between non-compensatory and compensatory models. In a compensatory model, a poor performance on one attribute can be made up by a superior performance on some other attribute. In a non-compensatory model this compensation is not possible.

10.1.2 Non-compensatory Models

10.1.2.1 Lexicographic Models: In the Lexicographic model, the consumer supposedly lists the attributes in descending order of importance. The alternative products are then screened with respect to the most important attribute. Let this be attribute 1. Then the product which has the highest rating on attribute 1 is the most preferred product. For example, if:

$$y_{k1} > y_{j1}$$

for all j not equal to k then product k would be the preferred product.

In cases of ties on attribute 1 the consumer would then choose attribute 2 to evaluate the various alternatives. If ties again occurred again, then the consumer would use attribute 3 to arrive at a choice. It is clear that when an alternative product does not rate best on the most important attribute, this cannot be compensated for by a better performance on another attribute and so such an alternative product will never be selected.

10.1.2.2 Conjunctive Model: The conjunctive model specifies that a product is acceptable only if certain minimum conditions are jointly satisfied for all attributes. For example a consumer may specify that his next car must have: five doors; seating for 8; 3-litre motor, and be capable of going at speeds in excess of 150 km/h.

10.1.2.3 The Disjunctive Model: In the disjunctive model "and" is substituted by "or". Again the consumer is assumed to set a number of conditions but now the fulfilment of each condition alone is sufficient to make a product acceptable.

10.1.3 Compensatory Models

10.1.3.1 The Vector Model: The simplest model of the compensatory type is the vector model, also called the linear compensatory or composite criterion model. In the vector model an individual consumer is represented by his preference vector, which indicates the direction of his preference in the MDS product space. The intensity of preference for a specific product is determined by the length of the projection of that product on the preference vector. A product with a longer projection is preferred above one with a shorter projection. Figure 10.2 illustrates the vector model for the case of 2 dimensions. It can be seen that consumer 1 prefers high levels of both attribute 1 and 2 (with a somewhat larger weight for attribute 1). Consumer 2 prefers high levels of attribute 2, but for attribute 1 he prefers low levels to high levels. Consumer 1 prefers product B, consumer 2 prefers product A.

From Figure 10.2 it is clear that in the vector model each consumer can have their own preference vector, so this model, like the models to follow, assumes heterogeneity among consumers with respect to preferences.

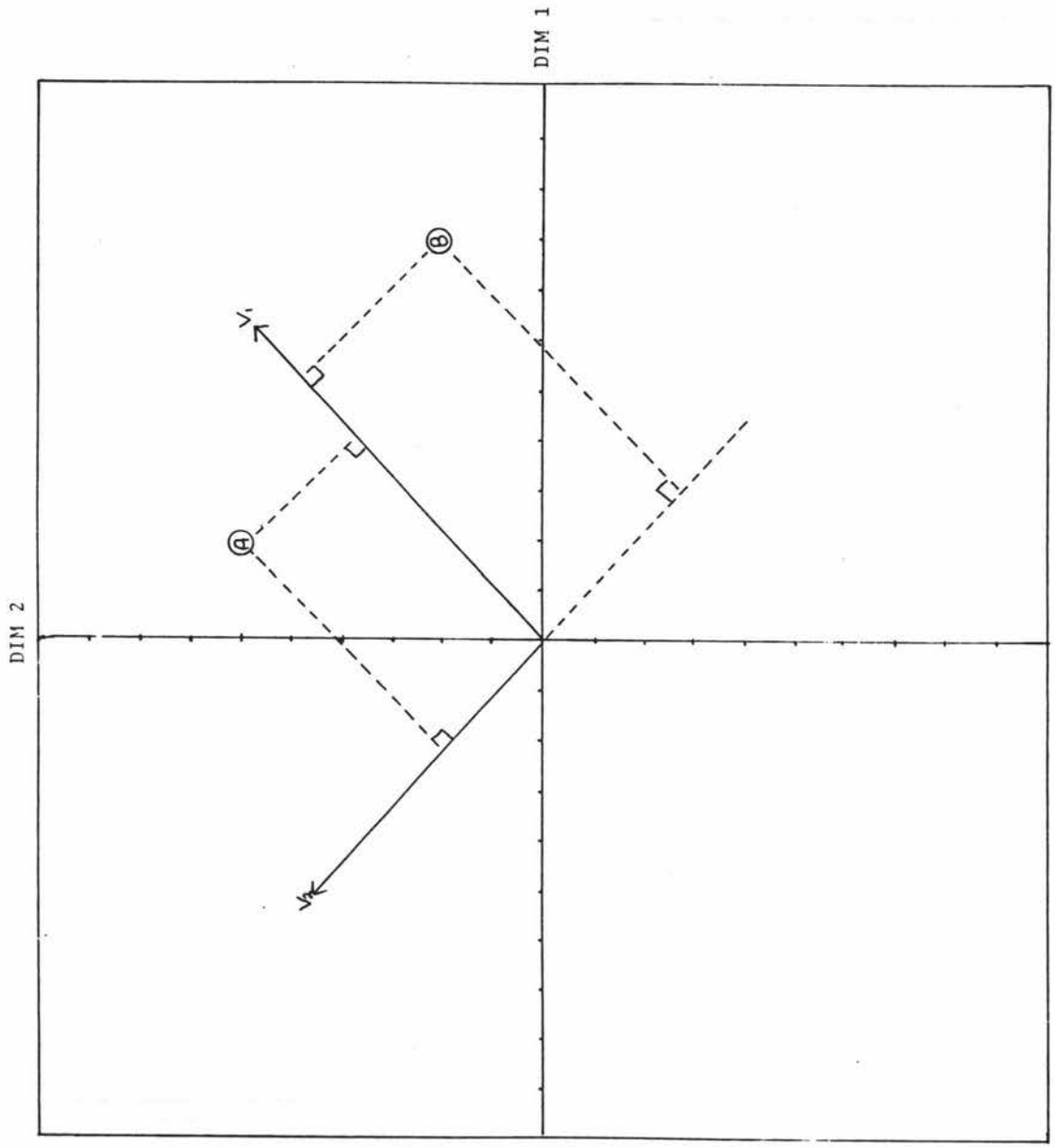

Fig. 10.2 Illustration of the vector model in the 2-Dimensional space. The preference vectors of consumers 1 and 2 are v_1 and v_2 respectively. A and B represent alternate products.

Algebraically the preference score (= projection) or utility of a specific product j, with coordinates $(x_{j1}, x_{j2}, \ldots, x_{kd})$, as assigned by consumer i with preference vector $(v_{i1}, v_{i2}, \ldots, v_{id})$ is according to the vector model:

$$U(x_j) = v_{i1}x_{j1} + v_{i2}x_{j2} + \ldots + v_{id}x_{jd}$$

So the model implies a utility function that is linear in the product attributes. For this reason the vector model is also called the linear compensatory model.

An attractive feature of the vector model is its simplicity. However, a disadvantage is the implicit assumption of a monotonic relationship between attribute scores and overall utility (Wierenga, 1983). For each attribute the idea "the more of the attribute the better concept applies". For many types of attributes this may be realistic (eg. safety, nutritional value), but not for others (eg. salt content of bacon, the sweetness of a fruit drink). These latter attributes generally have some optimal level and preferences decrease above and below some optimal value. This phenomenon cannot be represented by the vector model, but the ideal point model.

10.1.3.2 Ideal Point Model: In this model the consumer is represented in the MDS space by a point instead of a vector. This point is the consumer's ideal point: the combinations of attributes the consumers like most. It is assumed that the preference of a person for a specific product increases as the distance from this product to the ideal point decreases. Generally, different people have different ideal points. Figure 10.3 gives an illustration, again in 2 dimensions. Since product A is closer than product B to consumer 1's ideal point, product A is preferred over product B by consumer 1. For consumer 2 the opposite holds. In the ideal point model, the utility of product j for consumer i is inversely related to

$$d_{j1} = \left[\sum_{t=1}^{d} (x_{jt} - y_{it})\right]^{\frac{1}{2}}$$

where x_{jt} = the coordinates of product j on t attributes, i.e. the distance to the ideal point of consumer i, of which the coordinates are $y_{i1}, \ldots, y_{id}$.

It is possible in the ideal point model to have different weight factors

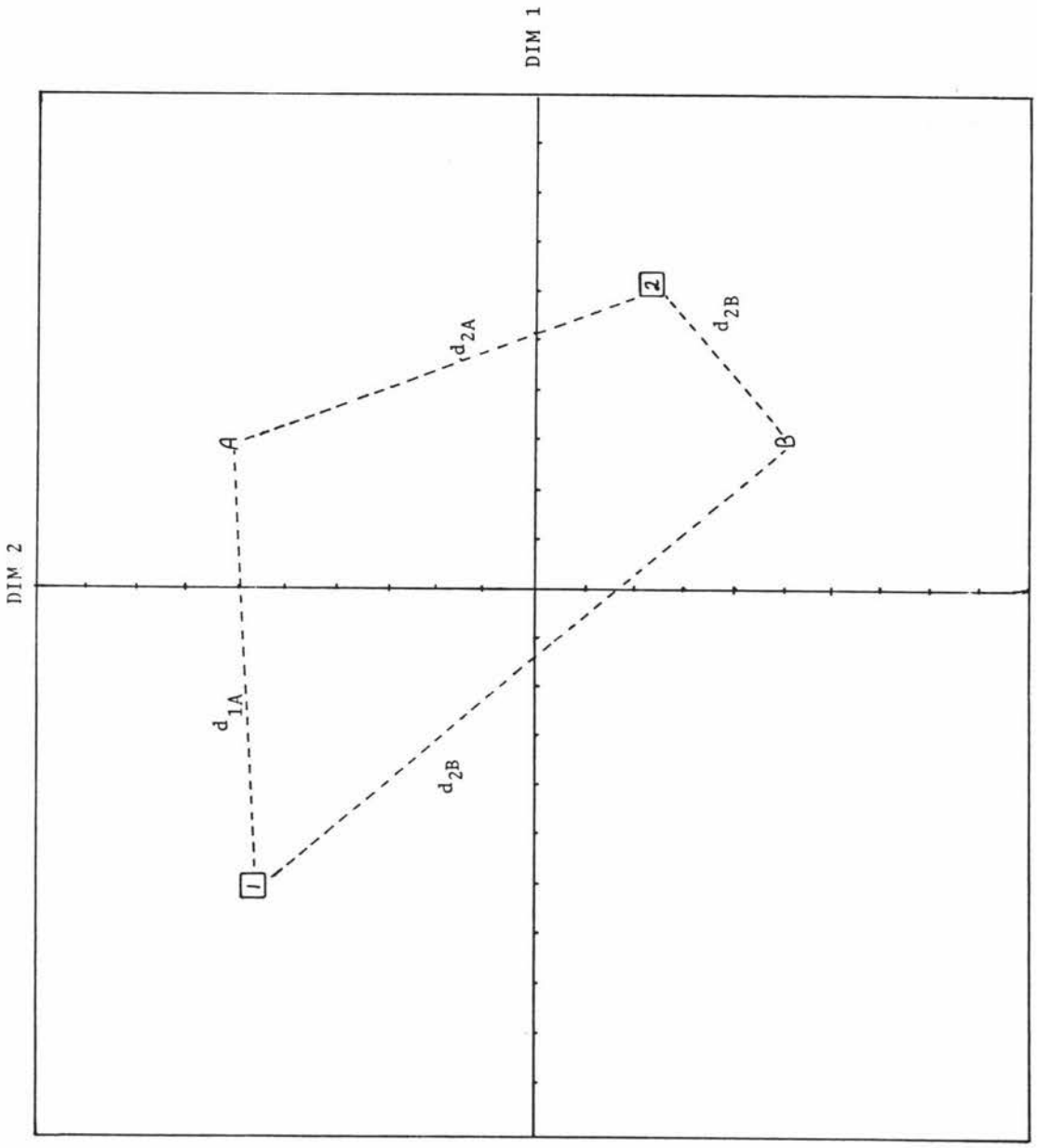

Fig. 10.3 Illustration of the ideal point model in 2-Dimensional space. 1 and 2 are the ideal points of consumers 1 and 2 respectively A and B are different products.

for different dimensions. The algebraic expression for the general ideal point model is:

$$U_{ij} = (-w_1(x_{j1} - y_{i1}) - w_2 8x_{j2} - y_{i2})^2)^{\frac{1}{2}}$$

where U_{ij} = the utility of product j for consumer i;
w_t = weight or importance of attribute t; and
x_{jt} = the coordinates of product j on attribute t
y_{id} = the distance to ideal point of consumer i.

10.1.3.3 Conjoint Measurement Model or Part-worth Model: In the conjoint measurement model, there is a separate utility function (= part-worth function) for each attribute. The overall utility is a combination of these part-worth utilities. The part-worth function for product j on attribute t can be given by:

$$U_t = U_t\ (y_{jt})$$

Where U_t = the Utility of product j on attribute t:
y_{jt} = a t-dimensional vector of attributes $'Y_{j1} \ldots, y_{jt})$

In the conjoint measurement model, the attributes are not continuous, but a number of discrete levels are distinguished for each attribute. The part-worth functions may have all possible forms.

10.1.4 Comparison of Compensatory Models

The three compensatory models form a hierarchy where each earlier model is a special case of the following one. The vector model is a special case of the ideal point model, i.e. an ideal point model with the ideal point in infinity. The ideal point model is a special case of the conjoint measurement model, i.e. with parabolic like part-worth functions with their maximum at the ideal point. According to Green and Srinivasan (1978), as one moves from the vector model to the ideal point model to the conjoint measurement model the flexibility of the form of the utility function increases, and with this greater flexibility so the number of different preference situations that can be modelled also increases. However, this greater flexibility has to be paid for by the increasing data requirements when the parameters of the model have to be estimated.

10.1.5 Choice of Preference Models

A number of preference models have been presented in this section, but the question arises: "Which preference model do consumers actually use?" Wierenga (1980b) has examined this question. He states that "general conclusions from the research so far are scarce, but several researchers seem to agree on the following. The choice process can be considered as a two-stage process where, in the first stage, some non-compensatory rule (eg. Lexicographic or Conjunctive model) is used to arrive at a set of acceptable alternatives. In the second stage, some compensatory model is applied to arrive at a choice from the remaining set of alternatives. Of the compensatory models, the linear compensatory model has been applied most, because in most preference situations the conditions are met under which this model constitutes a good approximation to the decision process.

With the present study, the ideal point model was used in preference to either the vector or the conjoint measurement models.

The ideal point model was selected instead of the conjoint measurement model mainly on the basis of time. To expect the respondents to answer a further series of questions dealing with their assessment of the effect of varying levels of an attribute on their meat and meat cut preferences so that conjoint measurement methods could be used to identify new meat product ideas could not be contemplated. The respondents had already given 25 hours of their time to answer the three very long questionnaires - which was far too long a time in the view of a majority of the respondents - and to ask them to answer a further series of questions would have jeopardised the whole study.

The second reason for rejecting conjoint measurement methods related to the nature of the present study. Much of the study was exploratory as little information on consumer preferences, attitudes, similarity assessments to meats was available for New Zealand consumers. Conjoint measurement is based on the assumption that fundamental information on the attributes governing consumers' preferences to meats exists and this was definitely not the case for the present study. Consequently the ideal point model rather than the conjoint measurement models was selected.

The reasons for selecting the ideal point model rather than the vector model related to the underlying philosophy of the respective models. The vector model is based on the implicit assumption of a monotonic relationship between attribute scores and overall utility (Wieranga, 1983), i.e. for each attribute the idea "that the more of a particular attribute the better" applies. Whereas, the ideal point model is based on the assumption that there is some optimal level of each attribute and that preferences decrease above as well as below this optimal point. Evidence exists in the literature to suggest that for some of the physical and sensory attributes (eg. fat level, texture, flavour and colour) there is some optimal level of these attributes and that consumers' preferences decrease above as well as below this optimal point. For instance, Horsfield and Taylor (1976) showed that with meat hamburgers, a vector model of preference was inappropriate as a number of attributes were shown to have some optimal level and that preferences decreased above and below these optimal levels. Barton (1969) quotes studies on fat levels of ground steaks which have shown preference for ground beef containing about 20% of high quality fat. Brayshaw et al. (1967) stated that the "quality characteristics of steaks can vary within quite broad limits and still result in a reasonable degree of satisfaction for the consumer, but that nevertheless a broad picture of a generally acceptable frying steak can be drawn. It should above all be tender, with a Warner Bratzler shear value between 7-22 lbs.; it should have a visible fat content of between 20 and 30%; and though most consumers are unlikely to detect quite marked differences, they should probably believe that it has a strong beef flavour."

Hood and Riordan (1973) found a linear relationship between the level of discolouration and the proportion of total sales of discoloured beef over a range of 5-33% metmyoglobin. The ratio of total sales of discoloured beef to bright beef was approximately 1:2 when 20% metmyoglobin was present in the discoloured batch. Puig et al. (1972), however, found that while consumers prefer very light red steaks, it is possible for steaks to be too light in colour to find favour with consumers.

Price and Schweigert (1971) claim that the most desirable properties of lean pork should be that it is firm, has a dry surface, that it is pinkish in colour. "The quality indicating characteristics evident on the cut surface of a major muscle includes marbling, firmness, colour

and exudate. Deficiencies in the latter three characteristics are typified as pale, soft, exudative (PSE) pork."

The above mentioned studies appear to show that consumers generally have some optimal level for physical characteristics such as colour, fat content, fat thickness and also for the sensory characteristics of flavour and tenderness. Since the ideal point model was developed to accommodate data which has optimal levels for a majority of the attributes and because the vector model is a special case of the ideal point model, the ideal point model was selected for the present study to identify new meat product opportunities in the 15 meat and 41 meat cut substitutability spaces.

Three methods were used to identify the ideal meat product for the 15 meat and 41 meat cut substitutability spaces. These included Fenker's (1972) and Kruskal et al.'s (1972) methods plus a further method developed by the author. With Fenker's (1972) method the 'population ideal point' is located whilst Kruskal et al.'s (1972) locates an 'ideal point' for each respondent. The method developed by the author also locates the 'population ideal point'.

10.2 RESEARCH PROCEDURE

The objective of the present study was to identify the overall population ideal point and the individual respondent's ideal points in the 15 meat and 41 meat cut substitutability spaces. The aim was to identify new meat cut product development opportunities using Fenker's (1972), Kruskal et al.'s (1972) and the author's methods of defining the 'ideal' point in an MDS space.

10.2.1 Fenker's Method of Locating the Population Ideal Point for the 15 Meats

The spatial configuration of the 15 meats derived from the substitutability data was chosen as a basis for the ideal point location rather than the preference similarity spaces because of its greater inherent stability to positional movement of the 15 meats in the 15 meat half matrix.

CONTROL STATEMENT NO.	CONTROL STATEMEMT DESCRIPTION
1	TORSCA
2	PRE-ITERATIONS=3
3	DIMMAX=3,DIMMIN=1
4	REGRESSION=ASCENDING
5	FIX=15
6	COORDINATES=AS-IS
7	ITERATIONS=50
8	CONFIGURATION
9	IDEAL POINT BY FENKER
10	15 3
11	(3F6.3)
	COORDINATES FOR 3-DIMENSIONAL SOLUTION
12	DATA
13	15 MEAT SUBSTITUTABILITIES PLUS RANKINGS
14	16 1 1
15	(16F5.1)
	DATA MATRIX
16	COMPUTE
17	STOP

FIG. 10.4 KYST II Control Cards for the Ideal Point Location by Fenker's Method (1972).

The ideal point was located according to the method described by Fenker (1972). The coordinates of the 15 meats derived from the multidimensional scaling analysis of the substitutabilities, were fixed in 3-dimensional space. The data matrix supplied to KYST II included the 15 x 15 meat matrix of substitutabilities and the overall preference rankings of the 15 meats derived from the Thurstone Case V method of analysis. Additional runs were carried out with the overall preference rankings for the 15 meats derived from the Thurstone General and the Semi-structured Linear Scale in place of the Thurstone Case V rankings. The preference rankings made up the 16th row and column of the matrix. Fixing the coordinates of the 15 meat points allowed for adjustment in the 16th point (ideal) only to minimise stress and maximise the monotonic relationship between the rank order of preferences for the 15 meats and the distances from the ideal point to the 15 meat points. The control statements required to locate the ideal point using KYST II are shown in Figure 10.4.

The same procedure was used for the 41 meat cuts substitutability space as described above for the 15 meats. An ideal point for the whole sample was located in the 3-dimensional spatial configuration of the 41 meat cut substitutability space.

10.2.2 Kruskal, Young and Seery's Method of Locating Ideal Points for Individual Respondents for the 15 Meats

The spatial configuration of the 15 meats derived from the substitutability data was chosen as a basis for the ideal point determination for the same reasons as were outlined for Fenker's (1972) method.

The ideal points for the individual respondents were located according to the method described by Kruskal *et al*. (1972). The coordinates of the 15 meats, derived from the multidimensional scaling analysis of the substitutabilities were fixed in 3-dimensional space. The data matrix supplied to KYST II included the 82 x 15 matrix of preference rankings derived from firstly the Thurstone Case V Interval scale data, the Thurstone General preference data and also the Semi-structured Linear Scale. The control statements required to locate the ideal point using KYST II are shown in Figure 10.5.

CONTROL STATEMENT NO.	CONTROL STATEMENT DESCRIPTION
1	TORSCA
2	PRE-ITERATIONS=3
3	DIMMAX=3,DIMMIN=1
4	REGRESSION=DESCENDING
5	FIX=15
6	COORDINATES=AS-IS
7	ITERATIONS=50
9	CONFIGURATION
10	15 3
11	(3F6.3)
	COORDINATES FOR 3-DIMENSIONAL SOLUTION
12	DATA
13	RANKINGS FOR 15 MEATS BY 82 RESPONDENTS
14	80 15 1 1
15	(15F5.1)
	MATRIX OF RANKINGS
16	COMPUTE
17	STOP

FIG. 10.5 KYST II Control Cards for the Ideal Points Location by Kruskal, Young and Seery's Method (1972).

Ideal points were also located for 82 respondents in the 3-dimensional spatial configuration of the 41 meat cut space. The same procedure was used as described above for the 15 meats. The rankings for the 41 meat cuts were obtained from the Thurstone Case V analysis of the 41 meat cut preference data. The Thurstone Case V Interval scale data was used because a Semi-structured Linear Scale was not used to obtain preferences for the41 meat cuts and secondly because the analysis of the 15 meat data showed that the Thurstone Case V data produced identical results to the Thurstone General data with respect to the positions of the Kruskal et al.'s ideal points.

10.2.3 Author's Method of Locating a Population Ideal Point for the 15 Meats

The spatial configuration of the 15 meats derived from the substitutability data was chosen as the basis for the ideal point for the same reasons outlined for Fenker's method.

The population ideal point was located as follows. The data matrix supplied to KYST II included the half matrix of substitutabilities values for the 15 meats together with a 16th row that included the interval scale preference values derived for each of the 15 meats from the Thurstone Case V Interval Scale of preference presented in Chapter 7. It was shown in Chapter 7 that chicken was the most preferred of the 15 meats. An additional run was made using the assumption that some meat existed that was preferred to chicken and that it had a score on the Thurstone Case V Interval Scale derived in Chapter 7 for the 15 meats that was 20% higher than that for chicken. With this additional run a 17th row was added to the half matrix of substitutability values for the 15 meats. The entries of this 17th row were those of row 16, but each was adjusted upwards by the difference in value between chicken and this 'new' meat on the Thurstone Case V Interval Scale. The aim of this additional run was to discover the direction of preference so that new and more preferred meats could be developed. The control statements required to locate the ideal point using KYST II are shown in Figure 10.6.

CONTROL STATEMENT NO.	CONTROL STATEMENT DESCRIPTION
1	TORSCA
2	PRE-ITERATIONS=3
3	DIMMAX=3,DIMMIN=1
4	COORDINATES=ROTATE
5	ITERATIONS=50
6	REGRESSION=ASCENDING
7	PLOT=SCATTER=SOME,PLOT=CONFIGURATION=ALL
8	DATA,LOWERHALFMATRIX,DIAGON=ABSENT
9	AUTHOR'S METHOD OF LOCATING POPULATION IDEAI
10	16 1 1
11	(16F5.2)
	HALF MATRIX OF SUBSTITUTABILITY VALUES
	16th ROW : THURSONE CASE V INTERVAL SCALE VALUES
	17th ROW : NEW IDEAL HYPOTHETICAL PRODUCT
12	COMPUTE
13	STOP

FIG. 10.6 KYST II Control Cards for the Ideal Point Location By the Author.

10.2.4 Axis Identification of the 15 Meat and 41 Meat Cut Substitutability Space

One of the difficulties with MDS studies is the identification of the axes of the substitutabilities space. To help with this identification 10 people who had originally participated in this study together with 10 others drawn from the Massey University Library were presented with the 3-dimensional configurations of both the 15 meats and 41 meat cut substitutabilities spaces, and asked to try to identify the dimensions underlying the spaces. The responses for the 20 respondents were collated for each of the dimensions and the modal value response was selected as the label for that particular dimension. In cases of ties both labels were used to identify the dimension.

10.2.5 Axis Identification for the 41 Meat Cut Substitutability Space

The 20 respondents had considerable difficulties in identifying the axes for the 41 meat cut substitutability space. Consequently, an alternative procedure was adopted to identify the axes. During the course of the 1979 survey, respondents' attitudes to the 45 meat cuts had been obtained for the following variables: stringiness of the meats; spicing requirement of the meats; wastage associated with the meat; convenience of the meat; fat content of the meat; bone content; tenderness; juiciness; flavour acceptability; flavour strength; value for money; preparation time; nutritional value; the prestige rating of the meat, i.e. whether the meat could be served to guests or not; and the number of dishes that can be prepared from the meat cut. Mean values for each of the meats on each attitude variable were determined.

The scale values for each of the 41 meat cuts for each of the dimensions obtained from the KYST II analysis of the 41 meat cut substitutability space were then correlated with each of the attitude scales. (Mean scale values for each of the 41 meat cuts were used.) The SPSS (Version 9) Correlation Analysis package was used to carry out the analysis. The aim of the analysis was to identify the attitudes that correlated highly with each of the substitutability dimensions and thus help to interpret the dimensions.

10.3 POPULATION IDEAL POINT LOCATED BY FENKER'S METHOD IN THE 15 MEAT 3-DIMENSIONAL SUBSTITUTABIITIES SPACE

The location of the population ideal point in the 3-dimensional configuration of 15 meats is shown in Figure 10.7 a, b and c. The preference data used to locate the ideal point in these figures was the final meat rankings obtained from the Thurstone Case V Interval Scale procedure. Identical solutions were obtained with the Thurstone General and Semi-structured Linear Scale rankings for the 15 meats.

The ideal point (P) was located at the mean of the 15 meat point distances along each of the axes and not at the centroid, i.e.

$$X_p = \frac{\sum_{i=1}^{j} x_{ij}}{n} \qquad j = 1,2,3,\ldots,d \text{ dimensions}$$

Table 10.1 Scale Values for the 15 Meats and the Population Ideal in the 3-dimensional Space - Fenker's Method (1972)

DIMENSION 1		DIMENSION 2		DIMENSION 3	
Meat	Scale Value	Meat	Scale Value	Meat	Scale Value
Beef	0.870	Salami	0.741	Shellfish	0.930
Hogget	0.838	Bacon	0.713	Fish	0.469
Lamb	0.800	Ham	0.689	Salami	0.447
Veal	0.774	Sausages	0.640	Veal	0.403
Mutton	0.758	Beef	0.220	Beef	0.106
Chicken	0.282	Veal	0.076	Lamb	0.021
Turkey	0.200	IDEAL	-0.032	Sausages	0.021
IDEAL	-0.095	Hogget	-0.131	IDEAL	0.000
Ham	-0.388	Lamb	-0.153	Hogget	-0.015
Fish	-0.548	Chicken	-0.217	Mutton	-0.041
Salami	-0.552	Pork	-0.228	Ham	-0.104
Pork	-0.713	Mutton	-0.238	Pork	-0.225
Shellfish	-0.494	Fish	-0.494	Chicken	-0.259
Bacon	-0.788	Turkey	-0.507	Bacon	-0.495
Sausages	-0.888	Shellfish	-0.662	Offal	-0.556
Offal	-1.355	Offal	-0.905	Turkey	-0.704

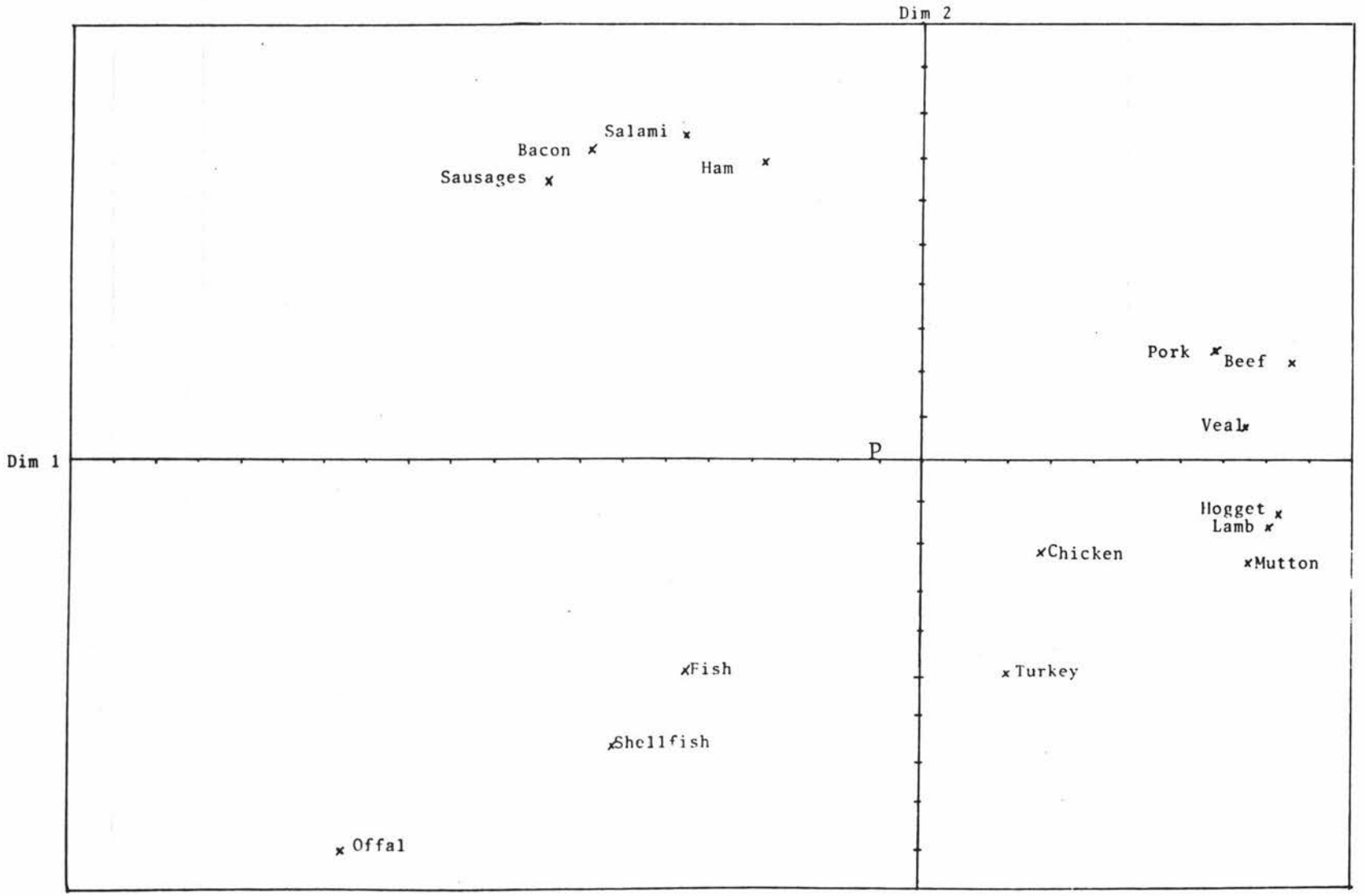

Fig. 10.7a Ideal Point Located in the 15 Meats Substitutability Space by Fenker's Method.

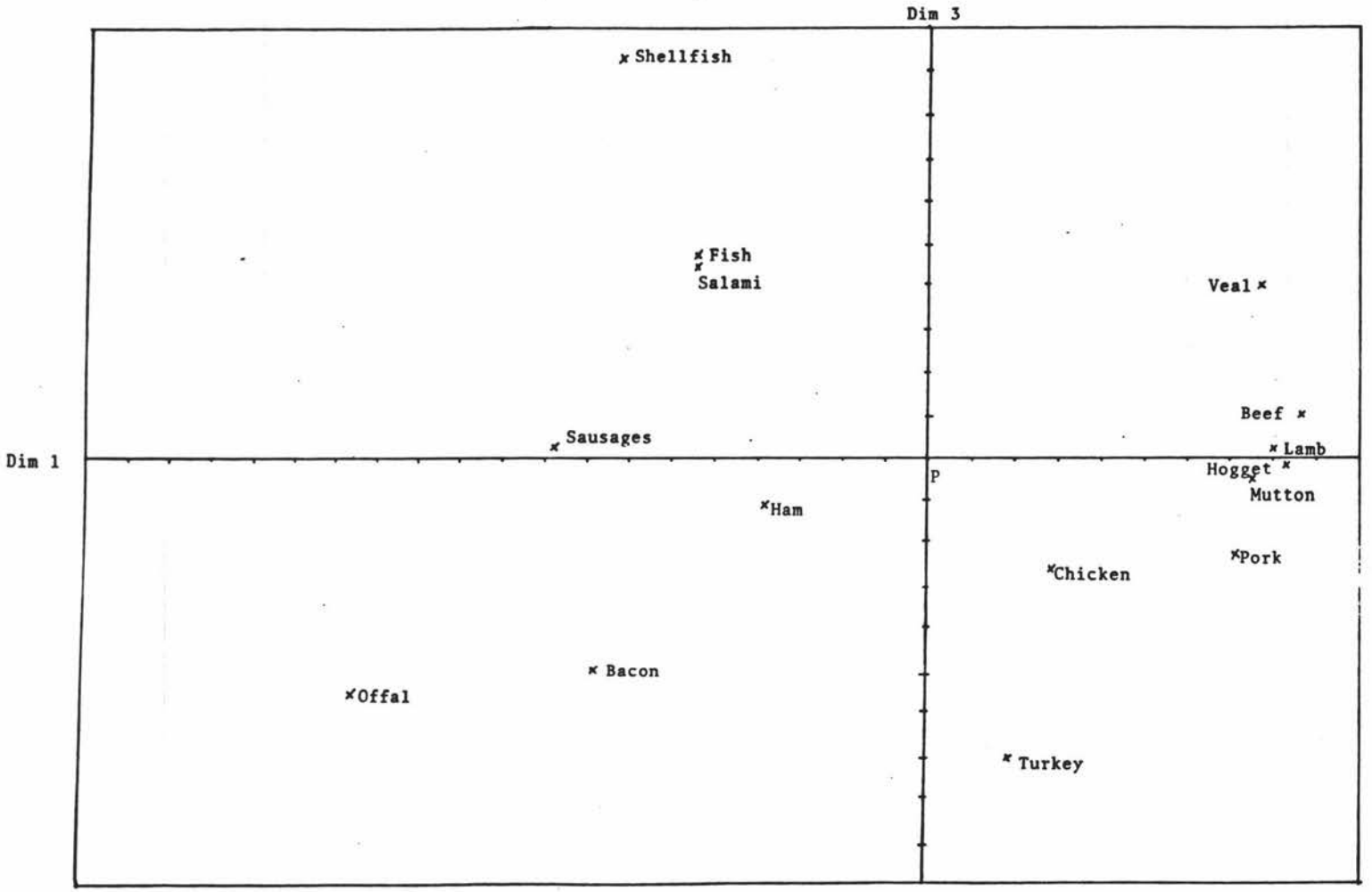

Fig.10.7b Ideal Point Located in the 15 Meats Substitutabilitity Space by Fenker's Method.

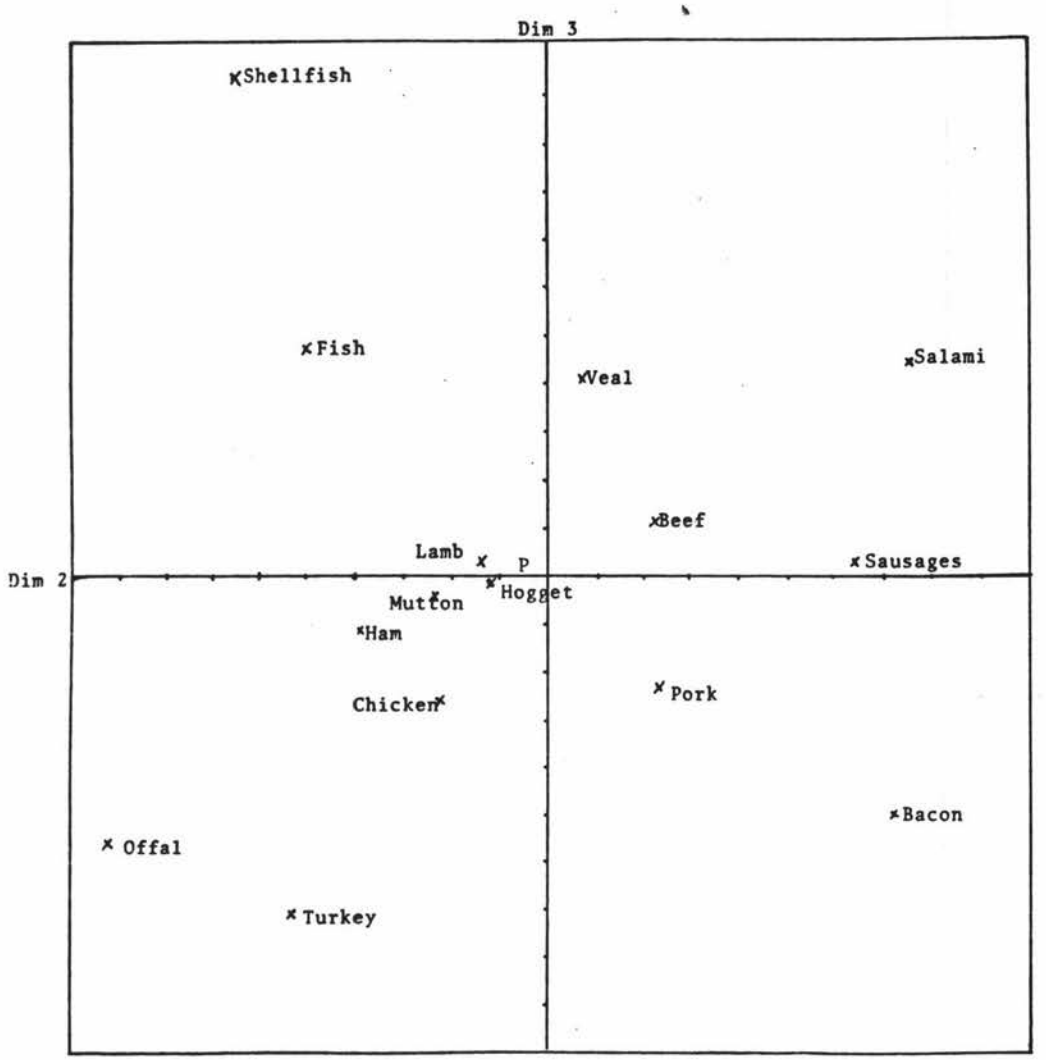

Fig. 10.7c Ideal Point Located in the 15 Meats Substitutability Space by Fenker's Method.

The location of the population ideal point in the 3-dimensional space has been presented also in Table 10.1. An examination of the scale values of Dimension 1 show that the ideal was located midway between turkey and ham with beef and veal located at opposite ends of Dimension 1. With the exception of pork, the main meal meats, i.e. beef, hogget, lamb, veal, mutton and chicken were located on one side of the ideal and the snack-type meats such as salami, shellfish, bacon, sausages and offal were located on the opposite. Twenty consumers identified Dimension 1 as being a bi-polar scale with main meal meats at the positive end of the scale and snack meal meats or ingredients on the negative end of the scale.

An examination of Dimension 2 shows that the ideal point was located between veal and hogget with salami and offal positioned at either end of the scale. Due to the fact that salami, bacon, ham and sausages were located at the positive end of the scale and offal, shellfish, turkey and fish at the opposite end of the scale the 20 respondents identified Dimension 2 as being a bi-polar scale with processed meats at one end and non-processed meats at the opposite and negative end of the scale. Some respondents referred to cured/non cured, others to chopped up and non-chopped up.

The ideal point on Dimension 3 was located between sausages and hogget with shellfish and turkey located at either end of the scale. The 20 respondents were unable to provide an adequate definition of the bi-polar scale.

10.4 POPULATION IDEAL POINT LOCATED BY FENKER'S METHOD IN THE 41 MEAT CUT 3-DIMENSIONAL SUBSTITUTABILITIES SPACE

The location of the population ideal point in the 3-dimensional configuration of 41 meat cuts is shown in Figure 10.8 a, b and c. The results are presented also in Table 10.2.

KEY

1. Wienersnitzel
2. Rump steak
3. Porterhouse steak
4. Stewing steak
5. Topside
6. Beef mince
7. Beef tongue
8. Beef hearts
9. Beef tripe
10. Corned beef
11. Beef sausages
12. Lamb forequarter
13. Lamb loin chops
14. Leg of lamb
15. Lamb's fry
16. Lamb's kidney
17. Hogget loin chops
18. Leg of hogget
19. Mutton forequarter
20. Mutton loin chops
21. Leg of mutton
22. Pork chops
23. Pork pieces
24. Leg of pork
25. Sliced ham
26. Leg of ham
27. Ham steaks
28. Middle bacon
29. Shoulder bacon
30. Fish
31. Chicken
32. Shellfish
33. Hamburger
34. Pork sausages
35. Luncheon
36. Ham n chicken
37. Salami
38. Frankfurters
39. Saveloys
40. Black pudding
41. Garlic sausage

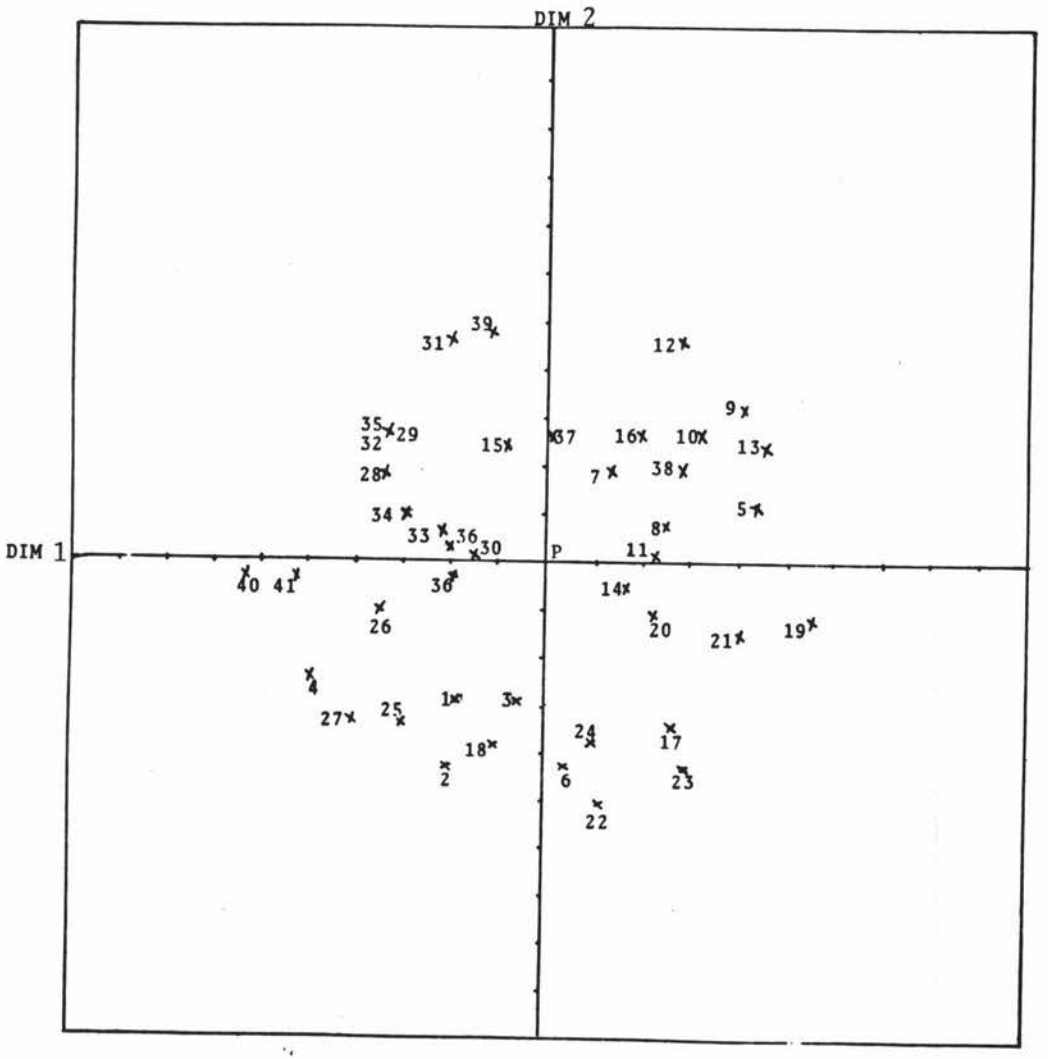

Fig 10.8 a Ideal Point Located in the 41 Meat Cut Substitutability Space by Fenker's Method.

KEY	KEY
1. Wienersnitzel	22.Pork chop
2. Rump steak	23.Pork pieces
3. Porterhouse steak	24.Leg of pork
4. Stewing steak	25.Sliced ham
5. Topside	26.Leg of ham
6. Beef mince	27.Ham steak
7. Beef tongue	28.Middle bacon
8. Beef hearts	29.Shoulder bacon
9. Beef tripe	30.Fish
10.Corned beef	31.Chicken
11.Beef sausage	32.Shellfish
12.Lamb forequarter	33.Hamburger
13.Lamb loin chop	34.Pork sausage
14.Leg of lamb	35.Luncheon
15.Lamb's fry	36.Ham'n'chicken
16.Lamb's kidney	37.Salami
17.Hogget loin chop	38.Frankfurters
18.Leg of hogget	39.Saveloy
19.Mutton forequarter	40.Black pudding
20.Mutton loin chop	41.Garlic sausage
21.Leg of mutton	

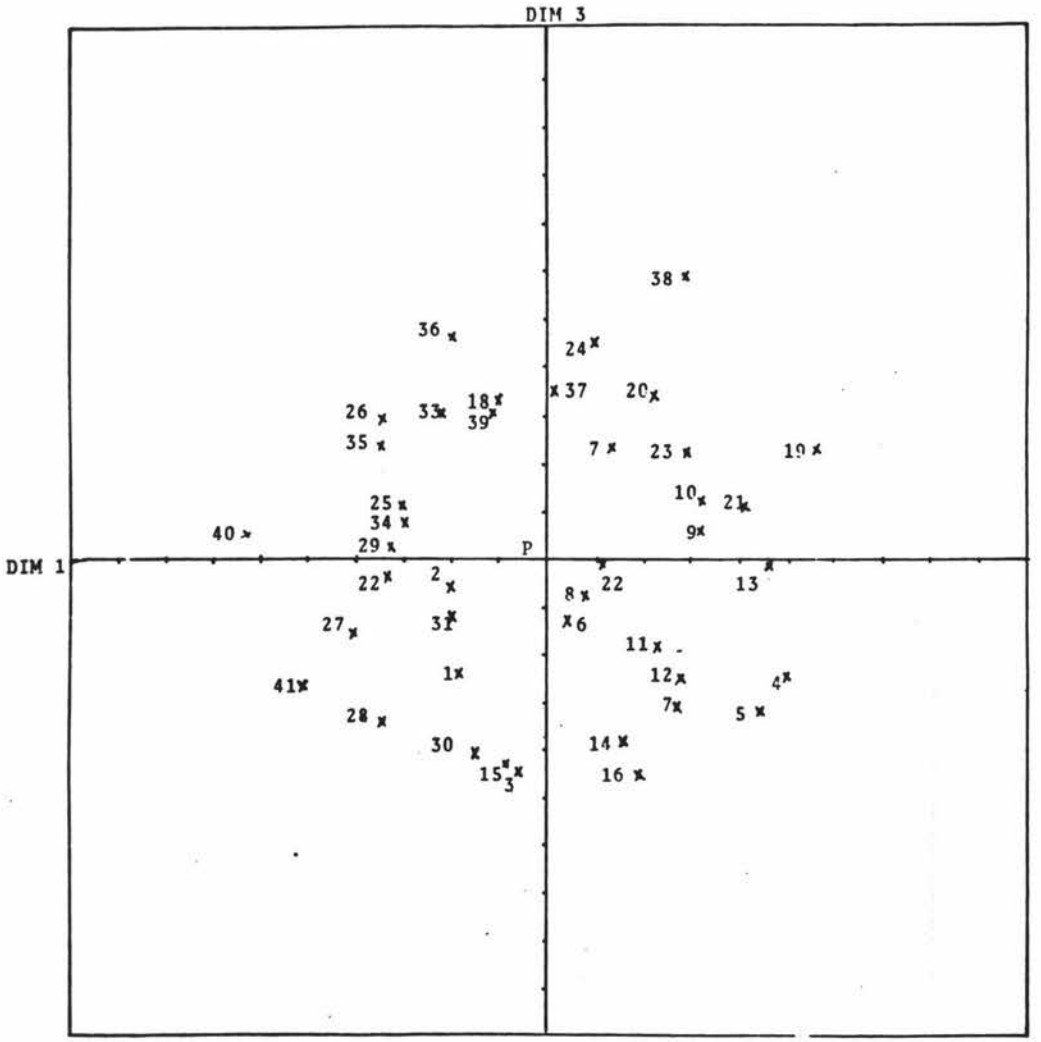

Fig. 10.8b Ideal Point Located in 41 Meat Cut Substitutability Space by Fenker's Method.

KEY

1. Wienersnitzel
2. Rump steak
3. Porterhouse steak
4. Stewing steak
5. Topside
6. Beef mince
7. Beef tongue
8. Beef hearts
9. Beef tripe
10. Corned beef
11. Beef sausage
12. Lamb forequarter
13. Lamb loin chop
14. Leg of lamb
15. Lamb's fry
16. Lamb's kidney
17. Hogget loin chop
18. Leg of hogget
19. Mutton forequarter
20. Mutton loin chop
21. Leg of mutton
22. Pork chop
23. Pork pieces
24. Leg of pork
25. Sliced ham
26. Leg of ham
27. Ham steak
28. Middle bacon
29. Shoulder bacon
30. Fish
31. Chicken
32. Shellfish
33. Hamburger
34. Pork sausage
35. Luncheon
36. Ham'n'chicken
37. Salami
38. Frankfurter
39. Saveloy
40. Black pudding
41. Garlic sausage

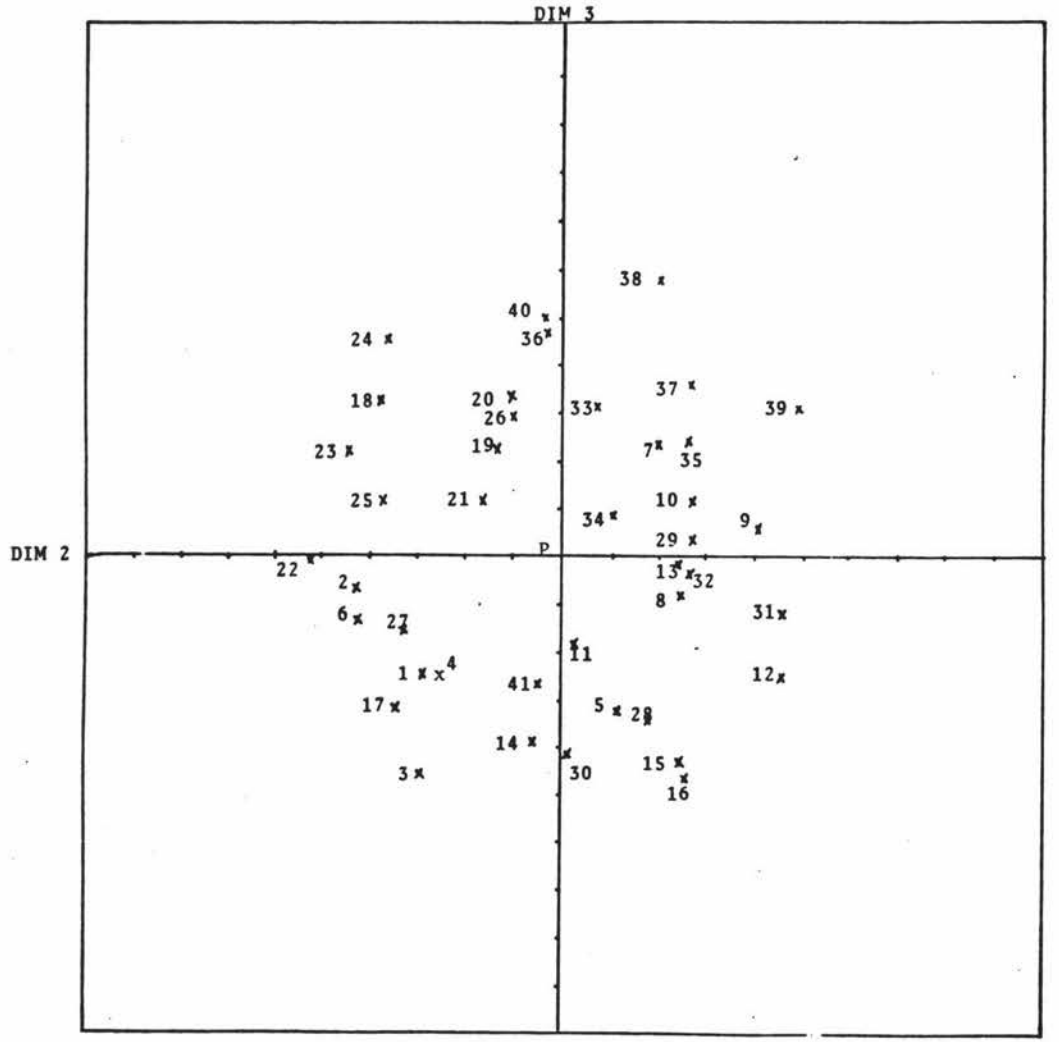

Fig.10.8c Ideal Point Located in the 41 Meat Cuts Substitutability Space by Fenker's Method.

Table 10.2 Scale Values for the 41 Meat Cuts and the Population Ideal in the 3-dimensional Space - Fenker's Method

Dimension 1		Dimension 2		Dimension	
Meat Cut	Scale Value	Meat Cut	Scale Value	Meat Cut	Scale Value
Pork chops	1.110	Saveloys	0.969	Frankfurters	1.173
Stewing steak	0.988	Leg of hogget	0.920	Ham & chicken	0.935
Lamb loin chops	0.909	Tripe	0.920	Ham steak	0.901
Topside	0.882	Corned beef	0.810	Salami	0.712
Leg of pork	0.823	Shellfish	0.541	Pork pieces	0.667
Lamb forequarter	0.642	Beef sausages	0.539	Leg of mutton	0.649
Beef sausages	0.641	Lambs' fry	0.533	Saveloys	0.620
Leg of ham	0.594	Luncheon	0.530	Kidney	0.610
Leg of hogget	0.573	Hogget loin chops	0.526	Shoulder bacon	0.587
Frankfurters	0.565	Salami	0.526	Luncheon	0.481
Mutton loin chops	0.554	Beef heart	0.504	Beef tongue	0.462
Lamb forequarter	0.462	Mutton forequarter	0.488	Pork chops	0.451
Pork pieces	0.434	Lamb loin chops	0.480	Leg of ham	0.436
Hogget loin chops	0.383	Frankfurters	0.393	Beef sausages	0.232
Leg of lamb	0.305	Beef tongue	0.391	Middle bacon	0.226
Beef tongue	0.246	Chicken	0.365	Leg of pork	0.224
Sliced ham	0.217	Topside	0.216	Pork sausages	0.161
Ham steak	0.178	Luncheon	0.203	Corned beef	0.114
Beef heart	0.155	Kidney	0.129	Black pudding	0.099
Beef mince	0.076	Lamb forequarter	0.036	Shellfish	0.045
Salami	0.013	Hamburger	0.034	IDEAL	0.000
IDEAL	0.000	IDEAL	0.000	Sliced ham	-0.006
Porterhouse steak	-0.111	Black pudding	-0.055	Lamb loin chops	-0.028
Mutton forequarter	-0.168	Ham & chicken	-0.057	Lambs' fry	-0.065
Leg of mutton	-0.196	Garlic sausage	-0.083	Rump steak	-0.134
Saveloys	-0.228	Leg of lamb	-0.096	Beef heart	-0.158
Hamburger	-0.298	Shoulder bacon	-0.203	Tripe	-0.241
Wienersnitzel	-0.366	Pork pieces	-0.222	Beef mince	-0.258
Ham & chicken	-0.397	Pork chops	-0.257	Fish	-0.305
Tripe	-0.400	Leg of pork	-0.311	Lamb forequarter	-0.373
Rump steak	-0.409	Stewing steak	-0.570	Wienersnitzel	-0.493
Kidney	-0.439	Porterhouse	-0.570	Stewing steak	-0.493
Pork sausage	-0.595	Wienersnitzel	-0.582	Leg of hogget	-0.495
Middle bacon	-0.598	Middle bacon	-0.655	Garlic sausage	-0.527
Shellfish	-0.660	Fish	-0.661	Mutton loin chops	-0.616
Lambs' fry	-0.670	Mutton loin chops	-0.683	Topside	-0.637
Chicken	-0.686	Ham steak	-0.742	Chicken	-0.692
Luncheon	-0.696	Leg of mutton	-0.757	Leg of lamb	-0.771
Shoulder bacon	-0.702	Beef mince	-0.848	Hamburger	-0.823
Fish	-0.815	Rump steak	-0.854	Mutton forequarter	-0.858
Garlic sausage	-1.053	Leg of ham	-0.884	Porterhouse	-0.899
Black pudding	-1.263	Sliced ham	-1.047	Hogget loin chops	-0.916

Pork chops and stewing steak could be found at one end of Dimension 1 and garlic sausage and black pudding at the opposite end. Correlation analysis between scale values and the 18 attitudes which will be dealt with in Chapter 14 showed that the scale values of the 41 meat cuts on Dimension 1 were negatively correlated with the following attitudes: the number of dishes; the prestige rating of the meat; the colour acceptability; the flavour strength; the juiciness of the meat and the nutritional value of the meat. The Dimension was clearly a very complex factor made up of at least 6 elements.

Saveloys and leg of hogget could be found on one end of Dimension 2 with leg of ham and sliced ham at the opposite end of the Dimension. Correlation analysis showed that the scale values of the 41 meat cuts were positively correlated with the following attitudes: colour acceptability; flavour acceptability and prestige value of the meat. Dimension 2 while not as complex as Dimension 1 still consisted of three elements.

Frankfurters and ham & chicken could be found at one end of Dimension 3 with porterhouse steak and hogget loin chops at the opposite end of the scale. Correlation analysis indicated that the only attitude variables to be correlated with Dimension 3 was the nutritional value of the meat and an R value of -0.34 indicated that it was not a strong relationship between the scale values and the attitude scores for the 41 meats.

10.5 RESPONDENTS' IDEALS LOCATED BY KRUSKAL, YOUNG AND SEERY'S METHOD IN THE 15 MEAT SUBSTITUTABILITY SPACE

The spatial configuration of the meats together with the ideals for the 82 respondents are presented in Figure 10.9 a, b and c. The location of each of the ideals is indicated by a circle on each of the figures. The letter P denotes Fenker's ideal point. The spatial configuration of the meats is identical to that presented in Figure 10.7 a, b and c. All of the 82 respondents' ideals were located around Fenker's ideal point. Most of the ideal points tended to be located between Fenker's ideal point and ham on Dimension 1 (see Table 10.1), between veal and hogget on Dimension 2 and sausages and hogget on Dimension 3.

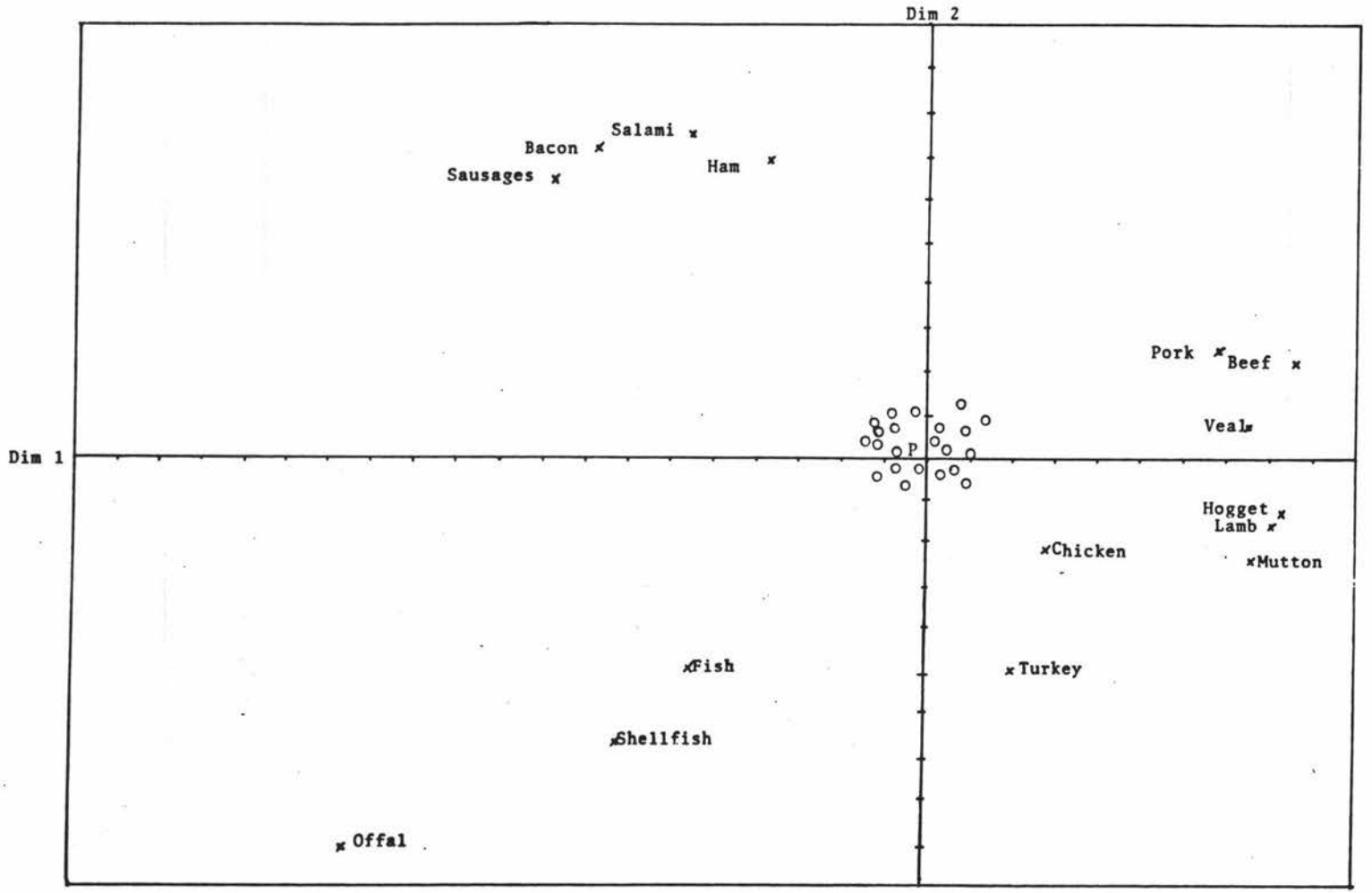

Fig 10.9a Ideal Points Located in the 15 meats Substitutability Space by Kruskal et.al's Method.

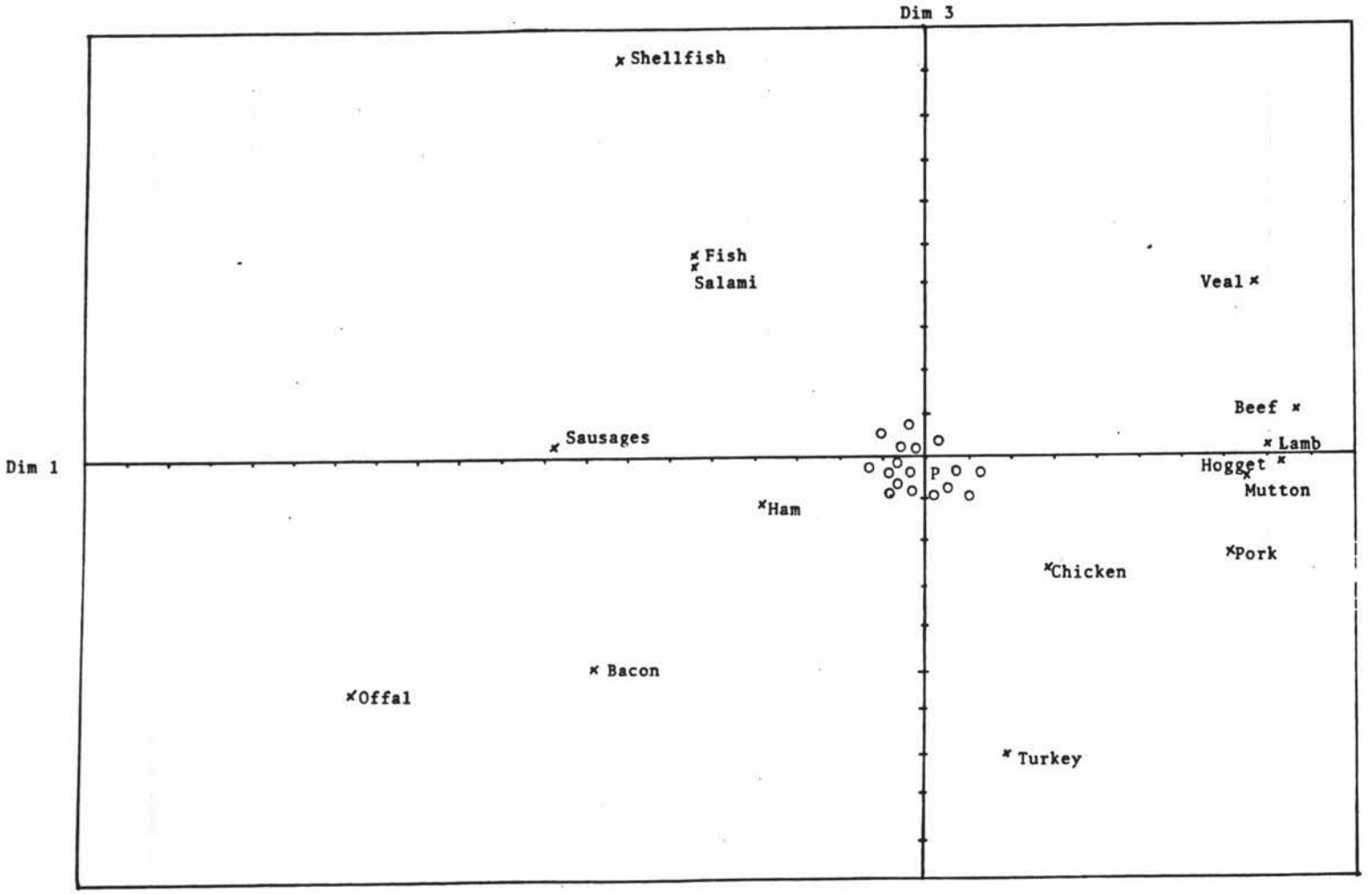

Fig.10.9b Ideal Points Located in the 15 Meats Substitutability Space by Kruskal et al.'s Method.

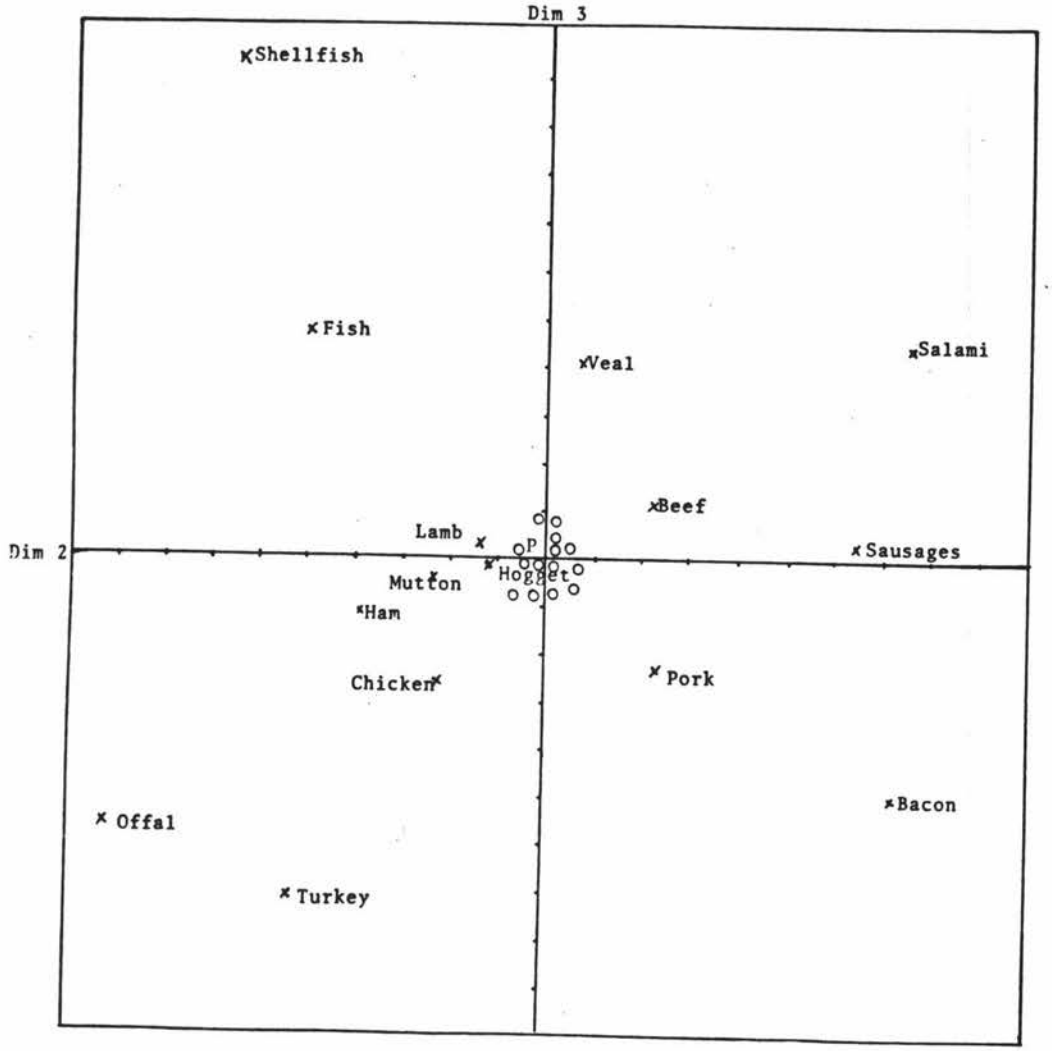

Fig. 10.9c Ideal Point Located in the 15 Meats Substitutability Space by Kruskal's Method

10.6 RESPONDENTS' IDEALS LOCATED BY KRUSKAL, YOUNG AND SEERY'S METHOD IN THE 41 MEAT CUT SUBSTITUTABILITY SPACE

The spatial configuration of the meats together with the ideals for the 82 respondents are presented in Figure 10.10 a, b and c. The locations of the ideals are indicated by circles on each of the figures. The letter P denotes Fenker's ideal point. The spatial configuration of the 41 meat cuts is identical to that presented in Figure 10.8 a, b and c. As with the 15 meat substitutabilities space, the 82 respondents' ideals were located around Fenker's ideal point.

10.7 POPULATION IDEAL POINT LOCATED BY AUTHOR'S METHOD IN THE 3-DIMENSIONAL SUBSTITUTABILITIES SPACE

The location of the population ideal point together with the more preferred ideal point, i.e. the Thurstone Case V Interval scale values for each meat increased by 20% as shown in Figure 10.11 and also in Table 10.3.

The population ideal based on the Thurstone Interval Scale scores was positioned between turkey and ham on Dimension 1, between ham and fish on Dimension 2 and between pork and beef on Dimension 3. The 'more preferred ideal' was located between turkey and chicken on Dimension 1, beyond shellfish on Dimension 2 and between pork and beef on Dimension 3.

The ideal meat showed a small change on Dimension 1 with an increase in preference values, a marked change on Dimension 2 and little or no change on Dimension 3. Dimension 3 was identified as being the most sensitive dimension to increases in the preference ratings of the meats.

Attempts to add an additional 'more preferred ideal point' with scale values greater than 20% could not be accommodated by the model as the solution attempted to fold back on itself.

Dimension 1 was identified as being a main meal/snack or ingredient dimension by the 20 respondents. It would appear from the analysis that the new meat should have properties intermediate between ham and turkey

KEY

1. Wienersnitzel
2. Rump steak
3. Porterhouse steak
4. Stewing steak
5. Topside
6. Beef mince
7. Beef tongue
8. Beef hearts
9. Beef tripe
10. Corned beef
11. Beef sausages
12. Lamb forequarter
13. Lamb loin chops
14. Leg of lamb
15. Lamb's fry
16. Lamb's kidney
17. Hogget loin chops
18. Leg of hogget
19. Mutton forequarter
20. Mutton loin chops
21. Leg of mutton
22. Pork chops
23. Pork pieces
24. Leg of pork
25. Sliced ham
26. Leg of ham
27. Ham steaks
28. Middle bacon
29. Shoulder bacon
30. Fish
31. Chicken
32. Shellfish
33. Hamburger
34. Pork sausages
35. Luncheon
36. Ham n chicken
37. Salami
38. Frankfurters
39. Saveloys
40. Black pudding
41. Garlic sausage

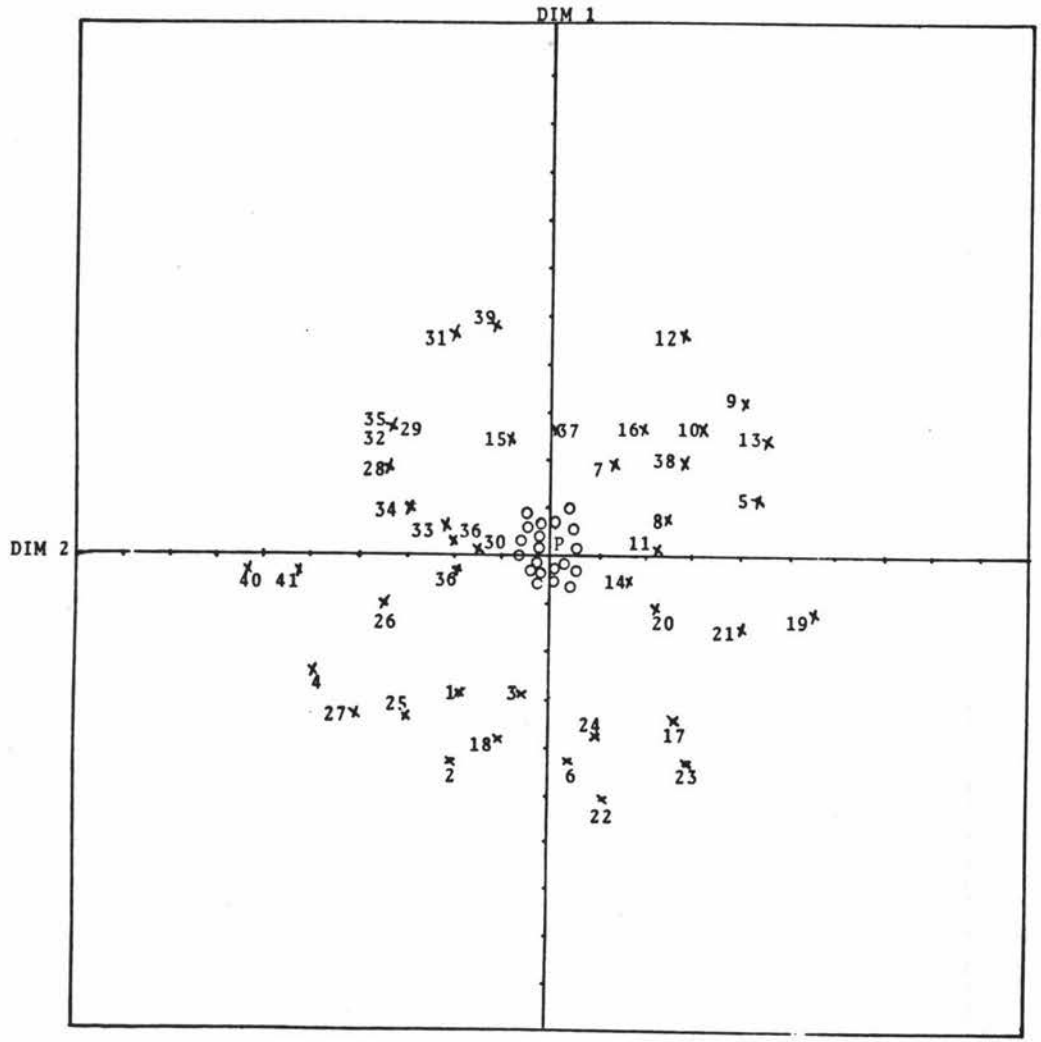

Fig.10.10a Ideal Points Located in the 41 Meat Cuts Substitutability Space by Kruskal's Method

KEY	KEY
1. Wienersnitzel	22.Pork chop
2. Rump steak	23.Pork pieces
3. Porterhouse steak	24.Leg of pork
4. Stewing steak	25.Sliced ham
5. Topside	26.Leg of ham
6. Beef mince	27.Ham steak
7. Beef tongue	28.Middle bacon
8. Beef hearts	29.Shoulder bacon
9. Beef tripe	30.Fish
10.Corned beef	31.Chicken
11.Beef sausage	32.Shellfish
12.Lamb forequarter	33.Hamburger
13.Lamb loin chop	34.Pork sausage
14.Leg of lamb	35.Luncheon
15.Lamb's fry	36.Ham'n'chicken
16.Lamb's kidney	37.Salami
17.Hogget loin chop	38.Frankfurters
18.Leg of hogget	39.Saveloy
19.Mutton forequarter	40.Black pudding
20.Mutton loin chop	41.Garlic sausage
21.Leg of mutton	

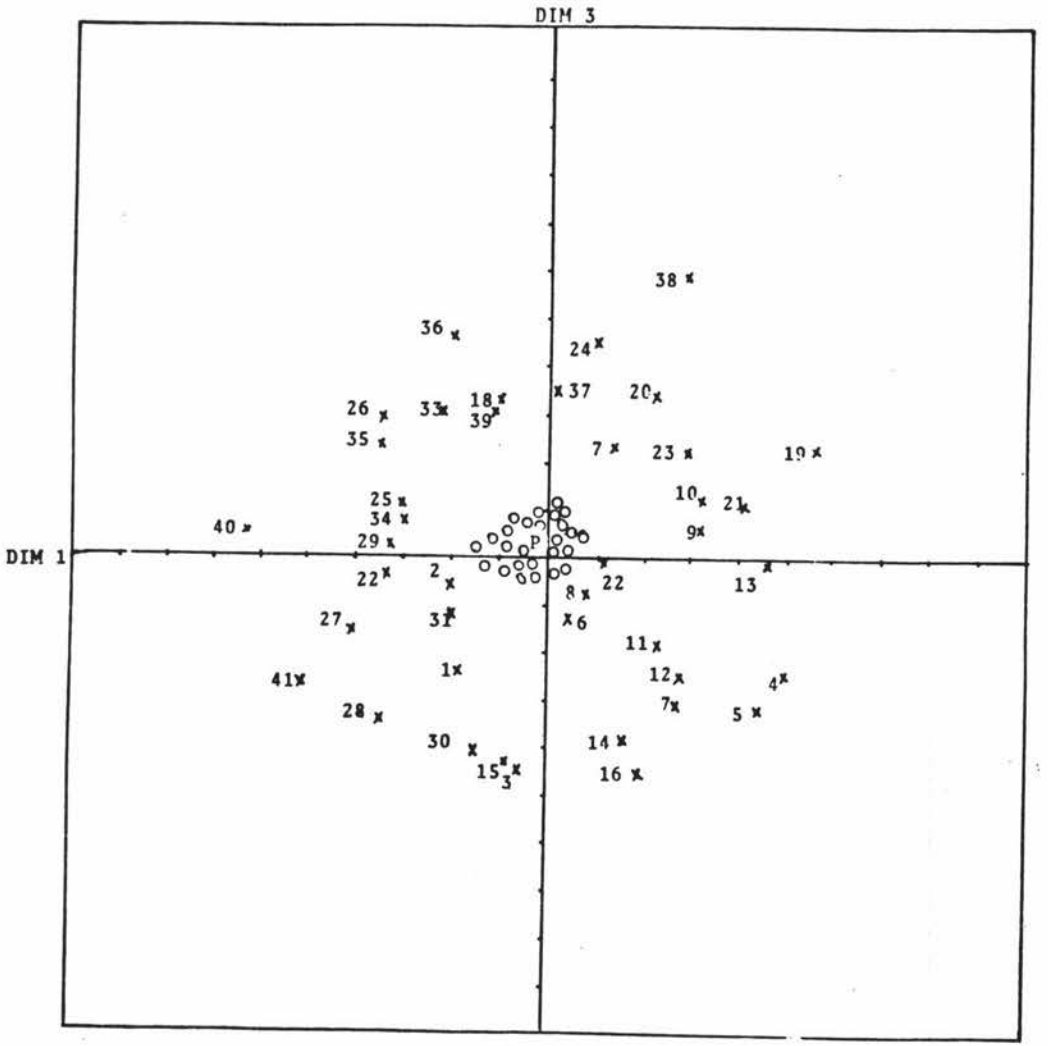

Fig 10.10b Ideal Points Located in the 41 Meat Cuts Substitutability Space by Kruskal et al's Method

KEY

1. Wienersnitzel
2. Rump steak
3. Porterhouse steak
4. Stewing steak
5. Topside
6. Beef mince
7. Beef tongue
8. Beef hearts
9. Beef tripe
10. Corned beef
11. Beef sausage
12. Lamb forequarter
13. Lamb loin chop
14. Leg of lamb
15. Lamb's fry
16. Lamb's kidney
17. Hogget loin chop
18. Leg of hogget
19. Mutton forequarter
20. Mutton loin chop
21. Leg of mutton
22. Pork chop
23. Pork pieces
24. Leg of pork
25. Sliced ham
26. Leg of ham
27. Ham steak
28. Middle bacon
29. Shoulder bacon
30. Fish
31. Chicken
32. Shellfish
33. Hamburger
34. Pork sausage
35. Luncheon
36. Ham'n'chicken
37. Salami
38. Frankfurter
39. Saveloy
40. Black pudding
41. Garlic sausage

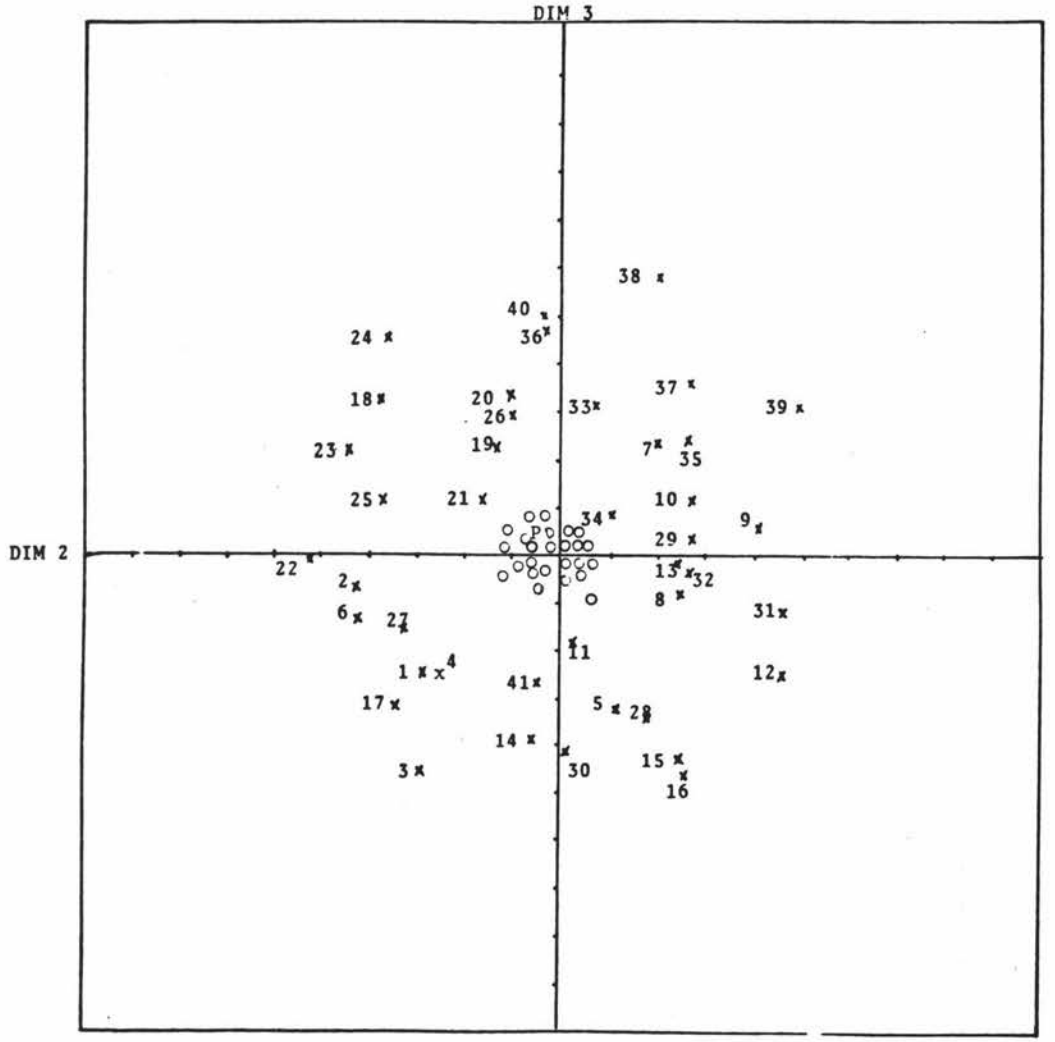

Fig. 10.10c Ideal Points Located in the 41 Meat Cut Substitutability Space by Kruskal et al.'s Method

Table 10.3 Scale Values for the 15 Meats and the Population Ideal in the 3-dimensional Space - Author's Method

DIMENSION 1		DIMENSION 2		DIMENSION 3	
Meat	Scale Value	Meat	Scale Value	Meat	Scale Value
Beef	0.913	Preferred IDEAL	0.784	Turkey	0.807
Hogget	0.812	Shellfish	0.654	Shellfish	0.723
Lamb	0.776	Bacon	0.541	Offal	0.646
Veal	0.725	Pork	0.506	Fish	0.392
Mutton	0.700	Ham	0.486	Veal	0.352
Pork	0.649	IDEAL	0.377	Chicken	0.331
Chicken	0.191	Fish	0.360	Beef	0.270
Preferred IDEAL	0.171	Chicken	0.174	Preferred IDEAL	0.113
Turkey	0.149	Beef	-0.059	IDEAL	0.060
IDEAL	0.081	Lamb	-0.074	Pork	-0.132
Ham	-0.263	Turkey	-0.156	Lamb	-0.196
Salami	-0.569	Hogget	-0.267	Mutton	-0.325
Fish	-0.596	Sausages	-0.465	Hogget	-0.404
Bacon	-0.723	Salami	-0.467	Ham	-0.511
Shellfish	-0.942	Veal	-0.536	Sausages	-0.552
Sausages	-1.005	Mutton	-0.654	Bacon	-0.680
Offal	-1.070	Offal	-1.205	Salami	-0.895

and chicken. The direction of the movement of the ideal would suggest that the new meat should be closer to chicken than to either ham or turkey.

Dimension 2 was interpreted by the 20 respondents to be a prestige scale, i.e. serve to guests or not to serve to guests - quite a different interpretation to Dimension 2 of Fenker's method. The first ideal was located between fish and ham suggesting that the new meat should have 'prestige' connotations somewhere between fish and ham. However, the positioning of the 'more preferred ideal' beyond shellfish would suggest that the 82 respondents were looking for a meat that was more prestigious than the 15 included in the survey.

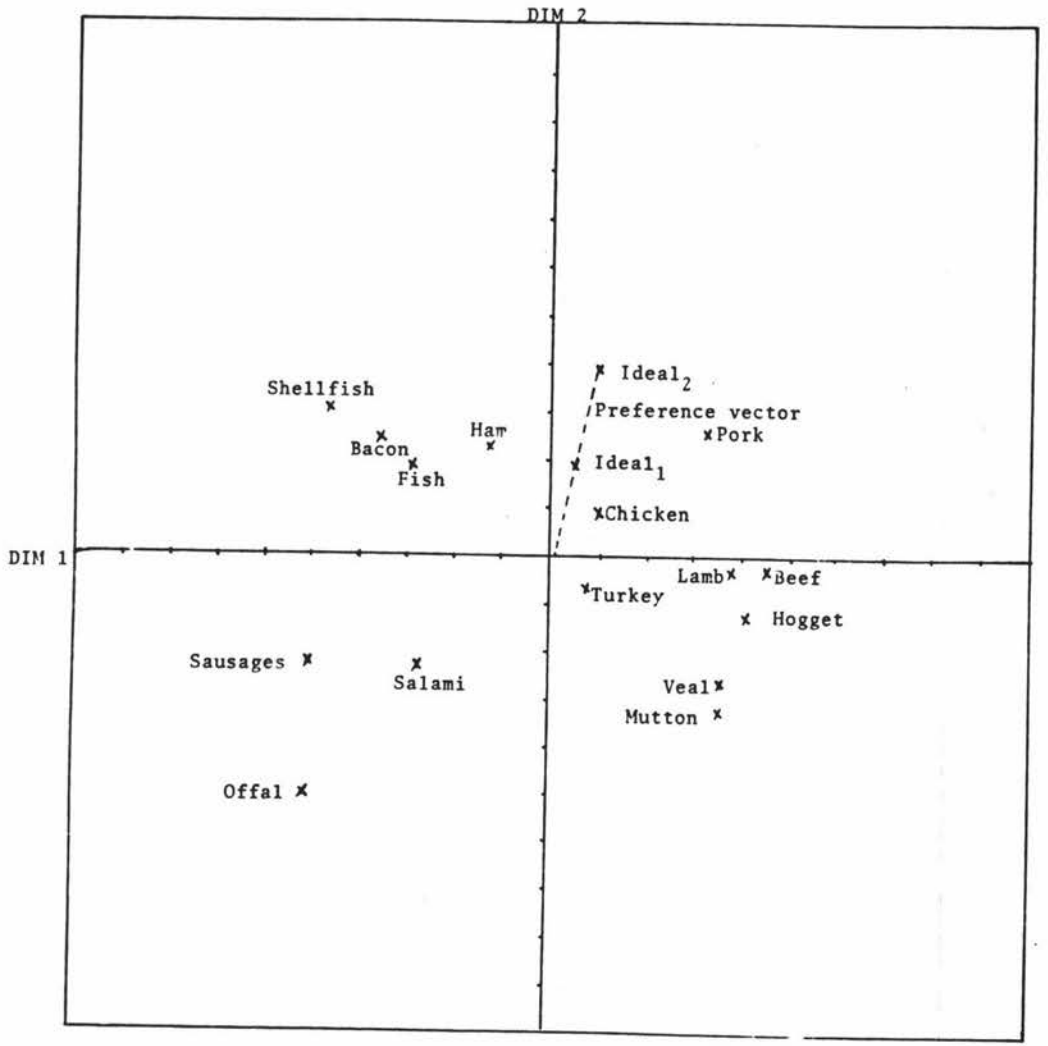

Fig 10.11 Ideal Point and Vector Located in the 15 Meats Substitutability Space by Author's Method.

Dimension 3 was interpreted by the 20 respondents to be a dual bi-polar scale, i.e. processed/non-processed, nutritious/non-nutritious. The ideal tended towards beef which was located at an intermediate position between turkey, shellfish and offal at one end and the processed meats of salami, bacon and sausages at the other end of the scale.

10.8 POPULATION IDEAL LOCATED BY AUTHOR'S METHOD IN THE 41 MEAT CUT SUBSTITUTABILITY SPACE

The location of the ideal point is shown in Table 10.4 and Figures 10.12. Unlike the 15 meat solution, the model was unable to accommodate an additional 'more preferred ideal' point.

The analysis suggested that the new meat product should have properties between that of leg of hogget and beef tongue on Dimension 1, i.e. a composite scale of the number of dishes, prestige rating, the colour acceptability, the flavour strength, the juiciness and the nutritional value of the meat. The new product should have properties between leg of lamb and leg of mutton on Dimension 2, i.e. a composite scale of colour acceptability, flavour acceptability and the prestige rating of the meat. Finally that the product should have properties between mutton forequarter and shellfish on Dimension 3, i.e. the nutritional content of the meat.

10.9 DISCUSSION

10.9.1 Comparison of the 3 Methods for Locating Ideals in the 15 Meat Substitutabilities Space

Fenker's (1972) method and Kruskal *et al.*'s (1972) method produced almost identical solutions for the location of the ideal point in the 15 meat substitutabilities space. Whilst Kruskal *et al.*'s method produce 82 separate ideal points all the ideal points were located around the position of Fenker's ideal point and little was to be gained from the use of Kruskal *et al.*'s method.

The two solutions suggested that the new meat should have properties between ham and turkey on the 'main meal/snack' dimension which represents an intermediate value between beef on one end of the scale and sausages and offal at the other end. Moreover, the two solutions suggested that the new meat should have properties between hogget and veal on the 'processed/non-processed, nutritious/non-nutritious' dimension midway between salami at one end and offal at the opposite end. Finally the two methods suggested that the new product should have properties between hogget and sausages on Dimension 3.

Table 10.4 Scale Values for the 41 Meat Cuts and the Population Ideal in the 3-dimensional Space - Author's Method

DIMENSION 1		DIMENSION 2		DIMENSION 3	
Meat Cut	Scale Value	Meat Cut	Scale Value	Meat Cut	Scale Value
Mutton forequarter	1.150	Saveloys	1.053	Lambs' kidney	0.951
Stewing steak	1.106	Lamb forequarter	0.956	Middle bacon	0.848
Leg of mutton	0.955	Tripe	0.871	Hogget loin chops	0.784
Lamb loin chops	0.772	Beef heart	0.812	Topside	0.782
Pork pieces	0.731	Frankfurters	0.789	Lambs' fry	0.782
Topside	0.705	Chicken	0.738	Leg of lamb	0.776
Corned beef	0.713	Salami	0.697	Sliced ham	0.733
Hogget loin chops	0.689	Lamb loin chops	0.654	Porterhouse	0.684
Beef mince	0.558	Lambs' fry	0.562	Fish	0.650
Tripe	0.502	Corned beef	0.527	Black pudding	0.648
Pork chops	0.453	Lambs' kidney	0.507	Lamb forequarter	0.464
Lamb forequarter	0.424	Fish	0.415	Ham steak	0.397
Beef sausage	0.378	Beef sausage	0.355	Stewing steak	0.328
Mutton loin chops	0.351	Shoulder bacon	0.324	Pork chops	0.219
Frankfurters	0.342	Beef tongue	0.304	Lamb loin chops	0.155
Lambs' kidney	0.300	Luncheon	0.236	Garlic sausage	0.151
Leg of lamb	0.231	Stewing steak	0.204	Shoulder bacon	0.121
Porterhouse	0.221	Middle bacon	0.124	Rump steak	0.071
Leg of pork	0.175	Shellfish	0.086	Beef sausage	0.065
Leg of hogget	0.164	Hamburger	0.059	Saveloys	0.028
IDEAL	0.144	Topside	0.014	Mutton forequarter	0.011
Tongue	-0.033	Pork sausage	0.014	IDEAL	0.000
Beef heart	-0.061	Mutton loin chops	-0.011	Shellfish	-0.022
Wienersnitzel	-0.063	Leg of lamb	-0.016	Chicken	-0.068
Lambs' fry	-0.139	IDEAL	-0.079	Beef heart	-0.083
Sliced ham	-0.263	Leg of mutton	-0.121	Wienersnitzel	-0.111
Salami	-0.308	Black pudding	-0.277	Tripe	-0.266
Rump steak	-0.313	Beef mince	-0.281	Leg of mutton	-0.298
Pork sausages	-0.448	Ham & chicken	-0.326	Corned beef	-0.309
Fish	-0.484	Mutton forequarter	-0.385	Pork pieces	-0.346
Ham steaks	-0.501	Hogget loin chops	-0.483	Hamburger	-0.359
Saveloys	-0.519	Garlic sausage	-0.535	Leg of pork	-0.423
Ham & chicken	-0.577	Sliced ham	-0.547	Salami	-0.502
Luncheon	-0.597	Leg of ham	-0.569	Leg of hogget	-0.556
Middle bacon	-0.614	Leg of pork	-0.695	Pork sausages	-0.576
Mutton loin chops	-0.618	Porterhouse	-0.739	Beef mince	-0.658
Chicken	-0.756	Leg of hogget	-0.786	Beef tongue	-0.659
Hamburger	-0.785	Ham steak	-0.864	Ham & chicken	-0.796
Shellfish	-0.848	Pork pieces	-0.867	Luncheon	-0.801
Shoulder bacon	-0.850	Wienersnitzel	-0.838	Mutton loin chops	-0.883
Garlic sausage	-1.039	Rump steak	-0.938	Leg of pork	-0.955
Black pudding	-1.047	Pork chops	-0.945	Frankfurters	-0.982

KEY

1. Wienersnitzel
2. Rump steak
3. Porterhouse steak
4. Stewing steak
5. Topside
6. Beef mince
7. Beef tongue
8. Beef hearts
9. Beef tripe
10. Corned beef
11. Beef sausages
12. Lamb forequarter
13. Lamb loin chops
14. Leg of lamb
15. Lamb's fry
16. Lamb's kidney
17. Hogget loin chops
18. Leg of hogget
19. Mutton forequarter
20. Mutton loin chops
21. Leg of mutton
22. Pork chops
23. Pork pieces
24. Leg of pork
25. Sliced ham
26. Leg of ham
27. Ham steaks
28. Middle bacon
29. Shoulder bacon
30. Fish
31. Chicken
32. Shellfish
33. Hamburger
34. Pork sausages
35. Luncheon
36. Ham n chicken
37. Salami
38. Frankfurters
39. Saveloys
40. Black pudding
41. Garlic sausage
42. IDEAL

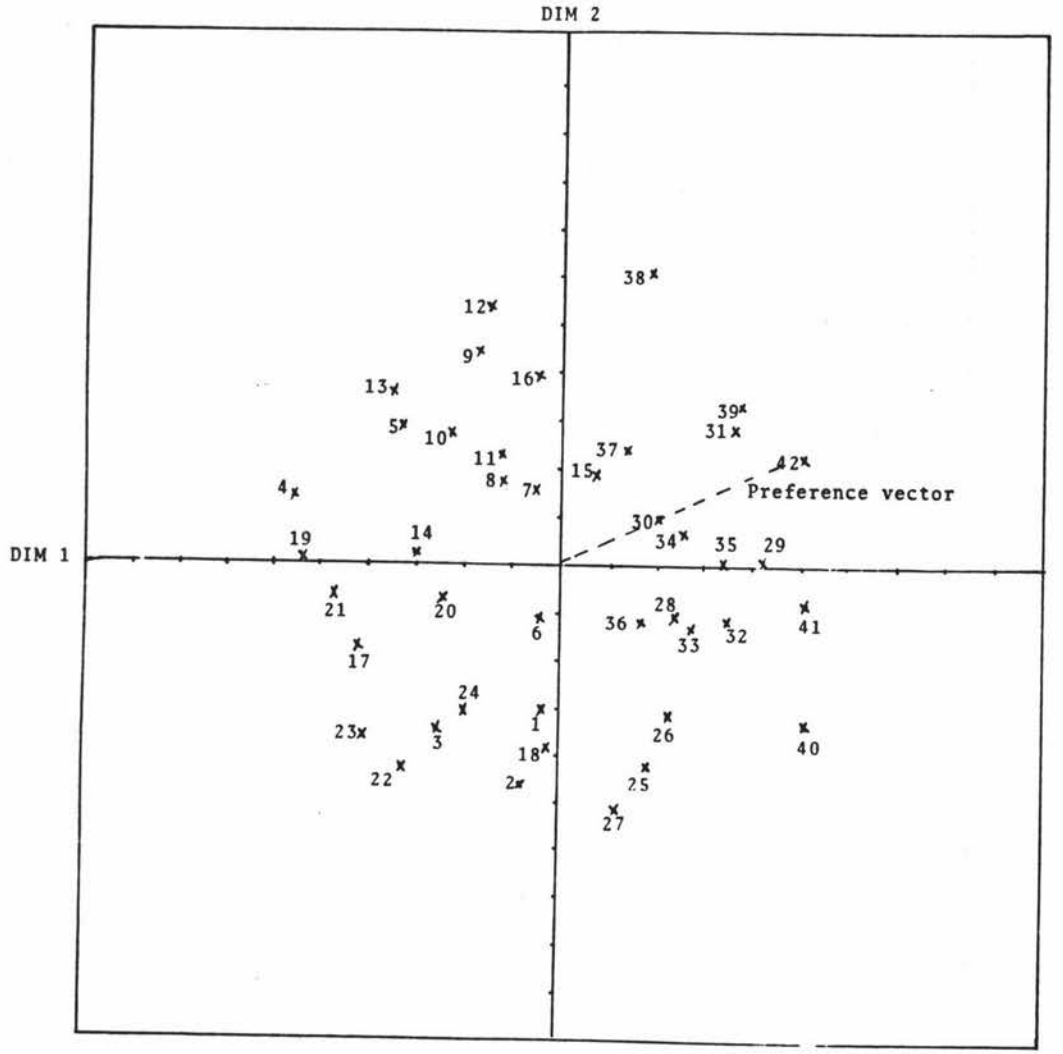

Fig. 10.12 Ideal Point and Vector Located in the 41 Meat Cuts Substitutability Space (Author's)

Fenker's and Kruskal et al.'s methods resulted in different solutions to the author's method. Dimensions 1 and 3 were very similar for the three methods in their arrangement of the 15 meats along the two dimensions. However, the arrangement of the 15 meats along Dimension 2 was quite different for the author's method compared to Fenker's and Kruskal et al.'s method. This was confirmed by the different interpretations put on Dimension 2 by the 20 respondents for the 3 solutions. They interpreted Dimension 2 as being a prestige dimension for the author's method and as a processed/non-processed, nutritious/non-nutritious dimension for the other two methods.

The rearrangement of the order of the meats on Dimensions 1 and 3 of the author's solution compared to the identical solutions provided by Fenker's and Kruskal et al.'s methods could be expected for two reasons. Firstly, Fenker's and Kruskal et al.'s methods constrained the spatial arrangement of the meats because of the control statements and input of the 3-dimensional coordinates for each meat. Whereas, with the author's method, the spatial arrangement of the meats was not constrained so that the preference scale values for each meat were able to influence the spatial arrangement of the meats in the substitutabilities space. The second reason for the expected rearrangement of the meats could be attributed in part to the fact that the configuration was not constrained with the author's method and in part to the fact that some meats on both Dimensions 1 and 3 of the Fenker's solution for the 15 meats had very similar scale values, for example, pork/shellfish and fish/salami with scale values of -0.714, -0.713; -0.552 and -0.548 respectively on Dimension 1 (see Table 10.1). These meats with very similar scale values could be expected to reverse their positions when the restrictions of the model were relaxed to enable some additional factors such as the preferences to affect the spatial arrangement of the meats as with the author's method.

Dimension 2 resulting from the author's ideal point method was quite different to the solution obtained from either Fenker's or Kruskal et al.'s methods. In the case of the 15 meats, Dimension 2 appeared to be the most susceptible dimension to changes in the Thurstone Case V Interval Scale values.

The above analysis showed that the model was constrained by the largest data entry in the half matrix of substitutability values, i.e. any attempt to increase any one of the Thurstone Case V Interval scale values above this value resulted in a model that tried to fold back on itself. In the case of the 15 meats increasing the scale values for the chicken, i.e. the most preferred meat to 20% more than the scale value for chicken represented the outer limit of the model. The question then became "What would happen if the Thurstone Case V Interval Scale values were progressively made smaller by decreasing the scale value for chicken and thereby decreasing the distance between each of the 15 meats?" The aim being to make the Thurstone Case V Interval Scale values approach zero to study what effect this would have on the position of the population ideal point. Subsequent analysis showed that as the Thurstone Case V Interval Scale values approach zero so the 'population ideal' as determined by the author's method approached Fenker's ideal point, though never quite reaching it. Moreover, the spatial positions of the meats also tended to the positions occupied by the 15 meats in Fenker's solution for the 15 meats.

The method appeared to provide a vector of fixed length along which 'more highly preferred' meats could be found. The model appeared to be a mixed vector and ideal point model, i.e. points along the vector existed for each set of Thurstone Case V Interval Scale values. Fenker's method of locating the ideal proved to be completely insensitive to any changes in the relative values of the Thurstone Case V Interval Scale. The Thurstone Case V Interval Scale values ranged from 3.45 for chicken to -4.88 for offal. If the values were all multiplied by 10 so that the scale value for chicken became 34.5 and for offal became -48.8 with similar transformations for the remaining 13 meats then Fenker's ideal point could still be found at the same position that it had occupied when the values were 10 times less, i.e. 3.45 to -4.88. Even if zeros were placed in each column of the preference row (i.e. the 16th row) the Fenker ideal point was still located at the position shown in Table 10.1.

Comments about the sensitivity or otherwise of Kruskal et al.'s method to changes in the relative values in the Thurstone Case V Interval Scale cannot be provided as it was not examined in the present study.

The author's method proved to be quite sensitive to changes in the Thurstone Case V Interval Scale. If the Thurstone values exceeded the largest substitutability entry then the model collapsed. However, by successively changing the relative size of the interval scale values between each of the meats in the 16th row and hence the ratio between the substitutability values and the Thurstone Case V Interval Scale values then it was possible to move the ideal point from the extremities of the configuration almost to the intersection of the axes, i.e. to construct an 'ideal point vector' for the 15 meats. This showed that the author's method offered the researcher a method of identifying the Dimension most susceptible to changes in the relative sizes of the Thurstone Case V Interval Scale values, i.e. the Thurstone Case V Interval Scale values are either made progressively larger or smaller compared to the fixed substitutability scale values. The method provides an indication to the researcher of what dimension should be concentrated on to improve the preference rating of the new product. Fenker's method cannot supply this information as the model was invariant to changes in the preferences for the 15 meats.

With the substitutabilities space, Dimension 2 proved to be the most sensitive to changes in the Thurstone Case V Interval Scale values, i.e. the prestige dimension. The results from the analysis suggest that all the meats should become more preferred if their prestige ratings were improved.

10.9.2 Comparison of the 3 Methods for Locating Ideals in the 41 Meat Cut Substitutabilities Space

Fenker's (1972) method and Kruskal *et al.*'s method (1972) for locating the ideal point(s) resulted in identical solutions for the 41 meat cut substitutabilities space. However, unlike the 15 meat cut space the author's method for locating the ideals in the 41 meat cut space resulted in quite different ideals compared to the other two methods. For instance, on Dimension 1 the author's method located the ideal between leg of hogget and tongue, whereas Fenker's method located the ideal between salami and porterhouse steak. On Dimension 2, the author's method located the ideal between leg of lamb and leg of mutton; whereas Fenker's located the ideal between hamburger and black pudding. Similarly with Dimension 3, Fenker's method located the ideal between

shellfish and sliced ham whereas the author's method located the ideal between mutton forequarter and shellfish.

As with the 15 meat substitutabilities space, the author's method affected one of the dimensions of the 41 meat cut substitutabilities space, in this case Dimension 3. Dimension 3 obtained by the author's method was quite different to the same dimension obtained using the other two methods (see Tables 10.2 and 10.4).

The positions of the meats in the 41 meat cut substitutability space showed a greater tendency to move than was the case in the 15 meat substitutabilities space when analysed by the author's method. The meats did not simply reverse positions as was the case in the 15 meats space, but actually moved to opposite ends of the scale. For example, tripe had a scale value on Dimension 1 of -0.400 with Fenker's method and 0.502 with the author's method. Fish had a scale value of -0.661 on Dimension 1 of Fenker's method and 0.415 with the author's method.

With the 41 meat cut substitutabilities space, although the position of the ideal could be affected by the Thurstone Case V Interval Scale preference values, it could not be moved to the same extent was was shown with the 15 meat substitutabilities space. This is not altogether surprising given the fact that the added row of preference values accounted for 6.7% of the data in the 15 meat space and 2.4% of the data in the 41 meat cut substitutabilities space, i.e. the additional rows in the 41 meat cut substitutability space tended to exert a greater degree of constraint on the position of the ideal than was the case in the 15 meat space.

As with the 15 meat space, the position of the ideal in the 41 meat cut space tended towards the ideal point located by Fenker's method as the interval scale distance between the meats on the Thurstone Case V Interval Scale was reduced, i.e. tended towards zero.

In the case of the 15 meats' solution the vector of preference was shown to extend from the point of intersection of the axes to the extremities of the model. However, in the case of the 41 meat cut substitutabilities space this was not the case. The 'vector' of preference was constrained well within the model, i.e. a point model of preference

appeared to be more appropriate for the 41 meat cut space than for the 15 meat space.

10.10 CONCLUSIONS

10.10.1 Methods of Locating Ideals

A comparison of the three different methods of locating new meat product opportunities indicated that two of the methods, Fenker's (1972) and Kruskal et al.'s (1972), produced almost identical solutions. The third method produced a similar solution to the above-mentioned methods on only 2 or the 3 dimensions for both the 15 meat and 41 meat cut substitutability spaces. This was due to the fact that the 3-dimensional configuration of the meats was unconstrained with the third method, unlike the other two methods.

Unlike Fenker's method the third method appeared to offer the researcher the opportunity of defining the dimension most sensitive to changes in preference, which is important in any new product development studies as the researcher needs to know what changes should be made to an existing product and what attributes should be built into the new product to improve their consumer preference.

Moreover, the third method appears to offer the researcher the opportunity of establishing whether the vector or the ideal point preference model would be the most appropriate for the analysis.

With the present study the population ideal was determined for the 15 meats and the 41 meat cuts. Future studies should investigate the application of the author's method to the study of individual respondent's ideals.

10.10.2 New Meat Product Opportunities

The Fenker and the Kruskal et al. methods indicated that a new meat should have main meal/snack attributes between ham and turkey; nutritional attributes between veal and hogget and unidentified attributes between hogget and sausages.

The third method of locating the ideal product in the 15 meat space suggested that the new meat should have main meal/snack attributes approaching chicken, nutritional attributes between pork and beef and a prestige rating above the 15 meats included in the present study.

With the 41 meat cut space the Fenker and the Kruskal et al.'s methods located the same new meat cut opportunity, indicating that it should have nutritional attributes between sliced ham and shellfish; colour acceptability and prestige attributes between black pudding and hamburger; and finally versatility, prestige, colour acceptability, flavour strength, juiciness and nutritional attributes between porterhouse steak and salami.

The third method of locating a new product opportunity in the 41 meat cut space suggested that the new meat product should have nutritional attributes between mutton forequarter and shellfish; colour acceptability, flavour acceptability and prestige attributes between leg of lamb and leg of mutton, and finally the versatility, prestige, colour acceptability, flavour strength, juiciness and nutritional attributes between beef tongue and leg of hogget.

PART 4

THE USE OF FACTOR ANALYSIS TO EVALUATE CONSUMER ATTITUDES TO MEAT PRODUCTS

One of the major advantages of Multidimensional Scaling is that the procedure to the point of producing the n-dimensional configurations is independent of the bias of the researcher. The technique enables consumers to make similarity, dissimilarity and preference assessments by whatever criteria they consider to be relevant to the occasion with minimal influence from the researcher. Consumers are able to make both conscious and unconscious assessments and MDS is able to extract the relevant information irrespective of the level of consciousness used by the consumer. The main disadvantage of MDS, and this is the irony, is that it produces a set of configurations without any definite labels to the axes and the configurations must be interpreted by the researcher and so ultimately the researcher does bias the technique because the interpretation of the MDS output is determined by the researcher's experience and knowledge of the subject area under investigation, unless the original respondents are asked to interpret the resulting dimensions. In which case the major criticism of researcher bias is overcome. From a product development perspective, there are no guarantees that MDS will extract those variables that are relevant to new product development, specifically formulation. As King (1973) pointed out, a product consists of both tangible and intangible attributes and if these intangible attributes figure more prominently in the consumers' minds, whilst they are making their similarity assessments, then MDS will naturally enough extract these variables. These intangible variables are more likely to be important in new product design, packaging, product use and promotional material design than to new product formulation.

Because the quality, content and relevance of the information from the MDS questionnaires would not be known until the completion of the analysis, it was decided that additional information specific to new meat product development would be obtained from the respondents. A section was included in the first questionnaire to obtain the attitudes of the respondents towards the 45 meats for which they had supplied consumption data. The first objective was to establish the variables

which were thought to be important by the respondents for all the meats, the various meat sub-groups and finally individual cuts.

Chapter 11 describes the Factor analysis of consumer attitudes to sensory, cooking and other characteristics of meats in general. It compares the use of different rotational procedures in the principal factoring with iterations method. After selecting the most useful method for Factor analysis, it compares the Factors for meat in general, beef, sheep meat, pig meat and offal.

In Chapter 12, the attitude data for each of the 45 meat cuts was analysed by Factor analysis. also the Q-Factor analysis method was used to group the meat cuts according to the consumers' overall attitudes and also according to the attitude groups of the three Factors identified in Chapter 11.

Finally in Chapter 13, the attitudes towards meat cuts of low, medium and high consumers and of different socio-economic groups were compared.

Only the 1979 data was used in Chapters 11, 12 and 13.

CHAPTER 11

FACTOR ANALYSIS OF CONSUMER ATTITUDES TO SENSORY, COOKING AND OTHER CHARACTERISTICS OF MEATS IN GENERAL

Ninety-two consumers in 1979 in Palmerston North indicated how they regarded eighteen characteristics of forty-five meat products including serving properties such as colour, flavour, texture; nutritional value; cooking properties such as cooking time, number of dishes; value properties such as wastage, expense. The strength of their attitudes was measured on semantic differential scales. The mean scores were analysed by four Factor analysis methods: Varimax rotation of factors, Equimax rotation of factors, Oblique rotation of factors and Quartimax rotation of factors. Factors were determined for meats in general, beef cuts, sheep meats, pig meats and offal cuts.

11.1 INTRODUCTION

People have certain conceptions about the products that they consume or use. These conceptions or attitudes to a whole range of products are based on past experience, individual family contributions, 'expert' influences, friends, hearsay, the media and any other influences that are likely to shape people's attitudes or conceptions to products. People can have both favourable and unfavourable opinions about different aspects of a product. The opinions can be wrong and these misconceptions can arise as a result of a whole host of reasons such as the person's ability to deal with the facts, lack of interest in the area, incorrect 'expert' advice. However, the opinions, conceptions, i.e. attitudes, that people have about products are likely to affect their purchasing behaviour. If they have a positive, favourable attitude toward a product then they are more likely to purchase it, and conversely a negative, unfavourable attitude will result in some alternative being purchased. Attitudes can then be defined as a predisposition to behave in particular ways.

It is obviously important to obtain both the positive and negative attitudes of consumers towards as many meat cuts as possible to determine or establish new product development strategies, educational strategies, promotional strategies and product improvement

strategies and indeed the overall merchandising strategies that are needed to overcome the negative attitudes of consumers towards the meat cuts and to reinforce their positive attitudes and hence increase consumer satisfaction with regard to meat consumption.

11.1.1 Scales for Attitude Measurement

Heise (1970) claims that for attitudes to be fully defined, they must include the three dimensions of evaluation, potency and activity. These dimensions can be described by adjective pairs. 'Evaluation' is measured by adjectives referring to the 'good-bad' qualities; 'potency' by 'strong-weak' qualities; and activity by 'active-passive' qualities.

Whilst there are a number of ways of measuring component opinions about a number of products such as the Likert Scale, paired comparison with Thurstone Case V Interval Scale, rankings, the method used by most meat consumer researchers has been the semantic differential (Weidenhamer *et al.*, 1969; Baron *et al.*, 1973; McFadyen *et al.*, 1973; Wilkinson, 1975; Hughes, 1976b; Baron *et al.*, 1981). The semantic differential consists of a set of bi-polar scales of approving description traditionally separated by a set of boxes, as illustrated below.

Unacceptable flavour	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	Acceptable flavour

Respondents are asked to rate each product over a number of scales. The scales are supposed to include the relevant dimensions that are considered to be important in determining either purchasing behaviour or preference or acceptability. The respondent rates the product by placing a tick in the box that corresponds to the strength of the person's agreement with one of the statements in the pair. Neutral feelings are expressed by placing a tick in the central box.

The main reasons for using the semantic differential are: time, ease of analysis, the production of detailed product profiles and most importantly, consumers find the technique easy to understand and use.

The attitude scales used by McFadyen *et al.* (1973) in their Canadian study are presented in Table 11.1 whilst the scales used by Baron *et al.* (1981), which represented a composite of scales used by Baron *et al.*

(1973), Hughes (1976b) and other workers is presented in Table 11.2. A comparison of the Tables shows that the Baron *et al.* (1981) study included most of the attitudes used by McFadyen *et al.* and additional ones which were found to be important in meat consumption.

Table 11.1. Attitude Scales Used by McFadyen et al., (1973).

Bi-Polar Scales

Evaluation Factors	
You wouldn't likely buy	You would likely buy
Expensive meat	Inexpensive meat
Less tender meat	Very tender meat
Fatty	Lean
Contain much waste such as bone and excess fat	Contain little waste
Not satisfactorily packaged in supermarkets	Meats whose packaging in supermarkets is good
Potency Factors	
Meats of low food value	Nutritious meats (high food value)
Wouldn't serve to guests (if all meats cost the same)	Would serve to special guests (if all meats cost the same)
More suitable for lunch or breakfast than for a main meal	More suitable for a main meal
Activity Factors	
Requires long cooking or preparation	Can be quickly prepared (could use when short of time)
Not versatile (limited number of ways to cook)	Versatile (can be cooked many different ways)
Used more often in summer (picnic, camping, barbecuing)	Used more often in winter

Table 11.2 Attitude Scales used by Baron et al. (1981).

Bi-Polar Scales

1	Poor value for money	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	Good value for money
2	Has a lot of wasteful fat	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	Has little wasteful fat
3	Poor taste	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	Good taste
4	A troublesome meat to prepare	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	An easy meat to prepare
5	Men dislike it	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	Men like it
6	Low in vitamins	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	High in vitamins
7	Not especially nourishing	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	Especially nourishing
8	Would not serve to visitors	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	Would serve to visitors
9	A tough meat	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	A tender meat
10	Few ways of serving	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	Many ways of serving
11	Not very digestible	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	Digestible
12	Disliked by children	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	Liked by children
13	Awkward to cut or carve	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	Easy to cut or carve
14	Does not make a substantial meal	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	Makes a substantial meal
15	An expensive meat	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	Not an expensive meat
16	Poor as a cold meat	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	Good as a cold meat
17	Low in proteins	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	High in proteins

11.1.2 Types of Meat Studied

Baron *et al*. (1973) studied the attitudes of respondents towards pork, beef, lamb and chicken. Hughes (1976b) obtained respondents' attitudes to six cuts of meat namely: leg of lamb; topside of beef; stewing steak; leg of pork; pork chops and lamb chops. The study by Baron *et al*. (1981) used the following meats: leg of lamb; beef burgers (bought);

topside; pork chops; grilling steak; mince; tinned corned beef; lamb chops; stewing steak; leg of pork; bacon joint; whole chicken.

The study by McFadyen et al. obtained people's attitudes towards 17 cuts of meat and with the exception of this study and one carried out by Wilkinson (1975), the number of meats for which attitudes have been obtained has been limited.

The attitudes to meats can be combined to give an attitude to meat in general or the attitudes can be analysed in species groups.

McFadyen et al. (1973) in their study found that the significance of the attitude variables changed with various meat groups; Wilkinson (1975) with a very limited pilot study observed similar results to McFadyen et al (1973). Hughes (1976b) found that the attitude content of factors changed depending on whether he was analysing attitude data relating to mid-week cuts as opposed to cuts used mainly on week-ends.

11.1.3 Methods of Factor Analysis

Factor analysis can be used to reduce a complex set of data to a comprehensible size. If the data contains any underlying patterns then the technique will extract these as a smaller set called 'factors'. Since the Factors are based on interrelationships within the larger data set, it can be argued that they provide an alternative and briefer description of respondents' beliefs. (Baron et al., 1981).

There are a number of factoring methods; however, the two most widely used factoring methods are "principal-component analysis" and "principal factoring with iteration" or PA2 (Gorsuch, 1983). With both of the above methods, the factors are extracted from the correlation matrix. With principal-component analysis, the correlation matrix has unities in the diagonal, whilst principal factor analysis uses communality estimates in the diagonal and the factors extracted with this method are often called 'inferred' factors. In spite of the mathematical differences, the two methods usually extract the same variables in the same Factors (Gorsuch, 1983).

Principal component analysis is the extraction of principal factors under the component model. The principal-component factor method is

applied to the correlation matrix with unities as diagonal elements. The factors then give the best least squares fit to the entire correlation matrix, and each succeeding factor accounts for the maximum amount of the total correlation matrix obtainable. Because the main diagonal is unaltered, the procedure attempts to account for all the variance of each variable and it is thus assumed that all the variance is relevant, and component factors result.

With PA2 factoring with iteration, the unities of the main diagonal of the correlation matrix are first replaced with communality estimates. Initial estimates of the communalities are given by the squared multiple correlation between a given variable and the rest of the variables in the matrix i.e. the R^2 estimates. These estimates are then improved by an iterative procedure.

The SPSS PA2 procedure initially determines the number of factors to be extracted from the original, or unreduced, correlation matrix. The programme then replaces the main diagonal elements of the correlation matrix with initial estimates of the communalities, the R^2 estimates. Next, it extracts the same number of factors from this reduced matrix, and the variances accounted for by these factors become the new communality estimates. The diagonal elements are then replaced with these new communalities. This process continues until the differences between two successive communality estimates are negligible.

As was stated previously, there are a number of factoring methods and these include principal component, axis, minimum residual, alpha, and maximum likelihood. The results can be different depending on which procedure is used. However, if the communalities are 1.0 or very close to 1.0 each of the methods will give the same solution. However, if the communalities are low or there are large differences in the communalities then Gorsuch (1983) maintains that "principal component solutions become a more distinctive procedure."

The number of variables also has a bearing on which factoring procedure should be used. As the number of variables increases, the proportion of the elements of the correlation matrix that are in the diagonal

decreases, and the diagonal elements take on less importance. Hence the various procedures will tend to produce the same results as the number of variables increases provided of course that the communalities are close to 1. Gorsuch (1983) states that "when the number of variables is moderately large, for example, greater than 30, and the analysis contains virtually no variables expected to have low communalities (eg. 0.4) practically any of the exploratory procedures other than diagonal or multiple-group analysis will lead to the same interpretations."

What procedure is best when the number of variables is not large, as was the case with the present study? In the component case, the selection is straightforward. Gorsuch (1983) personally prefers to use PA2 type factoring where less than 20 variables are being studied for three reasons. Firstly, because there are few studies where the variables are thought to be error-free and where all the variances of the variables can be expected to be predicted from the factors. Secondly, because component analysis tends to produce higher loadings than PA2 Factoring. As he states, the loading from component analysis may be sufficiently inflated as to be misleading due to the variables overlapping with the factor. The third reason for using PA2 is that it will produce a component analysis. If the communalities are actually equal to 1.0, then the PA2 factoring automatically becomes a component analysis.

11.1.4 Number of Factors Extracted

With factor analysis it is possible to extract as many factors as there are variables. However, this approach defeats the whole purpose of the exercise, namely condensing a data set to a more meaningful form.

Consequently there has to be some procedure for specifying the number of factors which should be extracted, particularly with 'exploratory factor analysis' as is the case with the present study where the intention was to examine the structure of the data and identify basic conceptual dimensions that could be examined in future research.

In the principal-component matrix the eigen values associated with each component represent the amount of total variance accounted for by the factor and the number of significant components retained for rotation is usually determined by the specification of some minimum eigen value criterion. SPSS uses Kaiser's criterion (1970)for both principal

component and PA2 factoring and thus retains only components with eigen values greater than or equal to 1. This criterion ensures that only components accounting for at least the amount of total variance of a single variable will be treated as significant. However, Kaiser's criterion is not a truly mathematical criterion but a rule of thumb of some use with less than 40 variables where the number of factors is expected to be between v/5 and v/3 and the number of respondents is large (Gorsuch, 1983) (where v = the number of attitudes).

An alternative procedure is Cattell's (1966) 'Scree test' which is very similar to the procedure adopted in MDS where the elbow in the stress versus dimensionality plot provides an indication of dimensionality of the data. With this method the percentage variance accounted for by each factor is plotted against the number of factors. When the roots or eigen values drop dramatically in size, an additional factor would add relatively little to the information already extracted. Thus the percentage of variance method has become a 'break-in-the-roots' method. Applying the test is relatively simple. All the roots are plotted with the value of the root along the ordinate and the root's factor number as the abscissa. A clear plastic ruler or straight edge is laid across the bottom position of the roots to see where they form an approximately straight line. That point where the factors curve above the straight line formed by the smaller foots gives the number of factors.

There are a number of statistical approaches to evaluating the number of factors to be extracted, eg. Bartlett's (1950) test of significance, but with the exception of Lawley's (1940) procedure which is only used in the Maximum Likelihood Analysis factoring method, a method not normally recommended for exploratory factor analysis, all the statistical approaches have tended to overestimate the number of factors that should be extracted (Gorsuch, 1983).

11.1.5 Rotation of Factors

It is possible to design research studies so that the factors are directly interpretable without further rotation, particularly if diagonal, multiple group, and confirmatory Maximum Likelihood Factor Analyses are used. Even with Principal-Component Factor Analysis it is possible, if the variables have been sampled appropriately, to hypothesize that the underlying dimension of interest is that factor.

However, with exploratory studies such as this, the researcher is not in a position to select the variables so that the principal factors - or any other factors given by the solutions - are pre-known. It is generally assumed that the initial factors will be rotated so that the factors meet criteria that make them more interpretable. Factors can either be rotated so that they are orthogonal (i.e. non-correlated) or they can be permitted to correlate with one another (i.e. Oblique).

The main guiding principle behind rotation is Thurstone's (1935) concept of 'simple structure'. He suggested that the factors should be rotated so that each variable loaded on as few factors as possible. Thurstone showed that such rotation led to a position being identified for each factor that would be independent of the number of variables defining it. Therefore, a simple structure factor should be relatively invariant across studies.

All initial solutions used in the SPSS programme extract Orthogonal factors in the order of their importance in accounting for the variance in the data. The purpose of orthogonalising the factors is to reduce the correlation among the factors to zero. With exploratory studies such as the present one, the first factor tends to be a general one, i.e. it tends to load significantly on every variable. Subsequent factors tend to be bipolar, that is some factor loadings are positive while others are negative. It is often hard to interpret such factors. Moreover, every variable tends to be decomposed into positive as well as negative factors, and the complexity of each variable is usually greater than 1, i.e. each variable loads on more than one factor. This usually indicates the presence of second order factors (Gorsuch, 1983).

The purpose of rotating the data is to find, if possible, the simplest factor structure, the expectation being that the meaning of the rotated factors will be easier to comprehend. Another important reason for rotation is that the loadings in the unrotated solution depend heavily on the relative number of variables; deletion of one variable may drastically change the relative loadings on the unrotated factors. Rotated factors are more stable in this respect.

The major option available to the analyst as far as rotation is concerned is whether to choose an Orthogonal or an Oblique rotation method.

Orthogonal factors are mathematically simpler to handle, while oblique factors are more flexible and empirically more realistic because the theoretically important underlying dimensions are not assumed to be independent (Gendall, 1978). SPSS offers three orthogonal rotation options: Quartimax, Varimax and Equimax, and one Oblique rotation method: Oblique.

Gorsuch (1983) advises researchers to apply several rotational procedures to each of two random halves of the total pool of individuals. The researcher should only extract those factors that appear across a number of solutions because the investigator could then be assured that the factors would have a high likelihood of being replicated in a new sample, regardless of the type of analytical rotation.

11.1.6 Salient Loadings

A salient loading is one that is sufficiently high to assume that a relationship exists between the variable and the factor. In addition, it usually means that the relationship is high enough so that the variable can aid in interpreting the factor and vice versa.

Schlinger (1969) proposed one workable criterion for selecting or identifying salient loadings and that is to assume that a significant factor loading should equal or exceed three times the standard error of a zero correlation, i.e. 3 x 1/n (n = sample size). For the present study with a sample size of 92 this would mean the acceptance of those variables that had a loading of 0.31 or greater as being significant and salient. Gorsuch (1983) on the other hand, suggests that the best general approach to the problem is to have a sufficiently large sample so that anything that would be of interest for interpretation would be significant. He states that a rough check can be provided by doubling the appropriate standard error and ensuring that the minimum salient loading is significant by that rough test. For example, the minimum significant correlation coefficient ($P > 0.05$) with an n of 100 is about 0.2; therefore only loadings greater than 0.4 would be accepted if the analysis was based on 100 individuals. According to his criterion if one wanted to include variables with loadings as low as 0.3 then a minimum sample size of 175 would be needed. Clearly, Gorsuch's procedure is more conservative than Schlinger's in the identification of salient loadings.

None of the above methods makes any adjustment for the number of variables or factors under consideration, yet, theoretically, the acceptable value for a loading to be judged significant should increase with subsequent factors. The Burt-Banks (1968) formula provides a method for adjusting the level of significance of a factor loading, which allows not only for sample size, but also for the number of variables correlated and the number of factors extracted.

The Burt-Banks (1968) formula is expressed mathematically as follows:

$$\text{Standard error of loading} - \text{standard error of correlation} \times \frac{n}{n+1-r}$$

where n = the number of variables in the analysis

r = the factor number and

Standard Error of correlation = significance levels for Pearson's Product-Moment Correlation Coefficients.

Significance levels for Pearson Product-Moment Correlation coefficient can be found in Appendix 11.1 and two tables of calculated significance values of the standard errors of loadings for n=50 and n=100 can be found in Appendix 11.2.

For this study, the levels of significance given by the Burt-Banks formula are 0.255 for the first factor, 0.261 for the second, 0.268 for the third and 0.276 for the fourth.

As with Schlinger's criterion, the Burt-Banks formula gives very low significance levels before a variable is considered to be salient.

11.2 RESEARCH PROCEDURE

11.2.1 The Sample

As was stated earlier, the attitude questions to the 45 meat cuts were included in the first of the three questionnaires. Originally, 150 people were contacted and asked to participate in the survey. However, only 92 completed the three surveys to the satisfaction of the researcher.

According to Gorsuch (1983), a "prime criterion for any rotation solution is that it should produce the same factors when random sets of individuals are drawn from the same underlying population." In line with this advice, the sample was randomly split into two approximately equal halves and then each sub-group was Factor Analysed and the resulting two solutions were compared to ensure that the Factors were the same, i.e. that the Factors could be replicated.

11.2.2 Questionnaire Depth

11.2.2.1 The Meat Characteristics: The meat characteristics used in the present study were

: evaluation - colour, meat flavour, value for money, bone content, tenderness, wastage, spicing, stringiness, fat content, juiciness, expense

: potency - strength of flavour, nutritional value, prestige

: activity - versatility, preparation time, cooking time, convenience.

The semantic differential scale was used, a 10 cm line with the two opposing polar statements at each end.

The attitude scales used in the present study are shown in Table 11.3. Attitudes relating to which person in the family liked the product, the time of the year that the meat was eaten, the best method of cooking the meat, day of the week, meal most often served at, were not included as part of the attitude study, as had been the case for either McFadyen et al. (1973) or Baron et al. (1981) because the questions had been asked in an earlier section of the present questionnaire in a "yes", "no" form. Baron et al. included attitudes relating to protein content and vitamin content separately whilst in the present survey, a single attitude related to nutritional content was considered to be adequate, because of the fact that both vitamin and protein content were extracted in the same factor by Baron et al. (1981).

Baron et al. (1981) included attitudes relating to ease of carving, adequacy as a cold meat, ability to provide a substantial meal and

digestibility. Some consideration was given to including the above attitudes, but as the intention was to obtain information relevant to new product development it was decided that other more relevant attitudes would be included. Though it is important to have inter-country comparisons to see if attitudes are indeed stable not only across social groups within a country (Baron et al., 1981) but also across countries.

With the present survey, attitudes were sought on the spicing requirements for the various meats in order to establish whether consumers expected to have to spice certain meats or not. Attitudes were also sought on the stringiness and juiciness of the various meats because if there were problems with some of the meats on either of the two attitudes then it would be possible, with some of the modern processing tezhniques (enzymes, tumbling and massaging), to overcome the problems. Finally, a question relating to convenience was included because of the increasing trend for more and more wives to work, or have interests in outside-the-home activities. From a development point of view it was important to determine which meat cuts were being used where preparation and cooking time were the limiting factors in meal preparation.

An examination of the study by Hughes (1976b) showed that all the studies to date including the present one have not included all the possible attitudes relating to meat consumption and the present survey is no exception. However, time and cost constraints have inevitably led to a compromise concerning the number of attitudes that can be included in a survey, and this was certainly true of the present survey.

Table 11.3. Attitude Scales Used in the Present Survey.

Bi-Polar Scales

EVALUATIVE FACTORS	
Colour Acceptability	
Unappealing meat colour	Appealing meat colour
Meat Flavour Acceptability	
Highly unacceptable flavour	Highly acceptable flavour
Value for Money	
Meat represents poor value for money	Meat is good value for money
Bone Content	
Meat has a high bone content	Meat contains no bone
Tenderness	
The meat is very tough	The meat is very tender
Wastage	
Meat has very high wastage i.e. bones, fat, leftover	No wastage with meat
Spicing	
Meat requires lots of spice to make palatable	Meat requires no spice to make palatable
Stringiness	
The meat is very stringy	The meat is not stringy
Fat Content	
The meat is always very fatty	The meat has no fat
Juiciness	
The meat is always very dry	The meat is always very juicy & succulent
Expense	
The meat is very expensive	The meat is very cheap
POTENCY FACTORS	
Strength of flavour	
The meat has very little flavour	The meat has a very strong flavour
Nutritional Value of Meat	
The meat has no nutritional value	The meat is highly nutritious
Prestige	
Meat is used for everyday use	Meat is only used for special occasions
ACTIVITY FACTORS	
Number of dishes	
Only use the meat in 1 dish	Use the meat in a number of dishes
Preparation Time	
Meat needs a great deal of preparation	Meat needs no preparation
Cooking Time	
Meat requires very long cooking	Meat requires no cooking
Convenience	
Never use the meat when in a hurry	Use the meat when in a hurry

11.2.2.2 Types of Meat: It was decided for the present study that attitudes would be sought for 45 meat cuts to overcome some of the limitations of previous studies and also to establish whether attitude structure explained the high consumption of certain meats and the very low consumption of others.

The meats studied were:

Beef Cuts: Wienersnitzel, rump steak, porterhouse steak, stewing steak, topside, beef mince and corned beef.

Lamb Cuts: lamb forequarter, lamb neck chops, lamb loin chops and leg of lamb.

Hogget Cuts: hogget forequarter, hogget neck chops, hogget loin chops and leg of hogget.

Mutton Cuts: mutton forequarter, mutton neck chops, mutton loin chops and leg of mutton.

Pork Cuts: Pork chops, pork pieces and leg of pork.

Ham Cuts: Sliced ham, ham-on-the-bone and ham steaks.

Bacon: middle bacon, shoulder bacon.

Sausage Products: beef sausages, pork sausages, hamburgers, luncheon, ham & chicken, saveloys, frankfurters, black pudding, salami and garlic sausage.

Offal Cuts: beef tongue, beef hearts, beef tripe, lambs' kidney and lambs' liver (fry).

White Meats: Fish, shellfish and chicken.

With the present survey, unlike those of Baron et al. (1973); Wilkinson (1975), and Baron et al. (1981), all the meats were included on the one page for each attitude rather than the one meat and all attitudes on one page as was the case for the other studies. This layout was adopted to obtain a better inter-meat comparison on each attitude structure.

The meats were listed on the left hand side of each page and adjacent to each meat was a 10 cm long line. An example of the layout is presented in Figure 11.1. The respondents were asked to place a mark at a point along the line that expressed the strength of their agreement with one or other of the adjectives placed at the top of the page for each meat. A semi-structured linear scale was used in place of the usual category scales to overcome many of the objections raised by Siegel et al. (1977) regarding category scales and the seeming advantage of the semi-structured linear scale. A 9-point scale was marked out on the top line on each page.

11.2.3 The Analysis

The collected data were checked first to see that the respondents had answered the questions satisfactorily. Each line was then measured to obtain the distance along the 10 cm line. The data were then coded and entered into the computer for analysis.

The data were initially analysed with the SPSS (1981) frequencies programme to obtain the means and distribution of the responses for each of the 18 attitude scales pertaining to each of the meats. For each individual the mean scores for each attitude were determined for all the beef cuts, all the sheep meat cuts, all the pig meat cuts and all the offal cuts. These were then summed to give an attitude score for the meats in general. These aggregated attitude scores of the 92 respondents were also analysed by the SPSS Frequencies programme to obtain the sample means for each of the attitude scores on each of the meat sub-groups.

The 92 x 18 matrix (i.e. 92 people by 18 attitudes) for each meat, meat sub-group - beef, sheep meat, lamb, pork, offal - and for meat in general were analysed with the SPSS PA2 Factor procedure with iterations to extract the principal factors. These principal factors were then rotated using the four rotational procedures available in the SPSS Factor programme, namely: Varimax, Equimax, Quartimax and Oblique, as suggested by Gorsuch (1983), and Factor Pattern Matrices were obtained for each of the rotational procedures. The number of Factors to be extracted was controlled by Kaiser's criterion, i.e. eigen values $\geq$ 1.0 and the efficacy of this criterion was checked by using Cattell's Scree Test.

Fig. 11.1 Example of the Semantic Differential Questionnaire Layout.

MEAT FLAVOUR

The meat has	no meat flavour								a very strong meat flavour
	1	2	3	4	5	6	7	8	9
Wienersnitzel									
Rump steak									
Porterhouse steak									
Stewing steak									
Topside									
Beef mince									
Corned beef									
Beef tongue									
Beef hearts									
Beef tripe									
Lamb's fry									
Lamb's kidney									
Lamb forequarter									
Lamb neck chops									
Lamb loin chops									
Leg of lamb									
Hogget forequarter									
Hogget neck chops									
Hogget loin chops									
Leg of hogget									
Mutton forequarter									
Mutton neck chops									
Mutton loin chops									
Leg of mutton									
Pork chops									
Pork pieces									
Leg of pork									
Sliced ham									
Ham steaks									
Leg of ham									
Middle bacon									
Shoulder bacon									
Fish									
Chicken									
Shellfish									
Hamburgers									
Beef sausages									
Pork sausages									
Ham'n'chicken									
Salami									
Frankfurters									
Saveloys									
Black pudding									
Garlic sausage									

For this study, because of its exploratory nature, Gorsuch's more conservative approach to salient loadings was adopted since it reduces the possibility of chance correlations being considered as 'significant' in the interpretation of the factors. This meant that with a sample of 92 people only loadings equal to or greater than 0.4 would be considered as salient.

11.3 RESULTS

11.3.1 Mean Attitude Scores for Different Meat Groups

The mean scores are shown in Table 10.4 and Figure 11.2. The attitudes have been arranged in the order of their appearance in 3 factors.

Table 11.4 Mean Attitude Scores for Different Meat Groups (on 9-point Semantic Differential Scale)

	All Meats	Beef	Sheep meat	Pig meat	Offal
Flavour strength	3.95	4.45	3.24	5.15	2.52
Acceptability of colour	3.98	5.10	3.90	4.82	2.10
Acceptability of flavour	4.29	5.32	4.02	5.65	2.17
Number of dishes	2.62	4.21	1.94	3.35	0.99
Preparation time	3.59	4.54	3.53	4.59	1.71
Nutritional value of meat	3.96	5.03	3.66	4.06	3.10
Value for money	3.88	5.04	3.58	3.84	3.05
Bone content	4.99	7.25	2.77	5.59	4.37
Tenderness	4.83	6.00	3.86	6.16	3.30
Wastage	4.97	6.58	3.82	5.79	3.68
Cooking time	3.74	4.79	2.75	5.12	2.29
Spicing requirement	4.64	5.23	4.48	6.06	2.78
Prestige	2.75	3.08	2.23	4.24	1.44
Stringiness of meat	4.21	4.47	3.91	5.44	2.71
Fat content of meat	4.18	5.58	3.32	4.49	3.35
Juiciness of meat	3.86	5.09	3.61	4.39	2.37
Expense	2.78	3.38	2.80	2.31	2.61
Convenience	3.27	4.24	2.55	4.39	1.90

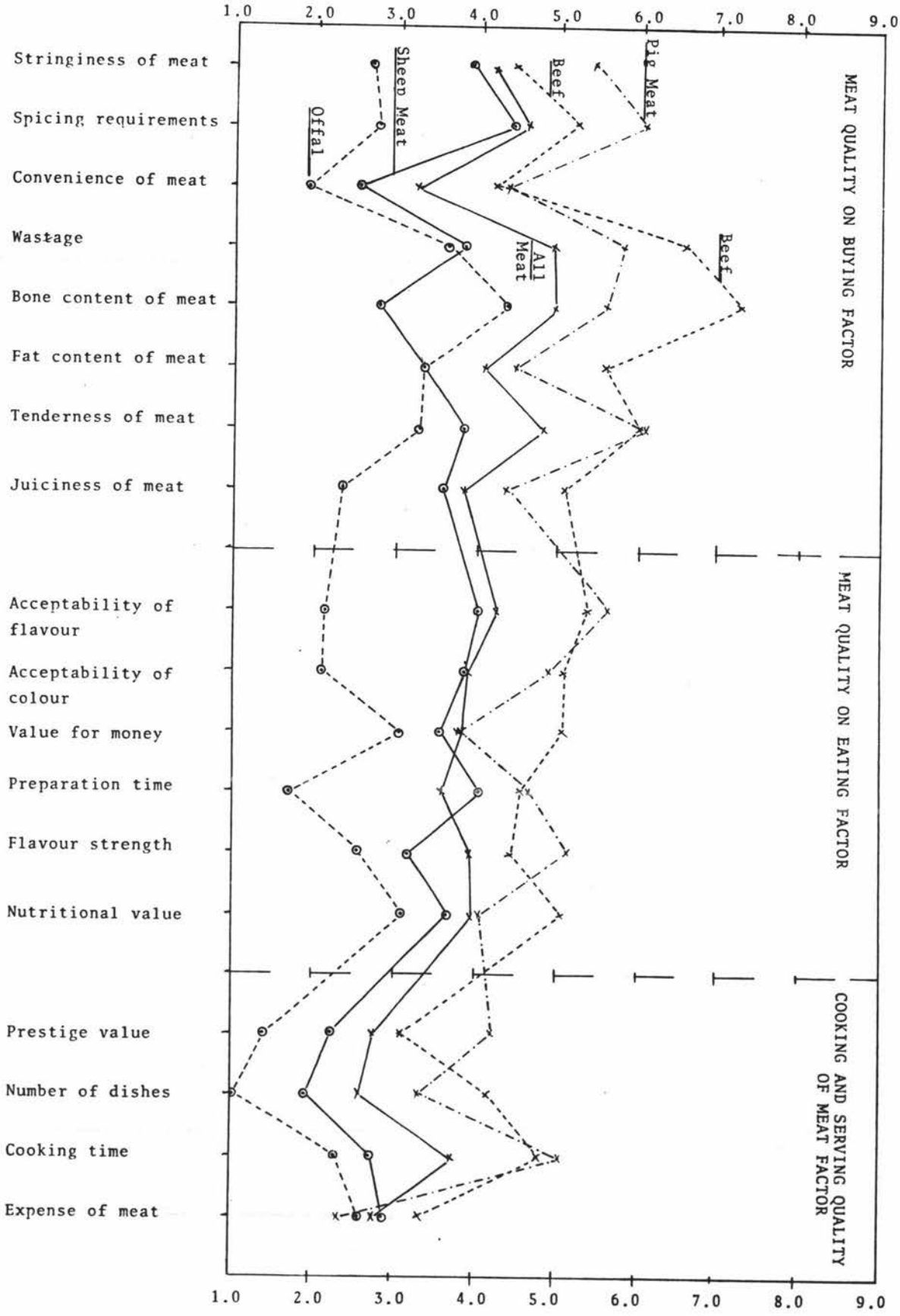

Fig.11.2 Profiles of the 5 Meat Groups on the 18 Attitudes.

Beef and pig meat scored more highly in all factors than sheep meat and offal. Beef scored highest for colour, number of dishes, nutritional value, value for money, bone content, wastage, spicing requirement, fat content of meat, juiciness of meat and expense. Pig meat scored higher for flavour strength, flavour acceptability, preparation time, tenderness, cooking time, prestige, stringiness and convenience. These respondents regarded pig meat as having a good flavour and texture, easy to cook and having prestige. Beef was more versatile, had a higher nutritional value and was juicier, had less fat and bone and was not so expensive. Sheep meat scored lower than pork or beef, except for expense where it scored higher than pork but less than beef. Offal scored lower than sheep meat except for bone content. Surprisingly, the respondents thought offal was expensive.

11.3.2 Factor Analysis of Attitudes towards Meat in General

The complete Factor Analysis of the Overall Meat Scores is shown in Appendix 11.3.

11.3.2.1 Number of Varimax Rotated Principal Factors: The factor loadings after rotation are shown in Appendix 11.3. Three factors were found to be adequate to describe the meat characteristics and are defined in Table 11.5.

Table 11.5 Major Factors Defined for Meat in General

	Factor Loading
1. Meat quality in buying	
Stringiness of meat	0.84
Spicing requirement	0.82
Convenience	0.78
Wastage	0.78
Bone content of meat	0.76
Fat content of meat	0.72
Tenderness	0.57 x
Juiciness of meat +	0.57 +
2. Meat Quality on Eating	
Acceptability of flavour	0.67
Acceptability of colour	0.65
Value for money	0.64
Preparation time *	0.59
Flavour strength	0.53
Nutritional value	0.50
3. Meat Quality on Cooking and Serving	
Prestige	0.77
Number of dishes	0.71
Cooking time	0.70
Expense	0.51

Note: * This could also be in Factor 1 - indeterminate characteristic (0.58)

+ " " " " " " 3 - " (0.43)

x " " " " " " 2 - " (0.47)

The factors have been labelled but it should be noted that such labels have no significance other than to help discussion of the factors. The first factor accounted for 50.2% of the variance, the second factor for 11.2% and the third factor for 8.2%, so the cumulative percentage of the variance was 69.6%. Therefore this could be extended to perhaps 4 and 5 factors.

Factor 1, in the present study, included the attitudes: stringiness; spicing requirement; convenience; wastage; bone content; fat content; tenderness and the juiciness of the meat. All of these variables have been identified as important determinants controlling consumers' meat-purchasing decisions (Jeremiah, 1982). For this reason the Factor was called "Meat Quality on Buying".

Factor 2 included the attitudes: acceptability of flavour; acceptability of colour; value for money; preparation time; flavour strength and nutritional value. The attitudes convey the impression of quality and value for money and food value, i.e. the second Factor appears to encompass the economist's concept of quality/price trade-offs. For this reason it was called "Meat Quality on Eating".

The attitudes: prestige, cooking time and expense were included in Factor 3. The Factor appears to capture the ingredients of quality/work trade-offs and for this reason was called "Meat Quality on Cooking and Serving".

Baron et al. (1981) in their study found 5 important factors underlying their attitude data for meat. The first Factor which they called "Nourishment " consisted of the attitudes: vitamins, proteins and nourishment. With the present survey only one characteristic was included in the survey, nutritional value, and so one would not expect to find a separate factor for this scale as was the case for Baron et al (1981). Their second factor, which consisted of the following: ease of preparation; tenderness; child like; digestible; cut; carve; wasteful fat, and which they entitled "usefulness" had some similarities with the first factor in the present survey. In their third factor could be found the variables of nourishment; taste; men like; substantial and visitors which was similar to the second factor of the present survey. Their fourth factor consisted of value; expense and ways of serving which once again was very similar to the third factor of the present survey.

In spite of the obvious differences in attitude content between Baron et al.'s (1981) U.K. study and the present study, where similar attitudes were included in the two surveys, these attitudes were extracted in similar factors.

11.3.2.2 Conformation of Factors: As can be seen from Table 11.6 and Appendix 11.3, all the rotational methods, with the exception of Quartimax, produced almost identical loadings for the variables in each factor.

Table 11.6 Comparison of Rotational Methods for Meat in General

	Varimax Rotation	Equimax Rotation	Oblique Rotation	Quartimax Rotation
1. Meat Quality on Buying				
Stringiness of meat	0.84	0.83	0.91	0.90
Spicing requirements	0.82	0.80	0.85	0.89
Convenience	0.78	0.76	0.84	0.91
Wastage	0.78	0.76	0.79	0.83
Bone content of meat	0.76	0.73	0.69	0.81
Fat content of meat	0.72	0.69	0.76	0.83
Tenderness	0.57	0.53	0.49	0.54
Juiciness of meat	0.57	0.54	0.56	0.60
2. Meat Quality on Eating				
Acceptability of flavour	0.67	0.68	0.70 *	0.71
Acceptability of colour	0.65	0.65	0.71 *	0.69
Value for money	0.64	0.64	0.68 *	0.73
Preparation time	0.59	0.61	0.53 *	0.54
Flavour strength	0.53	0.54	0.59 *	0.64
Nutritional value	0.50	0.51	0.48 *	0.52

* Factor 3 in solution

3. Meat Quality on Cooking and Serving				
Prestige	0.77	0.77	0.76 +	0.77
Number of dishes	0.71	0.71	0.66 +	-
Cooking time	0.69	0.72	0.58 +	-
Expense	0.51	0.53	0.40 +	-

\+ Factor 2 in solution

The Factors were similar from all rotational methods except that with the Oblique rotational method the position of factors 2 and 3 were reversed. However the meat characteristics in the factors were the same.

Gorsuch (1983) stated that Quartimax has not proved to be a popular method of rotation due to its tendency to produce a general factor and with the present study this certainly proved to be the case with most of the variables having high loadings on factor 1.

Comparison of the three rotational methods helped to confirm the positions of some of the factors. For example, the Oblique method showed that tenderness and juiciness belonged in the first factor, and Equimax confirmed that preparation time belonged in the second factor. A sub-sample of 50 respondents produced very similar solutions for all four rotational procedures. Because the solutions were almost identical across three of the rotational procedures and because of the similarity of the sub-sample results compared with the whole sample results, the three factors obtained from the present study would have a very high likelihood of being replicated with a new sample of respondents regardless of the type of analytical rotation (Quartimax being the exception; Gorsuch, 1983).

11.3.3 Further Analysis of Attitude Data for 7 Beef Cuts

The complete Factor Analysis of the beef scores is shown in Appendix 11.4.

11.3.3.1 Number of Varimax Rotated Principal Factors: Four factors were needed to describe the beef characteristics and are shown in Table 11.7.

Table 11.7 Major Factors Defined for Beef Cuts

1. Meat Quality on Buying

Stringiness of meat	0.70
Spicing requirement	0.65
Convenience	-
Wastage	0.85
Bone content of meat	0.79
Fat content of meat	0.69
Tenderness	-
Juiciness	-

2. Meat Quality on Eating

Acceptability of flavour	0.54*
Acceptability of colour	0.59
Value for money	0.59
Preparation time	0.47+
Flavour strength	0.78
Nutritional value	0.53

* Factor 3 in the solution

\+ This should be in Factor 1 - indeterminate characteristic

3. Meat Quality on Cooking and Serving

Prestige	0.58
Number of dishes	(0.50)*
Cooking time	0.84
Expense	0.59
Tenderness	0.51
Juiciness	0.60
Convenience	0.47+

* Factor 4 in solution

\+ Should be in Factor 1 - indeterminate characteristic

4. Versatility

Number of dishes	0.64

Unlike the attitude data for meat in general, the beef cut data was best described by a four-factor solution rather than a 3-factor solution. The percentage of the variance due to each factor was 34.1%, 15.2%, 10.1% and 5.6%, a total of 65.0%.

The first beef factor was very similar to the first meat factor except it contained three less attitude variables, namely: convenience, juiciness and tenderness. The third beef factor was identical to the second meat factor. The second beef factor, whilst similar to the third meat factor, contained the following additional variables: juiciness, convenience and tenderness. The fourth beef factor was a unique factor and consisted only of a single salient variable, namely 'the number of dishes'.

It would appear that the Factor Pattern Matrix for beef, whilst basically very similar to that for meat, also had some basic differences which appeared to differentiate the beef cuts from meat in general, particularly the fourth factor, i.e. the number of dishes, which probably sums up the importance of beef in the diet, namely versatility of many of the cuts.

11.3.3.2 Conformation of Factors: As can be seen in Table 11.8 and Appendix 11.5, in general, the rotational procedures produced similar Factor Patterns. The Equimax rotation had the same characteristics in Factor 2 as meat, but the others all reversed Factors 2 and 3. Convenience, preparation time, tenderness and fat content were placed in different factors according to the rotation method. As three methods produced preparation time in Factor 2, fat content in Factor 1, tenderness in Factor 3, convenience in Factor 3, therefore, the factors from the Varimax rotation can be taken. Number of dishes was in Factor 3 in two methods and Factor 4 in two methods. Therefore, it can be considered in Factor 3 or as a separate Factor 4.

Table 11.8 Comparison of Rotational Methods for Beef Cuts

	Varimax Rotation	Equimax Rotation	Oblique Rotation	Quartimax Rotation
1. Meat Quality on Buying				
Stringiness of meat	0.70	0.68	0.74	0.71
Spicing requirement	0.65	0.59	0.63	0.67
Convenience	-*	-*	-*	0.46
Wastage	0.85	0.85	0.90	0.84
Bone content of meat	0.79	0.80	0.84	0.78
Fat content of meat	0.69	(0.59)	0.65	0.73
Tenderness	-	-	-	-
Juiciness	-	-	-	-
Preparation time	-	-	-	0.48

* Should have been present in Factor 1

2. Meat Quality on Eating				
Acceptability of flavour	0.54+	0.56	0.49+	0.56+
Acceptability of colour	0.59+	0.58	0.58+	0.60+
Value for money	0.59+	0.55	0.64+	0.58+
Preparation time	0.47+	0.47	0.41+	(0.46)+
Flavour strength	0.78+	0.77	0.83+	0.76+
Nutritional value	0.53+	0.52	0.56+	0.54+

( ) Indeterminate - could be in Factor 1 or 2

\+ Factor 3, i.e. appeared in Factor 3

3. Meat Quality on Cooking and Serving				
Prestige	0.58+	-	0.66+	0.61+
Number of dishes		-	0.71+	0.60+
Cooking time	0.84+	0.60	0.79+	0.84+
Expense	0.60+	0.49	0.52+	0.59+
Tenderness	0.51+	-	0.58+	0.55+
Juiciness	0.60+	0.56	0.47	0.58+
Convenience	0.47+	0.57	0.40	-
Fat content of meat		(0.61)		

\+ Factor 2

4. Versatility				
Number of dishes	0.64	0.82	-	-
Tenderness	-	-	-	0.62

11.3.4 Factor Analysis of Attitude Data for 12 Sheep Meat Cuts

The same analytical procedure outlined for the beef cuts was followed for the sheep meat cuts and the results are detailed in Appendix 11.5.

11.3.4.1 Number of Varimax Rotated Factors: The Varimax Rotated Factors are shown in Table 11.9.

Table 11.9 Major Factors Defined for Sheep Meat Cuts

	Factor Loadings
1. Meat Quality in Buying	
Stringiness of meat	0.75
Spicing requirement	0.81
Convenience	0.59
Wastage	0.58
Bone content of meat	-
Fat content of meat	0.57
Tenderness	0.64
Juiciness	0.68
Cooking time	0.71
Expense	(0.50)

( ) Indeterminate - should have appeared in Factor 3

2. Meat Quality on Eating	
Acceptability of flavour	0.73
Acceptability of colour	0.69
Value for money	0.62
Preparation time	0.60
Flavour strength	0.66
Nutritional value	0.53
Tenderness	(0.64)
3. Meat Quality on Cooking and Serving	
Prestige	0.83
Number of dishes	0.76
Cooking time	-
Expense	0.56
Tenderness	-
Juiciness	-
Bone content of meat	0.65

For meat in general, three factors were deemed as adequate to describe the data. They accounted for 51.9%, 12.9% and 7.6% of the variance respectively, a total of 72.4%. Factors 1 and 2 for the sheep meat data were identical to factors 1 and 2 for the meat in general data. The third sheep meat factor consisted of the added variables of bone content, wastage, fat content and convenience. The sheep meat data more closely mirrored the Factor Pattern for meat in general than the beef data. However, the differences in the third factor of the sheep meat data compared with the third factor for meat in general pointed to slight differences in perception for sheep meats compared to meat in general.

11.3.4.2 Confirmation of Factors: Unlike the meat and beef cuts data the four rotational procedures tended to produce different Factor Patterns. In particular, Quartimax Rotation had only two factors and is not included in Table 11.10.

Table 11.10 Comparison of Rotational Methods for Sheep Meat Cuts

	Factor Loadings		
	Varimax Rotation	Equimax Rotation	Oblique Rotation
1. Meat Quality on Buying			
Stringiness of meat	0.75	0.74	0.64
Spicing requirement	0.82	0.80	0.68
Convenience	0.59	0.58	0.76
Wastage	0.58	0.57	0.64
Bone content of meat	-	-	-
Fat content of meat	0.57	0.56	0.74
Tenderness	0.64	0.62	-
Juiciness	0.68	0.66	0.62
Cooking time	0.71	0.70	0.93
Expense	(0.50)	0.50	0.74

( ) Indeterminate - should have been in Factor 3

2. Meat Quality on Eating			
Acceptability of flavour	0.73	0.73	0.84+
Acceptability of colour	0.69	0.69	0.82+
Value for money	0.62	0.62	0.74+
Preparation time	0.60	0.62	0.55+
Flavour strength	0.66	0.67	0.72+
Nutritional value	0.53	0.53	0.58+
Bone content of meat	-	-	0.49+
Tenderness	0.64	0.62	0.55+

+ Factor 3, appeared as Factor 3 in solution

3. Meat Quality on Cooking and Serving			
Pestige	0.83	0.83	0.69+
Number of dishes	0.76	0.76	0.65+
Cooking time	-	-	-
Expense	0.56	-	-
Tenderness	-	-	-
Juiciness	-	-	-
Convenience	-	-	-
Fat content of meat	-	-	-
Bone content of meat	0.65	0.65	-

+ Factor 2, appeared as Factor 2 in solution

Quartimax only produced two factors with any salient correlations and most of the variables were loaded on the first factor. The Varimax and Equimax solutions were very similar whilst the Oblique rotation produced a much simpler solution with only three variables appearing in more than one factor. However, the sub-sample provided a very similar result for each of the rotational procedures.

The Varimax factors can be used except that expense should be added to the first factor, and dropped fom the third factor.

11.3.5 Factor Analysis of Attitude Data for 8 Pig Meat Cuts

The complete Factor Analysis of the pig meat scores is shown in Appendix 11.6.

11.3.5.1 Number of Varimax Rotated Principal Factors: Three factors were needed to describe the pig meat characteristics and are shown in Table 11.11.

Table 11.11 Major Factors Defined for Pig Meat Cuts

	Factor Loading
1. Meat Quality on Buying	
Stringiness of meat	0.84
Spicing requirement	0.79
Convenience	0.71
Wastage	0.71
Bone content of meat	0.70
Fat content of meat	-
Tenderness	0.53
Juiciness	0.50
2. Meat Quality on Eating	
Acceptability of flavour	0.56
Acceptability of colour	0.45
Value for money	-
Preparation time	0.54+
Flavour strength	0.55
Nutritional value	-

+ This attitude should be in Factor 1 - indeterminate characteristic

3. Meat Quality on Cooking and Serving	
Prestige	0.61
Number of dishes	0.71
Cooking time	0.54
Expense	0.56
Tenderness	-
Juiciness	-
Convenience	-
Nutritional value	0.58+
Value for money	0.56+
Fat content of meat	0.59*

+ These attitudes should be in Factor 2

* These attitudes should be in Factor 1.

Factor 1 which had appeared in all the meat groups was evident again with the pig meat data although expense did not appear in the first factor. In the case of Factor 2 the additional variables of nutritional value, tenderness and fat content were evident for the pig meat data. With Factor 3 neither nutritional value nor value for money appeared in the factor as was expected given the results for the other three meat categories.

As with the other meat groups certain similarities were evident with the pig meat data compared to meat in general, however, there were also subtle differences which appeared to separate pig meats from the other meat groups and meat in general.

Table 11.12. Comparison of Rotational Methods for Pig Meat Cuts

	Factor Loadings			
	Varimax Rotation	Equimax Rotation	Oblique Rotation	Quartimax Rotation
1. Meat Quality on Buying				
Stringiness of meat	0.84	0.82	0.92	0.83
Spicing requirement	0.79	0.77	0.84	0.83
Convenience	0.71	0.67	0.78	0.75
Wastage	0.71	0.69	0.73	0.82
Bone content of meat	0.70	0.65	0.70	0.87
Fat content of meat	-	-	0.53	0.64
Tenderness	0.53	0.50	0.49	0.73
Juiciness	0.50	0.48	0.46	0.69
Preparation time	-	-	0.54	0.67
Cooking time	0.67	0.67	0.67	0.76
2. Meat Quality on Cooking and Serving				
Prestige	0.61	0.61	0.59	0.51
Number of dishes	0.71	0.71	0.75	0.66
Cooking time	-	-	-	-
Expense	0.56	0.55	0.57	0.50
Tenderness	-	-	-	-
Juiciness	-	-	-	-
Preparation time	0.54	-	-	-
Fat content of meat	0.59	0.59	-	-
Nutritional value	0.58	0.58	0.61	0.52
Value for money	0.56	0.55	0.57	0.48
3. Meat Quality on Eating				
Acceptability of flavour	0.56	0.59	0.43	-
Acceptability of colour	0.45	0.49	-	-
Value for money	-	-	-	-
Preparation time	0.54	0.58	-	-
Flavour strength	0.54	0.56	0.53	0.44
Nutritional value	-	-	-	-

11.3.5.2 Confirmation of Factors: In general, the rotational procedures produced similar Factor Patterns. Quartimax had only one salient loading on the third factor. However Factors 1 and 2 for all solutions tended to be the same. For all rotated solutions, two variables namely nutritional value and value for money, did not appear in the basic meat eating qualities factor as with the other meat groups but instead appeared in the meat quality on serving and cooking factor. Fat content and preparation time appeared in Factor 1 for the Oblique and Quartimax rotational procedures and in Factor 2 for the Varimax and Equimax rotational procedures. As the factor structures were basically the same for each of the rotational procedures (Quartimax being the exception) the Varimax Factors can be used to adequately describe the attitude data underlying the pig meat sub-group (see Table 11.12).

11.3.6 Factor Analysis of Attitude Data for Offal Cuts

The offal cuts consisted of beef tongue, beef tripe, beef heart, lambs' kidney and lambs' fry. Details of the Factor Analysis are in Appendix 11.7.

11.3.6.1 Number of Varimax Rotated Principal Factors: The attitude data for these 5 cuts was analysed according to the same procedure outlined for the beef cuts and the results are presented in Table 11.13.

Table 11.13 Major Factors Defined for Offal Cuts

	Factor Loading
1. Meat Quality on Buying	
Stringiness of meat	0.81
Spicing requirement	0.75
Convenience	0.62
Wastage	0.79
Bone content of meat	0.78
Fat content of meat	0.78
Tenderness	0.53
Juiciness	-
Preparation time+	0.60
Expense*	0.67
Nutritional value*	0.69

\+ Attitude should have appeared in Factor 2

* Attitudes should have appeared in Factor 3

2. Meat Quality on Cooking and Serving	
Prestige	0.73
Number of dishes	0.73
Cooking time	0.71
Expense	-
Tenderness	-
Juiciness	0.53
3. Meat Quality on Eating	
Acceptability of flavour	0.66
Acceptability of colour	0.54
Value for money	0.64
Preparation time	-
Flavour strength	0.57
Nutritional value	-

Factor 1 for the offal cuts whilst similar to the Factor 1 of meat in general contained the additional attitude variables of preparation time, expense and nutritional value. Factor 2 did not include preparation time and nutritional value, whilst Factor 3 excluded expense.

11.3.6.2 Confirmation of Factors: The Varimax, Equimax and Oblique rotations of the Principal Factors produced very similar results except for the Quartimax rotation and the solutions were almost replicated with the randomly-selected sub-sample of respondents. The results are shown in Table 11.14.

Table 11.14. Comparison of Rotational Methods for Offal Cuts

	Factor Loadings		
	Varimax Rotation	Equimax Rotation	Oblique Rotation
1. Meat Quality on Buying			
Stringiness of meat	0.81	0.76	0.92
Spicing requirement	0.75	0.71	0.81
Convenience	0.63	0.58	0.65
Wastage	0.79	0.75	0.87
Bone content of meat	0.78	0.73	0.85
Tenderness	0.53	(0.48)	0.51
Juiciness	(0.50)	(0.46)	0.49
Preparation time	0.60	(0.52)	0.55
Expense	0.67	0.62	0.69
Nutritional value	0.69	0.62	0.69

( ) Indeterminate - attitudes appeared in 2 or more factors

2. Meat Quality on Eating			
Acceptability of flavour	0.66+	0.70+	0.62+
Acceptability of colour	0.54+	0.54+	0.57+
Value for money	0.64+	0.67+	0.59+
Preparation time	(0.52)+	0.58+	- +
Flavour strength	0.57+	0.63+	0.48+
Nutritional value	(0.50)+	(0.58)+	- +

+ Factor 3 in solution

3. Meat Quality on Cooking and Serving			
Prestige	0.73*	0.73*	0.69*
Number of dishes	0.73*	0.73*	0.70*
Cooking time	0.71*	0.72*	0.60*
Expense	-	-	-
Tenderness	(0.51)*	0.53*	-
Juiciness	0.53*	0.54*	-

* Factor 2 in solution

The Quartimax Rotation forced most of the variables into one factor. Although there are some variations between the other three methods, generally the Varimax solution was confirmed by the Equimax and Oblique rotations.

11.4 DISCUSSION OF RESULTS

11.4.1 Rotational Method

The objective of Quartimax rotation is to minimise the complexity of a variable, that is, to rotate the initial factors in such a way that a variable loads high on one factor, but almost zero on others. In analytic terms, such a criterion means the minimisation of the cross product of factor loadings for variable j.

Since the method emphasises simplification of the rows of the factor matrix, the first rotated factor tends to be a general one, whilst subsequent factors tend to be sub-clusters of variables.

One of the criticisms of Quartimax is that solutions either tend to include one factor with all major loadings and no other major loadings in the rest of the matrix, or have the moderate loadings all retained on the same factor. This criticism of Quartimax was certainly valid for the results from the Quartimax rotation of the sheep meat, pig meat and offal data, but in the case of the beef data Quartimax rotation produced an identical solution to the other rotational procedures.

In contrast to Quartimax, the Varimax criterion centres on simplifying the columns whereas Quartimax centres on simplifying the rows. With Varimax a simple factor is defined as having only ones and zeros in the column. Such a simplification is equivalent to maximising the variance of the squared loadings in each column.

Equimax follows the general line of reasoning of the Quartimax and Varimax criteria and can be thought of as a compromise solution of the preceding two. The results from the present study would tend to suggest that this is not quite the case as the factor pattern matrix of the Equimax solutions for each of the meat sub-groups was very similar to the Varimax solutions as opposed to the Quartimax solutions.

Oblique rotation involves a similar type of simplifying principle, but the requirement of orthogonality among the factor axes is relaxed. In principle the initial factor axes are allowed to rotate freely to best summarise any clustering of variables. With the SPSS Factor programme it is possible to change the degree of correlation amongst the factors by changing the value of delta. With the present study a delta value of 0 provided a solution that met Thurstone's (1935) concept of simple structure best for all the rotational procedures.

The Varimax solutions for all meat sub-groups variables were sometimes loaded on two and sometimes even three factors if a salient loading of 0.4 was accepted. With the Oblique solutions there were no variables loaded on three factors for any of the meat sub-groups. With Oblique rotation of the meat in general data only two variables loaded on two factors and these variables were cooking time and preparation time. With the beef data no variable loaded on more than one factor with the Oblique rotation. With the sheep meat data three variables loaded on more than one factor and two of these variables had a negative correlation with the second factor. With pig meat data only one variable loaded on one factor, similarly with the offal data. The Oblique rotation procedure came closest to meeting Thurstone's concept of simple structure. Gorsuch (1983) suggests that the four rotational procedures should be used to explore the data to determine the underlying dimensions of the data. However, the results of the present survey suggest that there is no need to analyse attitude data with all four rotational procedures as suggested by Gorsuch and others.

The Quartimax procedure has been criticised by others for loading most variables onto the first factor and this criticism was found to be equally true for four out of five of the meat groups analysed for the present study. Given this criticism by others and the results of the present survey, there seems little point in analysing factor analysis data with this rotational procedure because it generally tends to condense the data too far, i.e. too few factors compared with the other rotational procedures.

Since the Equimax procedure produced almost identical results to the Varimax rotational procedure for all meat sub-groups there would appear to be little point in analysing factor analysis data by both rotational

procedures, and because the Varimax results are most commonly reported in the literature it is suggested that Varimax be the only orthogonal rotation procedure that is necessary for analysing attitude data.

Given the excellent solutions provided by the Oblique procedure it is suggested that attitude data should be analysed by both the Varimax and Oblique procedures to establish the simplest structure underlying attitude data. Varimax is usually adequate for most studies, but the Oblique rotation helps to unravel some of the problems of variable complexity which are encountered in some Varimax solutions.

11.4.2 Saliency of Variable Loadings

Three criteria were available to establish the saliency of the variable loadings on each of the factors: Schlinger's (1969), Burt-Banks' (1968) and Gorsuch's (1983). For 92 people a value of 0.31 was considered to be significant by Schlinger's criterion, values of 0.255, 0.261 and 0.268 for factors 1, 2 and 3 respectively by the Burt-Banks formula and a value of 0.4 for all factors by Gorsuch's method.

Gorsuch (1983) claims that if either Schlinger's criterion or Burt-Banks' criterion is used to control saliency then there is the likelihood that variables will be deemed significant when they are really due to chance correlations in the data. To avoid this problem Gorsuch's $p \leq 0.05$ criterion was adopted for the present study to determine saliency.

However had either Schlinger's criterion or the Burt-Banks' criterion then been adopted the interpretation of the factors would have been extremely difficult indeed. An examination of Table 11.15 shows that in addition to the variables allowed by Gorsuch's criterion, indicated by underline, the Burt-Banks's criterion would have included for meat in general, acceptability of flavour and nutritional value in Factor 1; spicing requirement, wastage, juiciness and number of dishes in Factor 2; tenderness and nutritional value in Factor 3. Both Schlinger's and Burt-Banks' criteria produce a far greater complexity to the factor pattern structure than Gorsuch's procedure. Most variables were loaded on at least two factors and some were even loaded on three factors. This degree of complexity is a clear departure from Thurstone's concept of simple structure. Moreover, the similarities between the factor

strctures of the Varimax and Oblique solutions decreases when either the Burt-Banks' or Schlinger's criterion is used to select salient loadings suggesting that it is unlikely that the factors would be reproducible in another study (Gorsuch, 1983). Clearly there is a need to select variables with as high a loading as possible if the intention, as it must be, is of isolating factors which can be reproduced in other studies. Only in this way can inter- and intra-country comparisons be made. The Gorsuch criterion as adopted in the study allowed for a minimum significant correlation coefficient of 0.406 with a $P \geq 0.05$. It could be argued that a $P \geq 0.01$ should be used to ensure with greater certainty that factors will be reproduced in further studies. In this case a loading of 0.54 or greater for a sample size of 100 would be needed before a variable became salient. If this criterion were adopted then an examination of Table 11.15 indicates that expense would drop out of Factor 1; tenderness, bone content, flavour strength and nutritional value would drop out of Factor 2, and fat content, juiciness, value for money and expense would drop out of Factor 3. The Factor Structure would then comply with Thurstone's criterion for simple structure and the factors would be more likely to be reproduced in further studies. Adopting a value of 0.54 would have very little effect on the content of Factor 1; however, Factors Two and Three would become far simpler as shown in Table 11.15.

Table 11.15 Varimax Rotated Factor Pattern Matrix of Attitude Data for Meat in General

Attitude	Factor Pattern		
	Factor 1	Factor 2	Factor 3
Stringiness	0.84	0.16	0.04
Spicing requirements	0.82	0.27+	0.16
Wastage	0.78	0.34+	0.17
Convenience	0.78	0.19	0.25
Fat content	0.72	0.23	0.40
Bone content	0.76	0.49	0.05
Tenderness	0.57	0.46	0.38+
Juiciness	0.57	0.31+	0.43
Acceptability of flavour	0.33+	0.67	0.12
Acceptability of colour	0.19	0.65	0.16
Flavour strength	0.15	0.53	0.15
Value for money	0.20	0.64	0.42
Preparation time	0.58	0.50	-0.14
Nutritional value	0.32+	0.50	0.32+
Prestige	0.09	0.05	0.77
Number of dishes	-0.04	0.29+	0.71
Cooking time	0.54	0.19	0.69
Expense	0.40	0.19	0.51

Note: Underlining indicates attitudes included in Factor by Gorsuch's 0.4 criterion, i.e. $p \leq 0.05$

Factor 2*		Factor 3*	
Acceptability of flavour	0.67	Prestige	0.77
Acceptability of colour	0.65	Number of dishes	0.71
Value for money	0.64	Cooking time	0.69
Preparation time	0.59		

* Structure of Factors 2 and 3 using Gorsuch's 0.54 saliency level, i.e. $p \leq 0.01$

\+ Denotes variables which could have been included in each factor had the Burt-Banks criterion been used for saliency.

A criticism of Gorsuch's criterion is that it makes no adjustment for the number of variables or factors under consideration, yet theoretically, the acceptable value for a loading to be judged significant should increase with subsequent factors. The Burt-Banks formula provides a method for adjusting the level of significance of a factor loading, which allows not only for sample size, but also for the number of variables correlated and the number of factors extracted. The significance values for a three-factor solution and a sample size of 100 using the Burt-Banks formula were respectively 0.255, 0.261 and 0.268, i.e. the values for the second and third factors were respectively 2.4% and 5.1% larger than the value for the first factor. If this value were adopted for Gorsuch's criterion then the values for the first, second and third factors would be respectively 0.40, 0.41 and 0.42 for $P \leq 0.05$ and 0.54, 0.55 and 0.57 for $P \leq 0.01$. Adoption of either of the above criteria would make very little difference to the salient loadings of either Factor 1 or Factor 2 of the meat in general factor solution. However, a value of 0.42 for the third factor would eliminate fat content from Factor 3. The adoption of the above criterion, whilst not markedly affecting the meat in general factor solution, could have marked results on other solutions, with the effect of producing unique factors for the later factors, i.e. Factors 2, 3 or greater.

11.4.3 Extraction of Factors

With the present study, Kaiser's criterion and Cattell's Scree test were used to determine the optimum number of factors that should be extracted from the data. The number of factors extracted for each meat sub-group together with the total variance extracted by the factors is shown in Table 11.16 for each data. Also shown is the number of factors needed to extract 80% of the variance.

Table 11.16 Number of Factors Extracted from each Data Set and Total Variance Accounted for by the Factors

Meat Sub-group	No. of Factors Extracted	Total Variance Extracted by Factors	No. of Factors Needed to Extract 80% of Variance
Meat in general	3	69.6%	6
Beef cuts	4	64.9%	7
Sheep meat cuts	3	72.4%	5
Pig meat cuts	3	64.1%	7
Offal cuts	3	72.8%	5

As can be seen from Table 11.16, in none of the analyses was more than 73% of the total variance extracted using Kaiser's criterion. It could be argued that no solution should be accepted unless 80 or 85% of the variance had been extracted. This was certainly the traditional approach adopted by factor analysts. However, as Cattell's Scree test clearly shows, when additional factors are extracted, the new additional factors each add a very small percentage to the total extrated variance. However, as a result of the extraction of additional factors in an attempt to meet the 80% total variance criterion, it is usual to see the loadings change on all factors, and the factors become increasingly complex as a result of variables loading on numerous factors. Computational time and therefore costs are increased and as Gorsuch (1983) states it is "very difficult to replicate the small additional factors in new studies." His advice is to follow the Kaiser criterion and particularly the Cattell Scree test since other research studies have shown the last two mentioned methods to accurately predict the number of underlying factors in 80% of cases. According to Gorsuch (1983) the 80% extracted variance criterion tended to overestimate the number of factors in 90% of studies and generally results in a number of additional trivial factors.

As Gorsuch (1983) points out, "there are few studies where the variables are thought to be error-free and where all the variance can be expected to be predicted from the factors. This is particularly true of the social sciences and at the growing edge of other sciences where factor analysis is often used."

Initial analysis of the meat sub-groups data using the 80% variance criterion confirmed Gorsuch's findings that the additional factors added little in the way of percentage variance, tended to complicate the interpretation of the factors as a result of variables being loaded onto a number of factors and usually resulted in the latter factors only having one or at best two salient variables. As a consequence, it was decided that Kaiser's criterion checked by Cattell's Scree test would be used as the criteria to determine the number of factors that should be extracted.

11.4.4 Comparison of Varimax Rotated Factors for Meat Groupings

A comparison of the rotated factor patterns for the various meat groups: meat in general; beef, sheep meat, pig meat and offal has been presented in Table 11.17. Using Gorsuch's 0.4 criterion for saliency there appeared to be a general broad agreement on Factor 1 for all the meat groups except beef.

Table 11.17 Comparison of Varimax Rotated Factors for Meat Groupings

Factor 1 Meat Quality on Buying

Attitude	All Meat	Beef	Sheep meat	Pig meat	Offal
Stringiness	0.84	0.70	0.75	0.84	0.81
Spicing requirement	0.82	0.65	0.81	0.79	0.75
Wastage	0.78	0.85	0.58	0.71	0.79
Convenience	0.78	0.43	0.59	0.71	0.63
Fat content	0.72	0.69	0.57	0.56	0.78
Bone content	0.76	0.79	-	0.70	0.78
Tenderness	0.57	-	0.64	0.53	0.53
Juiciness	0.57	-	0.68	0.50	0.50
Acceptability of flavour	-	-	-	-	0.41
Acceptability of colour	-	-	-	-	-
Flavour strength	-	-	-	-	0.52
Value for money	-	-	-	-	-
Preparation time	0.58	0.47	0.53	0.53	0.60
Nutritional value	-	-	-	-	0.69
Prestige	-	-	-	-	-
Number of dishes	-	-	-	-	-
Cooking time	0.54	-	0.71	0.67	-
Expense	0.40	-	0.50	-	0.67

Factor 2: Meat Quality on Eating

Stringiness	-	-	-	-	-
Spicing requirement	-	-	-	-	-
Wastage	-	-	-	-	-
Convenience	-	-	-	-	-
Fat content	-	-	-	-	-
Bone content	0.49	-	0.43	0.50	
Tenderness	0.46	-	0.64	-	-
Juiciness		0.41	-	-	-
Acceptability of flavour	0.67	0.54	0.73	0.56	0.66
Acceptability of colour	0.65	0.59	0.69	0.45	0.54
Flavour strength	0.53	0.78	0.66	0.55	0.57
Value for money	0.64	0.59	0.62	-	0.64
Preparation time	0.59	0.47	0.60	0.54	0.52
Nutritional value	0.50	0.53	0.53	-	0.50

Table 11.17 (continued)

Factor 3: Meat Quality on Cooking and Serving

Attitude	All Meat	Beef	Sheep meat	Pig meat	Offal
Stringiness	-	-	-	-	-
Spicing requirement	-	-	-	-	-
Wastage	-	-	0.42	-	-
Convenience	-	0.47	0.49	-	0.50
Fat content	-	0.44	0.54	0.59	-
Bone content	-	-	0.65	-	-
Tenderness	-	0.51	-	0.46	0.51
Juiciness	0.43	0.60	-	0.48	0.53
Acceptability of flavour	-	-	-	-	-
Acceptability of colour	-	-	-	-	-
Flavour strength	-	-	-	-	-
Value for money	0.42	-	0.56	0.56	0.51
Preparation time	-	-	-	-	-
Nutritional value	-	-	-	0.58	-
Prestige	0.77	0.58	0.83	0.61	0.73
Number of dishes	0.71	0.50	0.76	0.71	0.73
Cooking time	0.69	0.84	0.52	0.54	0.71
Expense	0.51	0.60	0.56	0.56	-

If the meat in general solution was adopted as the model, then the sheep meat and pig meat solutions were very similar differing only in one variable on Factor 1. The offal sub-group had more salient loadings than Factor 1 of the meat in general solution, 13 in total, and the first offal factor was close to being a general factor. The beef sub-group Factor 1 had only 7 of the 11 salient loadings of the meat in general factor. The difference was in part due to the extraction of a fourth factor for the beef data.

With Factor 2, there was once again a strong agreement between meat groupings with only the pig meat sub-group differing from the meat in general solution and the other solutions. However, the factor solutions for the meat groupings in Factor 3 did not show quite the same agreement with meat in general as was evidenced for Factors 1 and 2. In general,

the meat sub-groups tended to have a higher number of variables loading saliently than was the case for meat in general. Moreover, the sub-groups tended to have rather different variables loading when compared to one another than was the case for the first two factors.

If a value of 0.54 rather than 0.4 (i.e. $P \leq 0.01$ rather than $P \leq 0.05$) was adopted for determining saliency then the degree of agreement between the various meat sub-groups on each of the factors would not be as good as it had been for salient loadings of 0.4.

Factor 1 for the meat in general factor pattern matrix would have shown little change if saliency values of 0.54 were adopted with only expense being rejected. With the beef sub-group two variables, namely preparation and convenience would be rejected. With sheep meat, expense and preparation would be rejected from the first factor, whilst tenderness, juiciness and preparation would be rejected from the pig meat data. With offal, four variables would be rejected. With all of the meat sub-groups apart from meat in general the adoption of the 0.54 value as the saliency criterion would result in a simplified factor structure.

With Factor 2 the reverse of the above was true, i.e. the meat in general factor was simplified to a greater extent than the beef and sheep meat sub-groups. Although the pig meat second factor as a result of the 0.54 criterion became much simpler and only loaded with three variables.

As a result of the 0.54 saliency criterion the Factor 3 of the meat in general factor was reduced to the three variables of prestige, number of dishes and cooking time - a much simpler factor structure than any of the meat sub-groups.

Whilst there appeared to be general agreement between the first two factors if an 0.4 saliency criterion was used, this was certainly not the case for an 0.54 saliency criterion. The biggest differences between the various meat sub-groups occurred in the third factor, particularly if a value of 0.54 was used to determine the saliency.

An examination of the respective solutions for Factor 1 showed that the only variables to appear in all meat sub-groups were: preparation time,

wastage, spicing requirements, stringiness, fat content and convenience. With the other variables one or more of the sub-groups either possessed or did not possess the particular variable. With Factor 2 the only variables to appear for all meat sub-groups were flavour strength, meat colour acceptability, meat flavour acceptability and preparation time, and with Factor 3 the only variables to appear for all meat sub-groups were the number of dishes, cooking time and prestige, i.e. special occasions.

McFadyen et al. in their 1973 study, although they used a different set of variables, found that there were only certain attitude variables which were common to all meat, meat sub-groups and individual meats and these were tenderness, nutrition and guests. They also observed that there were additional variables that seemed to be specific to one or more of the meat sub-groups such as fat, waste, packaging and lunch for beef cuts and pork cuts, and that on top of these sub-groups specific attitudes there were additional attitudes that were specific to a single meat. To use a taxonomic comparison, they found that there were certain attitudes that were common to all meats, other attitudes that differentiated sub-groups from one another and finally attitudes that differentiated one cut of meat from another within the same meat sub-group. Whilst the present results have not gone quite so far, there are certain indications which reinforce the implied observations of McFadyen et al., namely that consumers appear to have attitudes which are common for all meats, and attitudes specific to meat sub-groups. In other words it would appear even for the limited number of variables included in the present study that the rotated Factor Pattern Matrix for each meat sub-group provides a fingerprint or chromatograph of attitudes specific to the meat sub-group which enables meat sub-groups to be differentiated one from the other.

11.5 CONCLUSIONS

* A comparison of the Varimax, Quartimax, Equimax and Oblique factor patterns resulting from the analysis of the attitude data for meat in general, beef, sheep meat, pig meats and offal showed that Quartimax tended to produce a general factor, with few variables being loaded on subsequent variables. With the exception of the beef data, the

Quartimax factor pattern was quite different to the factor patterns produced by the other rotational procedures.

It was also found that the Equimax procedure produced factor patterns that were almost identical to the factor patterns produced by the Varimax rotational procedure.

The Oblique rotational procedure produced factor patterns for all the meat sub-group data which came closest to meeting Thurstone's (1935) criteria for simple structure.

* On the basis of the results of the comparison of the factor patterns produced by the four rotational procedures available in the SPSS Factor programme it is suggested that the use of the Varimax orthogonal rotation procedure together with an Oblique rotation of the principal components is sufficient to explore the structure of the factors underlying meat attitude data.

* Schlinger's criterion and the Burt-Banks formula produced saliencies which were generally too low and the resulting factors were extremely complicated and difficult to interpret.

* Use of Gorsuch's criteria to select salient variables, i.e. 2 x standard error of correlation for $p \leq 0.05$, 0.40 resulted in factors in the Varimax and Equimax rotated factor structure for all the meat groupings that had variables loading on more than one factor. The Oblique rotation factor solution loaded most of the attitude variables on only one factor for all the different meat groups.

  Use of Gorsuch's formula for $p \leq 0.01$, i.e. saliency values of 0.54 generally overcame the problems of variables loading on two factors, and produced very simple factor structures that met Thurstone's requirements for simple structure.

* The Varimax rotated factor structures for the various meat groupings, i.e. meat in general, sheep meat, pig meats and offals were very similar for the first two factors if saliencies of 0.4 or greater were accepted. The beef factor solution was quite different to the

other meat sub-groups, because a fourth factor was extracted. As a result of the additional factor extracted for beef, the loadings of the variables on the other factor were affected. All the meat sub-group solutions were different on the third factor.

If saliencies of 0.54, i.e. $p \leq 0.01$ were accepted as significant then the broad agreement between the Varimax rotated solutions of the various sub-groups decreased as a result of a simplification of the factor structures. The second and third factors were particularly sensitive to the 0.54 saliency criterion.

* The first extracted factor for all solutions was tentatively named 'Meat quality on buying' and was generally loaded with the following variables: stringiness; spicing requirement; wastage; convenience; fat content; bone content; tenderness; juiciness; preparation and cooking time.

* The second extracted factor for all solutions was tentatively called 'Meat quality on eating' and was generally loaded with the following variables: bone content; tenderness; acceptability of flavour; acceptability of colour; flavour strength; value for money; preparation time and nutritional value.

* The third extracted factor for all solutions was tentatively called 'Meat quality on cooking and serving' and was generally loaded with the variables: juiciness; value for money; prestige; number of dishes; cooking time and expense.

* The Factor Score coefficients for the attitudes from the meat in general PA2 Factor run were used to calculate the scores for the 45 meats on the 3 Factors: 'Meat quality on buying'; 'Meat quality on eating' and 'Meat quality on cooking and serving'. These scores for each of the meats on the three Factors were then used in Chapter 14 to predict per capita consumption of the 45 meat cuts, preference ratings for the 45 meat cuts and also the proportion of households that would consume each cut.

CHAPTER 12

FACTOR ANALYSIS OF CONSUMER ATTITUDES TO 45 MEAT CUTS

The 45 meat cuts were scored by the respondents for eighteen product characteristics. The attitude data for each of the meat cuts was factor analysed by the principal factor PA2 method, rotated orthogonally by the Varimax procedure and also by the Oblique rotational procedure. Q-Factor analysis was used to group the meats on the basis of the consumers' attitudes.

12.1 INTRODUCTION

In past studies (Baron et al., 1973; Hughes, 1976b; Gendall, 1978; Baron et al, 1981), the researchers asked 1,100 consumers to rate between 6-12 meats on a number of attitudes deemed pertinent by the researchers to meat consumption. In spite of obvious differences in attitudes between individual products, the attitude data for each of the meats were aggregated to give an attitude construct for meat in general and this data was factor analysed by the principal factor PA2 procedures, and rotated orthogonally by the Varimax procedure. The resulting Factor Matrix was used to determine the basic factors for meat in general and also the Factor Score for each respondent. The relationships between the consumption of the specific cuts and this attitude data and also socio-economic data were analysed by Multiple Regression. The advantage of using Factor Score Coefficients in multiple regression as opposed to the original attitude scores is that the Factor Score Coefficients are uncorrelated, unlike the original attitude data which are usually highly intercorrelated. All the studies found that socio-economic data, whilst only accounting for between 20 and 30% of the variance, were more significant in predicting the consumption of the specific cuts of meat than the attitude data.

A number of questions arise as a result of the seemingly poor contribution of attitudes towards the prediction of meat consumption. One question relates to the very definition of attitudes, namely "that they are a pre-disposition to behave in a paraticular way" (Baron et al., 1981). The second relates to the methodology adopted by these workers, namely the aggregation of attitudes towards individual meats to produce

an overall construct for 'meat in general' and then the use of the Factor Score Coefficients for the 'meat in general' to determine consumer attitudes towards the individual products. The present analysis, in Chapter 11, of the attitudes relating to 'meat in general', beef, sheep meat, pig meat and offal had suggested, on the basis of the difference between the factor patterns for the various meat sub-groups, that it is possible to segregate the meat sub-groups one from another on the basis of consumer attitudes, and that the approach taken by Baron et al. (1981) and others was possibly not the most useful one.

It was decided, therefore, that Q-Factor Analysis would be used to determine whether themeats could be segregated on the basis of the consumers' overall attitudes to meat, attitudes to 'meat quality on buying' (Factor 1 for 'meat in general'); attitudes to 'meat quality on eating' (Factor 2 for 'meat in general') and attitudes towards 'meat quality on cooking and serving' (Factor 3 for 'meat in general).

The Q-technique, as it is more often called, arose from problems where the central issue was the grouping of individuals. The intent of the technique was to identify classes of individuals so that any new individual could be placed in that group which she or he most resembled as defined by the factor-analytic search (Gorsuch, 1983).

The definition for Q-Factor Analysis is:

$$Z_{vn}^{1} = F_{vf}^{1} P_{fn}$$

where Z is a data matrix standardized by rows (n), F the factor scores of the v variables on the f factors, and P contains the weights by which each of the n individuals' variable scores can be reproduced from the factor.

The factor loadings of P indicate to what extent each individual, or as in the present study each meat cut, resembles a hypothetical prototype. If the prototype product actually existed, then that product would clearly load a single factor. According to Gorsuch (1983), the results differ considerably from traditional typology because the factor matrix gives the relationships of each product to each of the hypothetical product types and, unless an exceptionally good simple structure is

found, most products tend to be related to more than one of the typological factors.

Cattell and Coulter (1960) used the Q-technique to explore the relationships of British naval ships. They used Jane's Fighting Ships as the source of their data. The variables they used included such characteristics as the number of light guns, submersibility, and the number of personnel. Their analysis resulted in separate factors for air-craft carriers, destroyers, frigates and cruisers, though submarines were negatively loaded in the destroyers' hypothetical factor.

The Q-technique can clearly differentiate objects on the basis of a set of variables and for this reason was of interest in the present study. If the meats could not be separated on the basis of consumers' attitudes by the Q-technique then the approach adopted by Baron et al (1981) and other researchers would clearly be the appropriate procedure to handle attitude data. The seemingly poor predictive contributions of attitudes towards meat consumption (Baron et al., 1981) raises the whole question of the necessity to obtain consumers' attitudes towards meat to predict consumption. If on the other hand, the meats could be separated on the basis of attitudes, then the hypothesis of King (1973) that a product is a unique blend of appeals could be extended to meat cuts. This would mean that meat cuts should be marketed and developed in much the same way as other consumer food products.

12.2 RESEARCH PROCEDURE

The sample of respondents and questionnaire format are identical to those described in Section 11.2.

12.2.1 General Factor Analysis

The collected attitude data for each meat cut were Factor analysed using the SPSS PA2 factoring procedure with 50 iterations. The number of Factors to be rotated was controlled by Kaiser's criterion (eigen values ≥ 1) together with Cattell's Scree test. The factors were then rotated orthogonally by the Varimax rotational procedure and also by the Oblique rotational procedure. Only the above two rotational procedures were used as it was shown in Chapter 11 that the Equimax rotational procedure

produced an almost identical solution to the Varimax procedure and that the Quartimax rotational procedure tended to condense the data into less factors than the other rotational procedures and to produce a general factor on the first factor.

The saliency of the loadings was determined by the use of Gorsuch's criterion with a significance of $p \leq 0.05$ (i.e. loadings ≥ 0.4 were considered to be significant and all loadings less than 0.4 were deemed to be a result of chance correlations).

Factor Score Coefficients for each respondent for each of the 45 meat cuts were also determined so that the attitude data for each meat cut could be condensed into as few salient uncorrelated factors as possible. In the analysis of the attitude data pertaining to the individual meat cuts the data was arranged in 45 subfiles, where each subfile was a 92 x 18 matrix, i.e. 92 respondents as rows and 18 attitudes as columns of data and each subfile was re-arranged to give 18 subfiles consisting of a matrix of 92 respondent rows by 45 meat columns. Each subfile was analysed separately.

The 18 subfiles were then grouped together to give four separate subfiles. The attitudes of stringiness, spicing requirement, wastage, convenience, fat, bone content, tenderness, juiciness, preparation and cooking, i.e. the attitudes 'Meat quality on buying' were arranged in a 920 row by 45 meat matrix to form the first attitude subfile. The attitudes of bone cntent, tenderness, flavour acceptability, colour acceptability, flavour strength, value for money, preparation and nutritional value were combined to give a second subfile which was called 'Meat quality on eating' attitudes. The attitudes relating to 'Meat quality on cooking and serving', i.e. juiciness, value for money, prestige, number of dishes, cooking time and expense, were combined to give a third subfile and then all 18 attitude subfiles were combined to give an overall attitude structure towards the 45 meat cuts, (i.e. a 1656 row by 45 column matrix). Each of the four subfiles was factor analysed using the SPSS PA2 Factoring procedure with 50 iterations. The number of factors to be rotated was determined by the application of Kaiser's criterion (i.e. eigen values ≥ 1.0) and the appropriateness of the Kaiser's criterion was double-checked by Cattell's Scree test.

The factors were rotated by both the Varimax and Oblique rotational procedures. With the Oblique procedure, delta was set at -4.0, -3.0, -2.0, -1.0, 0 and 1.0. A delta value of 0 gave the Factor structure which came closest to Thurstone's (1935) criterion of 'simple structure'.

The saliency of the loadings was determined by using Gorsuch's criterion at a significance level of $p \leq 0.05$ (i.e. values ≥ 0.4 were considered to be salient).

12.2.2 Factor Analysis of Typical Products Using Q-Factor Analysis

The 45 meat cuts were Q-Factor analysed using the following four attitude subfiles:

* All 18 attitudes;
* The 'Meat quality on buying' attitudes;
* The 'Meat quality on eating' attitudes; and
* The 'Meat quality on cooking and serving' attitudes.

With the 18 attitudes subfile, 7 'Hypothetical Products' were identified whilst 9 'Hypothetical Products' were identified for each of the remaining attitude subfiles.

Meats representing each of the 'Hypothetical Products' from the Q-Factor analysis of the 18 attitude subfile were identified and the 92 row by 18 column matrix of each meat cut representing a 'Hypothetical Product' was Factor analysed using the SPSS PA2 Factoring procedure. The number of extracted factors was controlled by Kaiser's criterion and Cattell's Scree test; the extracted factors were rotated by both the Varimax and Oblique rotational procedures and the saliency of the loadings was those greater than 0.4.

The above procedure was repeated for the 9 meat cuts representing the 9 'Hypothetical Products' resulting from the Q-Factor analysis of the 'Meat quality on buying' attitudes; 'Meat quality on eating' attitudes and the 'Meat quality on cooking and serving' attitudes.

The overall objective of the above analysis was to determine whether Q-Factor analysis segregated the 45 cuts of meat into either 7 or 9

'Hypothetical Products' on the basis of the similarity of the Factor Structures of the meats which were grouped into individual 'Hypothetical Products' or whether the technique used some other criteria on which to base the meat cut segregation or typology.

12.3 Q-FACTOR ANALYSIS OF THE 45 MEAT CUTS ON THE BASIS OF 'MEAT BUYING' ATTITUDES

12.3.1 Q-Factor Analysis

The results of the Q-Factor analysis are presented in Table 12.1. Nine Factors or hypothetical products were extracted from the data and these nine factors accounted for 65.1% of the variance in the data.

The correlation coefficients of the meat with the respective factor provided an indication of the degree to which each product represented the hypothetical product. It can be seen from Table 12.1 that no hypothetical product existed in the sample of products used in the present survey, although mutton neck chops with a loading of 0.88 came closest of all the products to representing a hypothetical product.

Lamb forequarter, mutton neck chops, garlic sausage, luncheon, beef tongue, stewing steak, hogget loin chops, ham steaks and rump steak were respective representatives of each of the nine hypothetical products.

'Hypothetical Product 1' comprised all the lamb cuts, leg of pork, pork chops, ham-on-the-bone and chicken. The loadings of the last four products were respectively 0.52, 0.47, 0.41 and 0.41 indicating a decrease in their similarity with lamb forequarter. The very similar loadings of the four lamb cuts indicated a high degree of similarity between the cuts, though the small differences also indicated discernible attitudinal differences to the four lamb cuts.

'Hypothetical Product 2' comprised the four mutton cuts together with hogget neck chops. A loading of 0.44 for the latter indicated a limited degree of similarity with the mutton cuts. As was observed for the lamb cuts the mutton cut loadings changed within the factor suggesting discernible attitudinal differences between the products.

Table 12.1 Varimax Rotatated Q-Factor Matrix of 'Meat Quality on Buying' Attitudes

Hypothetical Product 1		Hypothetical Product 2		Hypothetical Product 3		Hypothetical Product 4		Hypothetical Product 5	
Meat	Value	Meat	Value	Meat	Value	Meat	Value	Meat	Value
Lamb forequarter	0.74	Mutton neck chops	0.88	Garlic sausage	0.78	Luncheon	0.62	Beef tongue	0.69
Leg of lamb	0.72	Mutton loin chops	0.84	Salami	0.76	Beef sausages	0.61	Beef heart	0.64
Lamb loin chops	0.67	Leg of mutton	0.76	Frankfurters	0.74	Pork sausages	0.58	Lambs' kidney	0.60
Lamb neck chops	0.67	Mutton forequarter	0.76	Black pudding	0.70	Saveloys	0.53	Lambs' liver	0.59
Leg of pork	0.52	Hogget neck chops	0.44	Ham & chicken	0.41	Beef mince	0.49	Beef tripe	0.55
Pork chops	0.47					Ham & chicken	0.47		
Ham-on-the-bone	0.41								
Proportion of variance	30.3		7.9		6.6		5.3		3.9

Hypothetical Product 6		Hypothetical Product 7		Hypothetical Product 8		Hypothetical Product 9	
Meat	Value	Meat	Value	Meat	Value	Meat	Value
Stewing steak	0.63	Hogget loin chops	0.71	Ham steaks	0.61	Rump steak	0.45
Topside	0.60	Hogget forequarter	0.68	Ham-on-the-bone	0.47	Wienersnitzel	0.41
Corned beef	0.54	Leg of hogget	0.64	Sliced ham	0.38		
		Hogget neck chops	0.50	Fish	0.37		
Proportion of variance	3.3		2.9		2.6		2.3

Note: Middle bacon, shoulder bacon, hamburagers and pork pieces were not included in anyof the factors.

The four Continental sausage products together with ham & chicken made up 'Hypothetical Product 3', although ham & chicken only shared a limited similarity of attitudinal structure with the other products in the group. 'Hypothetical Product 4' consisted of sausage products and beef mince. 'Hypothetical Product 5' consisted of the 5 offal products and the loadings varied from 0.69 to 0.55 indicating a limited agreement with the Hypothetical Product but broad attitudinal agreement between the 5 offal products.

Stewing steak, topside and corned beef made up 'Hypothetical Product 6'; the four hogget cuts made up 'Hypothetical Product 7', although hogget neck chops with a loading of 0.5 wre seen by the consumers to be slightly different from the other hogget cuts.

Ham steaks and ham-on-the-bone made up 'Hypothetical Product 8'. Sliced ham and fish with loadings of 0.38 and 0.37 respectively were not included in any of the factors, buthad the highest loadings in 'Hypothetical Product 8' indicating some slight similarities with ham steaks. Rump steak and wienersnitzel made up 'Hypothetical Product 9' with very low loadings of 0.45 and 0.41 respectively indicating a poor similarity with the prototype of hypothetical product.

Middle bacon, shoulder bacon, hamburgers, pork pieces, sliced ham and fish were not saliently loaded on any of the factors, indicating quite different buying attitudes for these meats compared with themeats loaded saliently on any one of the 9 Hypothetical Products.

12.3.2 Structure of Varimax Rotated 'Meat Buying' of Each of the 9 Meats Selected to Represent the 9 Hypothetical Products

The factor loading scores for each meat attitude for each of the 9 meat cuts, i.e.lamb forequarter, mutton neck chops, garlic sausage, luncheon, beef tongue, stewing steak, hogget loin chops, ham steaks and rump steak are presented in Table 12.2. In addition to the factor structure, the proportion of variance accounted for by each factor together with the factor number in which the 'Meat buying' attitude variables were extracted are presented in Table 12.2.

In general, the 'Meat buying' factor was extracted as the first factor for most of the meat cuts. In the case of lamb forequarter, mutton neck

Table 12.2 Structure of Varimax Rotated Factor 1 (Meat Quality on Buying Attitude) for the 9 Groupings Identified by Q-Factor Analysis

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8	Group 9
	Lamb Forequarter	Mutton neck chops	Garlic sausage	Luncheon	Beef tongue	Stewing steak	Hogget loin chops	Ham steaks	Rump steak
Stringiness	0.80	0.74	0.81	0.68	0.73	0.46	0.49	0.81	0.71
Spicing requirement	0.80	0.80	0.74	0.72	0.61	0.70	0.58	0.67	0.65
Wastage	0.49	0.53	0.83	0.65	0.75	0.71	0.46	0.72	0.77
Convenience			0.79	0.61	0.40		0.71	0.78	0.75
Fat content	0.49	0.45	0.59	0.57	0.65	0.62	0.62	0.67	0.67
Bone content			0.71	0.72	0.80	0.65		0.82	0.73
Tenderness	0.84	0.63	0.62	0.46	0.56			0.62	
Juiciness	0.67	0.68	0.58		0.46	0.40	0.65	0.53	0.58
Acceptability of Flavour					0.42			0.53	
Acceptability of colour									
Flavour strength	0.48	0.41							
Value for money			0.55						
Preparation time	0.70	0.57	0.70	0.67	0.49			0.73	0.62
Nutritional value		0.41			0.67				
Prestige									
Number of dishes									
Cooking time	0.45	0.57	0.69				0.60	0.70	0.69
Expense		0.43	0.74	0.71	0.55		0.70		0.62
Proportion of Variance	14.0	8.0	52.9	36.6	55.0	26.4	14.1	52.6	45.5
Extracted as Factor No.	2	2	1	1	1	1	2	1	1

chops and hogget loin chops the 'eating attitude' factor was extracted first followed by the 'buying attitude' as Factor 2. With stewing steak Factor 1 accounted for only 26.4% of the variance, but this was only due to the fact that 5 factors were needed to adequately describe the dimensions underlying the attitude data.

An examination of Table 12.2 indicates that the only attitudes toload on each of the individual 'meat buying' factor were: stringiness, spicing requirement, wastage and fat content. Juiciness loaded on all meat cuts except for luncheon. As was seen for the various sub-groups in Chapter 11, each meat cut tended to have similar loading values where the variables were common to meat cuts, and a variable loading pattern for the 'meat buying' attitudes which tended to be different and specific for each meat cut.

12.3.3 Mean 'Meat Buying' Attitude Scores for the 9 Meats Representing the 9 Hypothetical Products

The meat attitude scores for the 9 meat cuts representing the 9 Hypothetical Products are presented in Appendix 12.1 and as an attitude profile for each product in Figure 12.1.

An examination of Figure 12.1 (a, b and c) shows that the attitude profiles for the 9 meat cuts were indeed quite different. The more preferred products such as rump steak, ham steak and even luncheon (low on the preference scale, but served by 80% of households) were scored highly. Products which were low on the preference scale such as beef tongue and mutton neck chops were given low product ratings on all of the meat buying attitudes. Garlic sausage, essentially with the same product characteristics as luncheon sausage, was scored substantially lower on all buying attitudes compared to luncheon, essentially indicating a lack of knowledge leading to consumer misconceptions and bias to the products as less than 15% of households consumed the product.

The mutton neck chops were scored lower than hogget loin chops but had a similar shape except for convenience, which was very much lower for mutton neck chops.

The attitude profiles for the meats in one group were also compared. The profiles for the 5 meats belonging to the Hypothetical Product 2

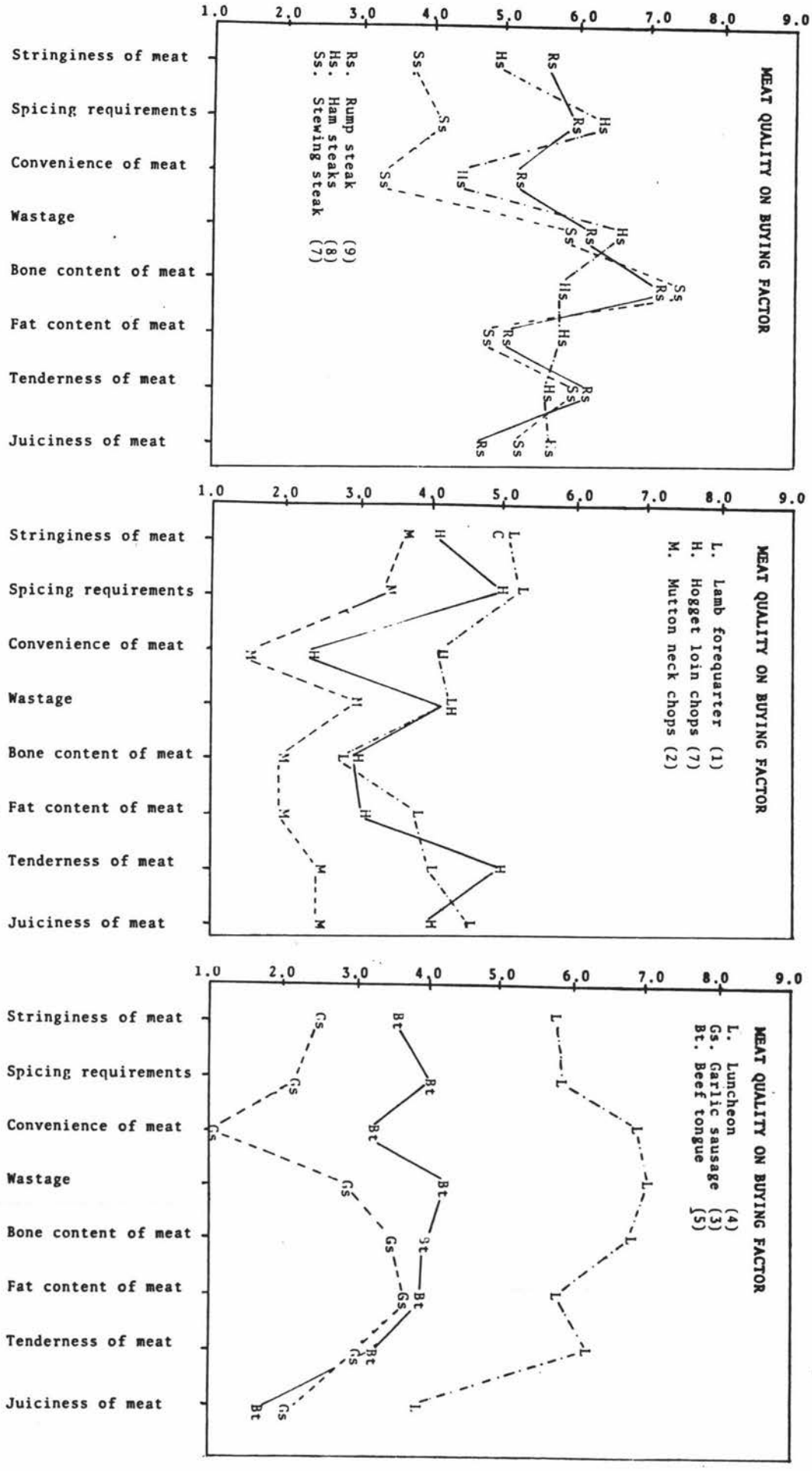

Fig. 12.1 Profiles for 9 'Hypothetical Product' Representatives of the 'Meat Quality on Buying' Factor.

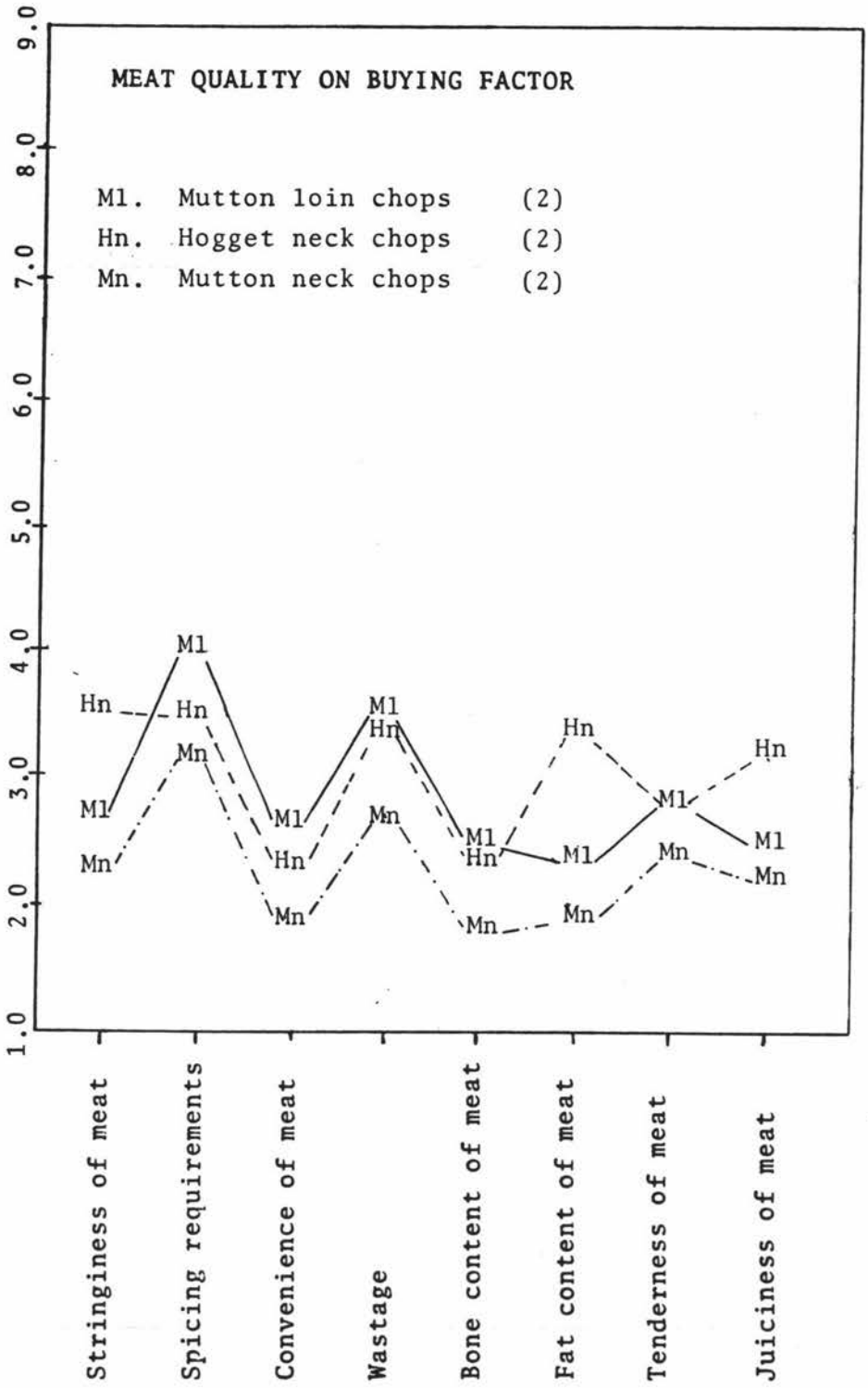

Fig. 12.2 Profiles for 3 Meat Cuts Representing 'Hypothetical Product' 2 of the 'Meat Quality on Buying' Factor

have been presented in Figure 12.2. As can be seen, the meats within Hypothetical Product 2 tended to have very similar-shaped profiles, with subtle differences. The attitude profiles of the meats belonging to the othr Hypothetical Products were very similar within each group. The meats had very similar-shaped profiles, differing mainly in the magnitude of the scores on certain attitude variables, and with deviations from the general shape also occurring in one or two variables, particularly for the meats with low loadings on the factor.

12.4 Q-FACTOR ANALYSIS OF THE 45 MEAT CUTS ON THE BASIS OF 'MEAT EATING' ATTITUDES

12.4.1 Q-Factor Aalysis

The 8 salient attitudes to 'basic meat eating' included: bone content, tenderness, flavour acceptabiity, colour acceptability, value for money, preparation time and nutritional value. The 45 meats were factored in the same way as outlined in 12.2.2. The results of the Q-Factor analysis are presented in Table 12.3. As with the 'meat buying' attitudes, nine factors were extracted which accounted for 68.4% of the variance in the data.

The nine Hypothetical meat cuts were represented by sliced ham, mutton neck chops, luncheon, beef tongue, lamb neck chops, rump steak, garlic sausage, hogget loin chops and chicken.

Hypothetical Product 1 contained all the pig meat cuts and also corned beef, leg of lamb and porterhouse steak. None of the meat cuts had a particularly highloading with sliced ham having the largest loading at 0.67. The loadings for the 3 ham products were very similar; 0.67, 0.65 and 0.65 respectively for sliced ham,ham-on-the-bone and ham steaks. Then came the 3 pork products; leg of pork, pork chops and pork pieces with loadings of 0.59, 0.57 and 0.53 respectively. The two bacon products, whilst belonging to group 1, were closer to the non-pig meat products than the pig meat group.

The mutton cuts made up Hypothetical Product 2 with all four products having very similar loadings; though mutton forequarter and leg of

Table 12.3 Varimax Rotated Q-Factor Matrix of 'Meat Quality on Eating' Attitudes

Hypothetical Product 1		Hypothetical Product 2		Hypothetical Product 3		Hypothetical Product 4		Hypothetical Product 5	
Meat	Value	Meat	Value	Meat	Value	Meat	Value	Meat	Value
Sliced ham	0.67	Mutton neck chops	0.77	Luncheon	0.77	Beef tongue	0.80	Lamb neck chops	0.75
Ham steaks	0.65	Mutton loin chops	0.85	Saveloys	0.75	Beef heart	0.79	Lamb loin chops	0.72
Ham-on-the-bone	0.65	Mutton forequarter	0.81	Ham & chicken	0.65	Beef tripe	0.58	Lamb forequarter	0.67
Leg of pork	0.59	Leg of mutton	0.79	Beef sausages	0.64	Lambs' kidney	0.58	Leg of lamb	0.64
Pork chops	0.57			Pork sausages	0.62	Lambs' liver	0.49	Hogget neck chops	0.42
Pork pieces	0.53			Hamburgers	0.42	Black pudding	0.44		
Shoulder bacon	0.44			Frankfurters	0.40	Shellfish	0.41		
Corned beef	0.44								
Middle bacon	0.43								
Leg of lamb	0.42								
Porterhouse steak	0.40								
Proportion of variance	30.8		9.9		7.1		4.9		4.1

Hypothetical Product 6		Hypothetical Product 7		Hypothetical Product 8		Hypothetical Product 9	
Meat	Value	Meat	Value	Meat	Value	Meat	Value
Rump steak	0.65	Garlic sausage	0.81	Hogget loin chops	0.75	Chicken	0.73
Stewing steak	0.63	Salami	0.78	Leg of hogget	0.73	Fish	0.67
Beef mince	0.53	Frankfurters	0.62	Hogget forequarter	0.66		
Topside	0.49	Black pudding	0.56	Hogget neck chops	0.53		
Porterhouse steak	0.48						
Wienersnitzel	0.43						
Proportion of variance	3.8		2.9		2.5		2.3

mutton with loadings of 0.81 and 0.79 respectively were seen to be more similar to one another than to mutton neck chops.

The traditional sausage products, luncheon, saveloys, ham & chicken, beef sausages and pork sausages, together with hamburgers and frankfurters made up Hypothetical Product 3. Hamburgers and frankfurters with loadings of 0.42 and 0.40 respectively appeared to only share a few attitudes with the other products in the factor as evidenced by the factor loadings. Hypothetical Product 4 comprised the 5 offal products together with black pudding and shellfish. Black pudding is largely made from blood and so it was interesting to see this product included in the offal factor, though a loading of 0.44 indicated only a partial similarity with the other offal cuts. The inclusion of shellfish with a loading of 0.41 suggested that shellfish possessed some of the negative eating attributes possessed by the offal cuts.

The lamb cuts together with hogget neck chops comprised Hypothetical Product 5, just as had been the case with the buying attitudes, suggesting that the 5 products shared the same basic eating attitudes as well as buying attitudes.

The seven beef cuts, wienersnitzel, rump steak, porterhouse steak, stewing steak, beef mince, topside and corned beef were grouped in the Hypothetical Product 6 indicating that the seven beef cuts were seen by the consumers to have very similar eating characteristics to one another.

Chicken and fish occupied their own separate Hypothetical Product grouping indicating quite clearly that consumers see these products as being quite separate in terms of eating characteristics to the other 43 meats included in the survey.

12.4.2 Structure of Varimax Rotated 'Meat Eating' Factor of Each of the 9 Meats Selected to Represent the 9 Hypothetical Products

The Varimax rotated factors corresponding to the 'Meat quality on eating' factoridentified in Chapter 11 for each of the 9 meat cuts identified by Q-Factor analysis as being closest to the 9 Hypothetical Products are shown in Table 12.4. Included in the Table is the factor number in which the factor was extracted and the proportion of variance

Table 12.4 Structure of Varimax Rotated Factor 2 (Meat Quality on Eating Attitudes) for the 9 Groupings Identified by Q-Factor Analysis

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8	Group 9
	Sliced ham	Mutton neck chops	Luncheon	Beef tongue	Lamb neck chops	Rump steak	Garlic sausage	Hogget loin chops	Chicken
Stringiness								0.60	
Spicing requirement								0.64	
Wastage		0.41						0.53	
Convenience									-0.75
Fat content									
Bone content		0.70					0.44	0.45	
Tenderness		0.51				0.59		0.79	
Juiciness				0.50		0.48		0.48	
Acceptability of Flavour	0.57	0.74	0.81	0.70	0.59	0.69	0.78	0.60	0.49
Acceptability of colour	0.47	0.61	0.50	0.63	0.64	0.57	0.65	0.58	
Flavour strength	0.65	0.43		0.54		0.76	0.46	0.67	
Value for money	0.51	0.70	0.55	0.67	0.70	0.43	0.58	0.48	
Preparation time	0.44	0.41		0.51				0.79	
Nutritional value	0.53	0.57		0.46	0.61	0.52		0.52	
Prestige		0.50							
Number of dishes		0.79							
Cooking time								0.49	-0.56
Expense									
Proportion of Variance	12.2	57.7	7.4	6.5	5.6	12.3	6.8	5.4	9.4
Extracted as Factor No.	2	1	3	2	3	2	3	1	3

accounted for by the factor. In the case of hogget loin chops and mutton neck chops the 'Meat quality on eating' factor was extracted as the first factor and as a result accounted for the highest proportion of the variance in the data pertaining to each meat cut. With sliced ham, beef tongue and rump steak the 'Meat quality on eating' factor was extracted as the second whilst for luncheon, lamb neck chops, garlic sausage and chicken it ws extracted as the third factor.

The structure of the Varimax rotated 'Meat quality on eating' factor was unique for each meat cut with only flavour acceptability, colour acceptability and value for money being common to all 9 meat cuts.

Chicken had an extremely simple structure with convenience and cooking time being negatibely loaded against flavour acceptability. Luncheon too only had three variables loaded on the 'Meat quality on eating' factor and these were flavour acceptability, colour acceptability and value formoney. Garlic sausage, a communited product very similar in characteristics to luncheon sausage, had the additional attitudes of bone content and flavour strength loaded onto the factor in addition to the attitudes mentioned for luncheon sausage.

Mutton neck chops and lamb neck chops - the same cut but from animals of differing age - had markedly different factor structures with mutton neck chops being loaded with 7 additional attitudes to the ones loading onto lamb neck chops. And hogget loin chops had 2 more attitudes loading onto the 'Meat quality on eating' factor than mutton neck chops. However, in addition to two additional attitudes, the pattern of attitudes was different for hogget loin chops compared to mutton neck chops.

The 'Meat quality on eating' factor identified for meat in general which was identified in Chapter 11 ws matched by only one cut, namely sliced ham.

12.4.3 Mean 'Meat Eating' Attitude Scores for the 9 Meats Representing the 9 Hyothetical Products

The mean scores for the 8 'Meat quality on eating' attitudes, i.e. bone content, tenderness, flavour acceptability, colour acceptabiity, flavour strength, value for money, reparation time and nutritional value, for

the 9 meats are presented in Appendix 12.2 and in diagrammatic form in Figure 12.3.

An examination of Figure 12.3 shows that, with the exception of the attitude profiles of hogget loin chops and lamb neck chops which were similar, the remaining attitude profiles were quite different. As with the attitude profile of 'basic meat quality on buying' there were three distinct groupings of products. At the top of Figure 12.3, i.e. the positive end, are the more preferred products of chicken, sliced ham and rump steak. In the negative region can be found mutton neck chops, beef tongue and garlic sausage, and a middle group consisting of hogget loin chops and lamb neck chops. Luncheon sausage had an unusual profile in that it was seen to share equivalent status with chicken, rump steak and sliced ham on the bone content, tenderness and preparation attitudes, but only a medium response to flavour strength, colour acceptability, flavour acceptability, nutritional value and value for money.

In comparison to rump steak and sliced ham, chicken was downgraded on the basis of colour acceptability, flavour strength and bone content and ouscored the other two products with higher ratings for value for money, preparation time and nutritional value. Sliced ham scored badly on value for money and nutritional value.

In comparison to the three more preferred products, hogget loin chops and lamb neck chops received markedly lower ratings on all eight attitude variables and the rating for mutton neck chops was lower still. With the exception of leg of lamb which had the most positive of all the sheep cut attitude ratings, the respondents had a clearly negative view ofmost sheep meat cuts and in particular mutton cuts.

Garlic sausage had an identical attitude profile to lunehcon sausage exceptit was shifted quite markedly towards the negative end of the attitude scales. Garlic sausage had very similar attitude ratings to beef tongue, differing substantially only on flavour strength and preparation time. Continental smallgoods had a marked negative attitude towards them, particularly in the basic meat eating attributes which could explain the very low and slow market penetration for these products.

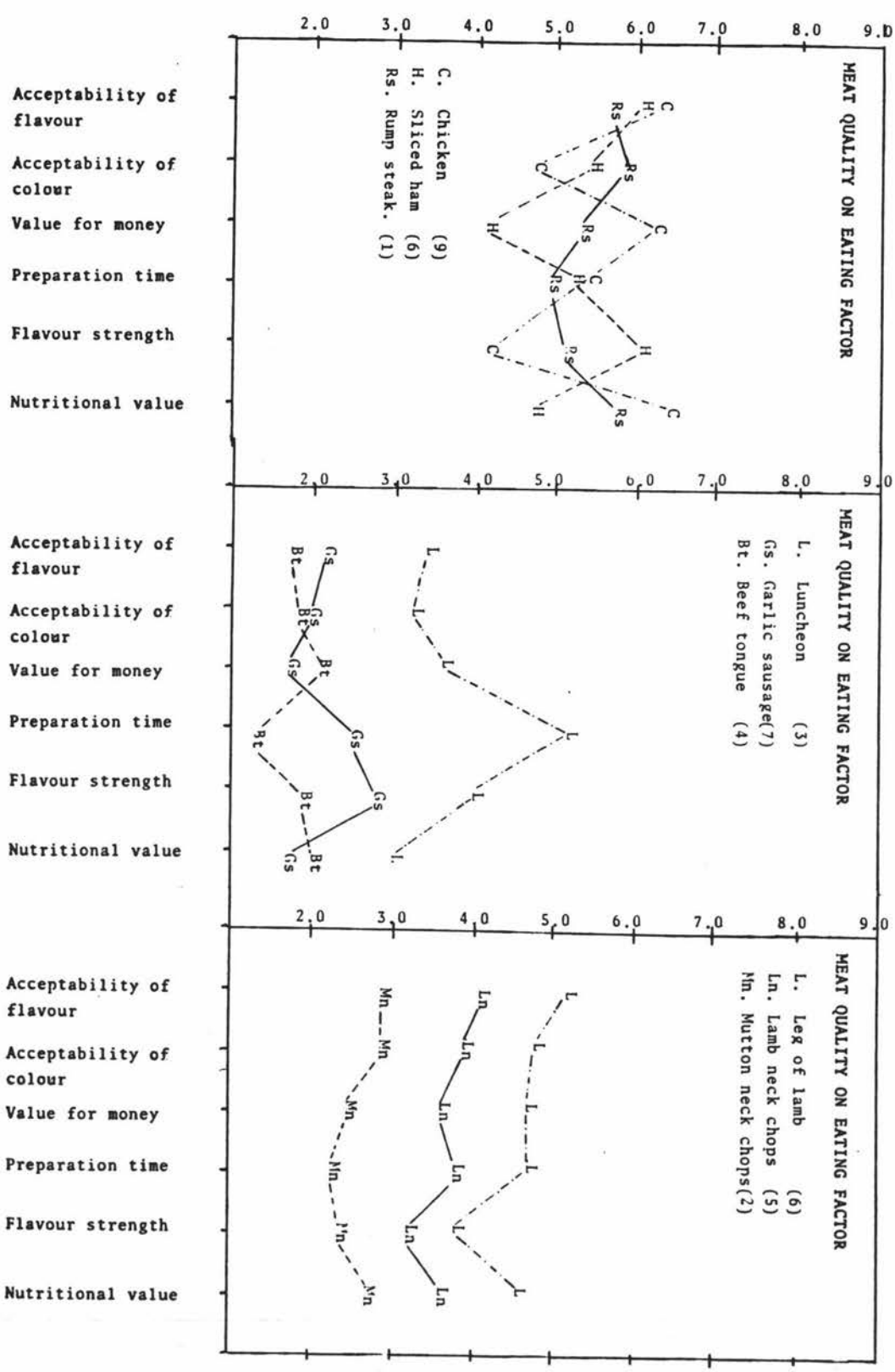

Fig.12.3 Profiles for 9 'Hypothetical Product' Representatives of the 'Meat Quality on Eating' Factor.

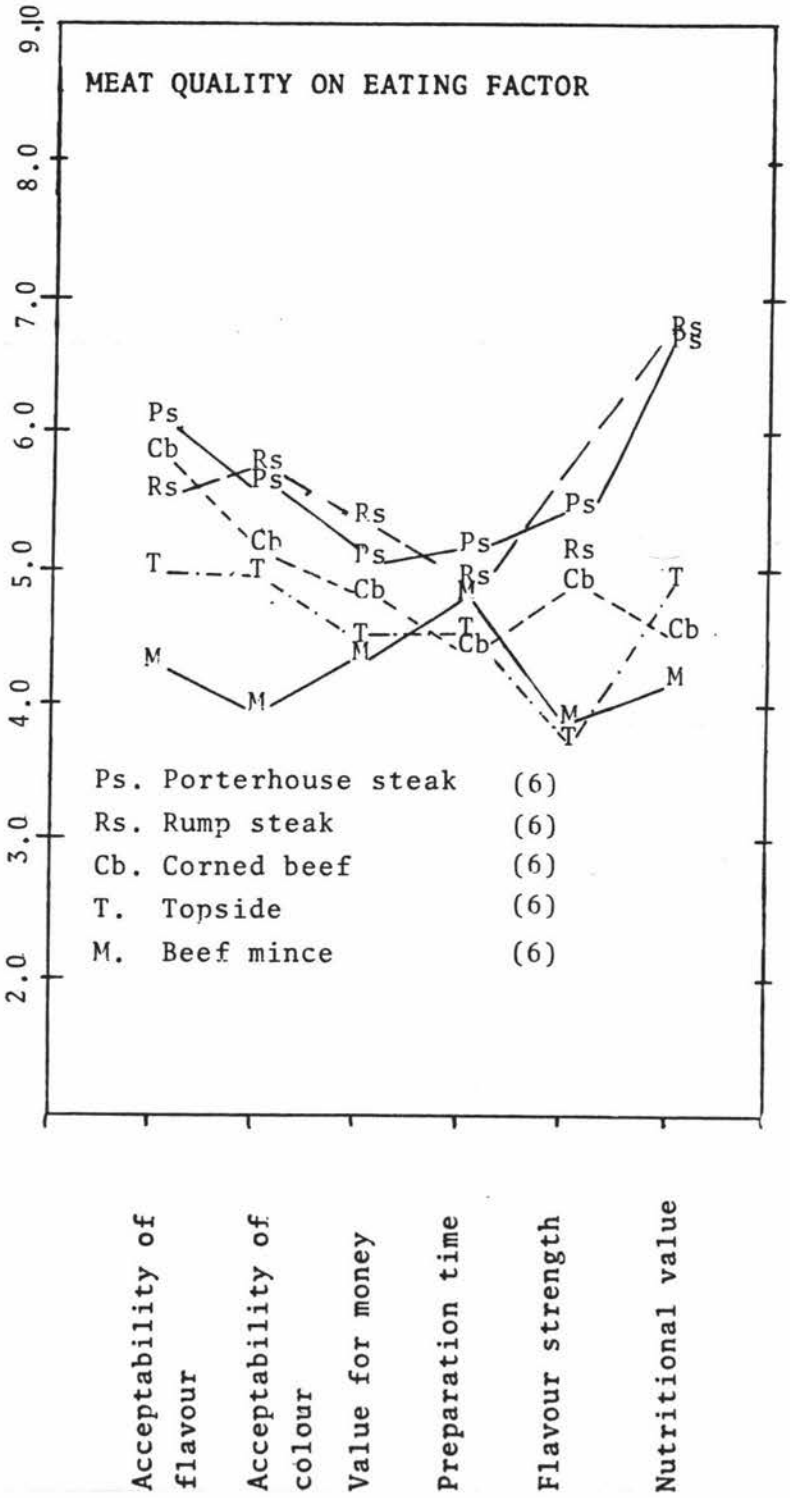

Fig. 12.4 Profiles for 6 Meat Cuts Representing 'Hypothetical Product' 6 on the 'Meat Quality on Eating' Factor.

As a contrast to the 9 meat cuts chosen to represent the 9 Hypothetical Products, the profiles of the 7 beef cuts in one Hypothetical Product, number 8, are presented in Figure 12.4. As can be seen from this figure, the profiles for the 7 beef cuts tended to have a very similar shape; though as would be expected from the loadings of the respective beef cuts, there were differences in the mean scores and indeed the shape of the profiles.

Porterhouse steak and rump steak had almost identical-shaped profiles as indicated by the closeness of the loadings. The less preferred and cheaper beef cuts such as wienersnitzel, topside, beef mince and stewing steak were given lower scores for flavour acceptability, colour acceptability and flavour strength than rump or porterhouse steak. Wienersnitzel of all the beef cuts was accorded the lowest score for value for money and preparation time. Beef mince was accorded the lowest flavour acceptability, colour acceptability and nutritional value scores of all the beef cuts. Corned beef with very similar scores on most attitudes to rump and porterhouse steak was accorded lower preparation time, colour acceptability and nutritional value scores than the two steak products.

12.5 Q-FACTOR ANALYSIS OF THE 45 MEAT CUTS ON THE BASIS OF 'COOKING AN SERVING' ATTITUDES

12.5.1 Q-Factor Analysis

The 'cooking and serving' attitudes included: juiciness, value for money, prestige, number of dishes, cooking time and expense. The results of the Q-Factor analysis are presented in Table 12.5. Once again 9 factors or Hypothetical Products were extracted from the data and these 9 factors accounted for 68.9% of the variance in the data.

Ham-on-the-bone, mutton loin chops, leg of lamb, luncheon, salami, chicken, beef tongue, hogget loin chops and lamb forequarter were identified as the 9 meat cuts to represent the 9 Hypothetical Products.

The groupings of the products within individual factors were not quite as clear cut for the 'cooking and serving' attitudes as they had been for either the 'buying' or 'eating' attitudes. In the 'eating'

Table 12.5 Varimax Rotated Q-Factor Matrix of 'Meat Quality on Cooking and Serving' Attitudes

Hypothetical Product 1		Hypothetical Product 2		Hypothetical Product 3		Hypothetical Product 4		Hypothetical Product 5	
Meat	Value	Meat	Value	Meat	Value	Meat	Value	Meat	Value
Ham-on-the-bone	0.74	Mutton neck chops	0.81	Leg of lamb	0.73	Luncheon	0.79	Salami	0.79
Sliced ham	0.72	Mutton loin chops	0.81	Lamb forequarter	0.72	Saveloys	0.73	Garlic sausage	0.74
Pork chops	0.70	Leg of mutton	0.78	Topside	0.56	Beef sausages	0.61	Black pudding	0.67
Ham steaks	0.67	Mutton forequarter	0.77	Corned beef	0.53	Ham & chicken	0.58	Frankfurters	0.66
Pork pieces	0.61	Hogget neck chops	0.50	Lamb loin chops	0.52	Pork sausages	0.53	Ham & chicken	0.43
Leg of pork	0.58	Hogget forequarter	0.49	Porterhouse steak	0.46	Wienersnitzel	0.40		
Middle bacon	0.53			Leg of hogget	0.46				
Shoulder bacon	0.51			Hogget forequarter	0.45				
Porterhouse steak	0.50			Lamb neck chops	0.44	Hamburgers *	0.34		
Shellfish	0.49								
Rump steak	0.43								
Proportion of variance	33.2		8.0		7.1		5.7		4.5

Hypothetical Product 6		Hypothetical Product 7		Hypothetical Product 8		Hypothetical Product 9	
Meat	Value	Meat	Value	Meat	Value	Meat	Value
Chicken	0.61	Beef tongue	0.80	Hogget loin chops	0.52	Lamb forequarter	0.48
Fish	0.60	Beef heart	0.72	Leg of hogget	0.50	Hogget neck chops	0.47
Beef mince	0.56	Beef tripe	0.59				
Stewing steak	0.54	Lambs kidney	0.46				
Middle bacon	0.47						
		Lambs' liver **	0.35				
Proportion of variance	2.9		2.7		2.5		2.4

groupings, the meats tended to be grouped in meat species categories, i.e. all the beef cuts together, pig meat cuts together and so on. With the 9 hypothetical meat products derived from the 'cooking and serving' attitudes the groupings were broader-based, although with some hypothetical meat products, the meats from one species or meat type were grouped together as was the case with Hypothetical Meat Product 1 which contained all the pig meats, Hypothetical Product 5 which contained all the continental sausages, and Hypothetical Product 7 which contained all the offal cuts.

However, Hypothetical Meat Product 1 also contained porterhouse steak, rump steak and shellfish. The loading ranged from 0.74 for ham-on-the-bone to rump steak with a loading of 0.43. The ham products together with pork chops had very similar loadings.

The four mutton cuts together with hogget neck chops, and hogget forequarter made up Hypothetical Product 2. The mutton cuts all had similar loadings as did the two hogget cuts with quite a marked difference in value between the mutton and hogget cuts.

Hypothetical Meat Product 3 included the four lamb products although the loadings for the four cuts, unlike the mutton cuts, were quite different in value ranging from 0.73 for leg of lamb to 0.44 for lamb neck chops. In addition to the lamb cuts, Hypothetical Product 3 also included 3 beef cuts, namely topside, corned beef and porterhouse steak and two hogget cuts, leg of hogget and hogget forequarter.

Hypothetical Product 4 included all the traditional sausage products, together with wienersnitzel, albeit with a very low loadingof 0.4. Hamburgers were not loaded on any of the factors but came closest to a loading on Hypothetical Product 4 with a value of 0.34. The continental sausage products together with ham & chicken made up Hypothetical Product 5.

It was interesting to see the composition of Hypothetical Product 6 which included chicken, fish, beef mince, stewing steak and middle bacon. None of the loadings were particularly high with chicken at 0.61 with the highest value. However, the loadings for all 5 meat cuts were very similar ranging from 0.61 for chicken to 0.47 for middle bacon.

Hypothetical Product 7 consisted of all the offal cuts except lambs' liver. However, lambs' liver with a value of 0.35 came closest to be included in Hypothetical Product 7 out of all the factors. The loadings for the 4 offal products differed quite markedly, ranging from 0.80 for beef tongue to 0.46 for lambs' kidney. The large differences suggested that whilst the products shared a similar 'cooking and serving' attitude profile, there were differences.

Hogget loin chops and leg of hogget made up Hypothtical Product 8 and lamb forequarter and hogget neck chops Hypothetical Product 9. With both factors, the product loadings were quite low at 0.52 and 0.48 for hogget loin chops and lamb forequarter respectively. The appearance of lamb forequarter in Hypothetical Product 3 together with Hypothetical Product 9 suggests that only 7-8 factors have been extracted from thedata.

12.5.2 Structure of Varimax Rotated 'Cooking and Serving' Factor of Each of the 9 Meats Selected to Represent the 9 Hypothetical Products

The results of the factor analyses of the attitude data for the 9 individual meat cuts are presented in Table 12.6.

The 'cooking and serving' attitudes tended to be extracted in the second, third and even later factors as was the case for chicken, Hypothetical Product 6, and for ham-on-the-bone, Hypothetical Product 4. However, in the case of lamb forequarter the factor was extracted as the first factor.

The only variable common to all 9 meat cuts was the 'number of dishes'. The differences in the factor structures for the 9 meats were more marked for the 'cooking and serving' factor than either the 'meat quality on buying' factor or the 'meat quality on eating' factor. Each product appeared to have a unique factor structure which differentiated it from the other 8 products. None of the 9 meat cuts had a factor structure approaching the 'meat quality' or 'cooking and serving' factor which was isolated from the analysis of the meat in general attitude data.

Table 12.6 Structure of Varimax Rotated Factor 3 (Meat Quality on Cooking and Serving Attitudes) for the 9 Groupings Identified by Q-Factor Analysis

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8	Group 9
	Ham-on the-bone	Mutton loin chops	Leg of lamb	Luncheon	Salami	Chicken	Beef Tongue	Hogget loin chops	Lamb forequarter
Stringiness									
Spicing requirement					0.40				
Wastage	0.46		0.44					0.44	0.67
Convenience							0.45		0.58
Fat content		0.43	0.50	0.47	0.55			0.45	0.58
Bone content		0.60						0.61	0.63
Tenderness					0.56		0.49		
Juiciness				0.59			0.41		
Acceptability of Flavour		0.45						0.43	
Acceptability of colour									
Flavour strength				0.49					
Value for money		0.51						0.57	0.54
Preparation time						0.44			
Nutritional value		0.44	0.52	0.72	0.83			0.49	0.41
Prestige		0.85	0.70	0.80	0.72		0.61	0.80	0.77
Number of dishes	0.73	0.85	0.68	0.67	0.59	0.53	0.57	0.83	0.76
Cooking time			0.54	0.41			0.68		0.71
Expense	0.70	0.44	0.59					0.43	0.62
Proportion of Variance	6.3	6.4	14.9	16.8	9.7	6.1	5.9	6.5	49.2
Extracted as Factor No.	4	3	2	2	2	6	3	3	1

12.5.3 Mean 'Cooking and Serving' Attitude Scores for the 9 Meats Representing the 9 Hypothetical Products

The mean scores for the 6 'meat quality on cooking and serving' attitudes, i.e. juiciness, value for money, prestige, number of dishes, cooking time and expense for the 9 meats are presented in Appendix 12.3 and in diagrammatic form in Figure 12.3. As with the other analyses three distinct product groupings can be discerned in the figure; fish, chicken and ham with very positive attitude scores; leg of lamb, lamb forequarter and hogget loin chops with medium attitude scores, and beef tongue, salami and mutton loin chops with negative scores. Luncheon tended to roam through the medium and high attitude groups scoring poorly on prestige and number of dishes, moderately well on juiciness, value for money and expense and very well on cooking time. Salami had an identically-shaped attitude profile to luncheon except that it was biased more towards the negative end of the attitude scale.

Ham-on-the-bone scored poorly on two attitudes: value for money and particularly expense, where it was sen as a very expensive meat. Leg of lamb scored well. As can be seen from Figure 12.5 the shape of the attitude profiles for the nine products tended to be generally different. Lamb forequarter and leg of lamb had very similar-shaped profiles which was not unexpected given that lamb forequarter was included in factor 3 and factor 8. The similarity between the two profiles would tend to support the view that 6 rather than 8 factors could have been extracted from the "Cooking and Serving" attitude data.

Fish was extracted in the same hypothetical factor as chicken with a loading difference of 0.1 and as can be seen from Figure 12.5 the shape of the attitude profiles for the two products was remarkably similar, but for one attitude namely cooking time where fish had a more positive score on juiciness, value for money and prestige, but only moderately on number of dishes, cooking time and expense. The respondents had an extremely negative attitude towards the offal products, scoring them poorly on all attitude constructs. In spite of the products not containing things such as bone, the products were still given low scores. Some of the offal products have quite strong flavours, but as far as the consumers were concerned the products had weak flavours in comparison to the other meat included in the survey.

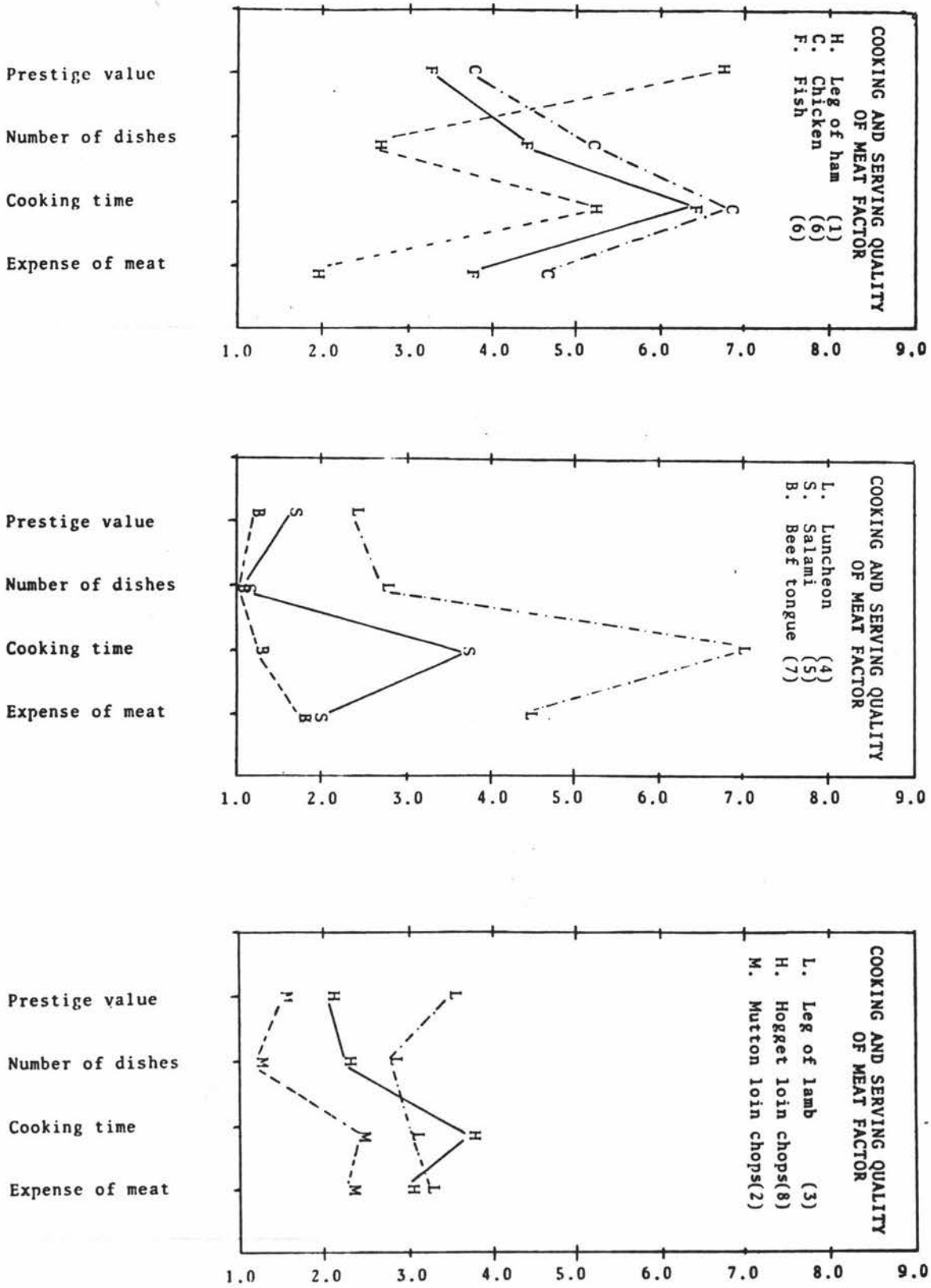

Fig. 12.5 Profiles for 9 'Hypothetical Product' Representatives on the 'Meat Quality on Cooking and Serving' Factor.

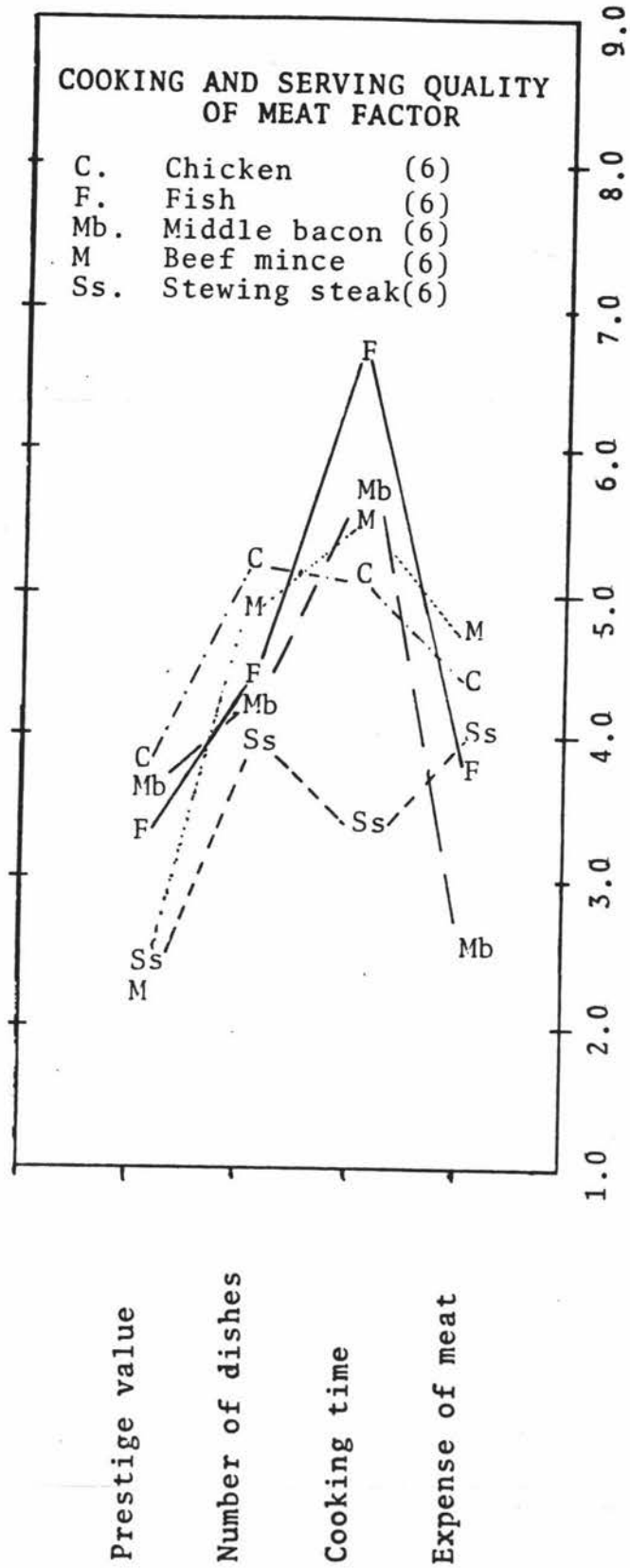

Fig 12.6 Profiles for 5 Meat Cuts Representing 'Hypothetical Product' 6 on the 'Meat Quality on Cooking and Serving Factor.

In Figure 12.6 the attitude profiles of the 5 products belonging to Hypothetical Product 6 have been presented. In general, the shapes of the attitude profiles for the 5 products were very similar. Bacon with the lowest factor loading in the group had the lowest rating for juiciness, value for money and expense of all the products in the group. Stewing steak apart from a low rating on cooking time and a very low rating on the attitude of cooking time had a very similar shape to the fish profile. The more preferred cuts, i.e. chicken and fish, were generally given higher scores on all the attitudes than the other products within the group. None of the products was given a particularly high prestige rating, i.e. "serve to guests", but beef mince and stewing steak were accorded substantially lower scores at 2.2 for the prestige factor than the other meats.

12.5.4 Q-Factor Analysis of the 45 Meats on the Basis of the 18 Attitude Variables

The results of the Varimax rotation are presented in Table 12.7. Seven factors were extracted from the data which accounted for 63.2% of the variance.

The seven products selected as the most representative of the supposed Hypothetical Products were mutton neck chops, ham-on-the-bone, luncheon, garlic sausage, stewing steak and beef tongue. Mutton neck chops with a loading value of 0.86 was the closest of all the meat cuts to being one of the Hypothetical Products. Products in the sixth and eighth Hypothetical Products were not particularly representative of the Hypothetical Products, as indicated by respective loadings of 0.59 and 0.56 for stewing steak and hogget loin chops.

Hypothetical Product 1 consisted of all the mutton cuts and also all the hogget cuts. The mutton cuts with loadings of 0.86, 0.85, 0.81 and 0.78 for mutton neck chops, mutton loin chops, mutton forequarter and leg of mutton were clearly very similar in attitude profiles. The hogget cuts had loadings ranging from 0.51 for hogget neck chops to 0.42 for hogget loin chops and whilst being similar to the mutton cuts had a greater similarity with one another.

Table 12.7 Varimax Rotated Q-Factor Matrix of Meats on all 18 Attitudes

Hypothetical Product 1		Hypothetical Product 2		Hypothetical Product 3		Hypothetical Product 4		Hypothetical Product 5	
Meat	Value	Meat	Value	Meat	Value	Meat	Value	Meat	Value
Mutton neck chops	0.86	Ham-on-the-bone	0.69	Luncheon	0.74	Lamb forequarter	0.68	Garlic sausage	0.77
Mutton loin chops	0.85	Ham steaks	0.64	Beef sausages	0.67	Lamb neck chops	0.66	Salami	0.77
Mutton forequarter	0.81	Sliced ham	0.64	Saveloys	0.67	Leg of lamb	0.62	Frankfurters	0.71
Leg of mutton	0.78	Leg of pork	0.58	Pork sausages	0.64	Lamb loin chops	0.61	Black pudding	0.64
Hogget neck chops	0.51	Pork chops	0.58	Ham & chicken	0.58	Hogget neck chops	0.54		
Hogget forequarter	0.51	Pork pieces	0.50	Beef mince	0.44	Hogget forequarter	0.52		
Leg of hogget	0.46	Shoulder bacon	0.43	Hamburgers	0.40	Leg of pork	0.42		
Hogget loin chops	0.42	Porterhouse steak	0.43			Hogget loin chops	0.42		
		Middle bacon	0.42			Leg of hogget	0.41		
		Leg of lamb	0.40						
		Shellfish	0.40						
Proportion of variance	33.6		7		6.8		4.9		4.2

Hypothetical Product 6		Hypothetical Product 7	
Meat	Value	Meat	Value
Stewing steak	0.59	Beef tongue	0.76
Rump steak	0.59	Beef heart	0.75
Topside	0.55	Beef tripe	0.57
Porterhouse steak	0.50	Lambs kidney	0.56
Corned beef	0.50		
Wienersnitzel	0.46		
Fish*	0.39		
Chicken	0.32		
Proportion of variance	3.4		2.6

Note: * Fish and chicken should not really be included in this Hypothetical factor as their loadings were $\leq$ 0.4.

Hypothetical product 2 consisted of all the pig meat cuts together with porterhouse steak, leg of lamb and shellfish. Whilst the latter three products were grouped together with the pig meat cuts, the low loading values of 0.43, 0.40 and 0.40 for the three products indicated that they only shared some similarity with the pig meat cuts. It was interesting to see the low loadings of shoulder and middle bacon indicating that these two products had more in common with the non-pig meat products than they did to the pig meat products.

Luncheon, beef sausages, saveloys, pork sausages, ham & chicken, beef mince and hamburgers were included in Hypothetical Product 3. The loadings ranged from 0.74 for luncheon to 0.40 for hamburgers. It was interesting to see beef mince which is a comminuted product, as are hamburgers, included in the traditional sausage Hypothetical Product. However, the low loadings of 0.44 for beef mince and 0.40 for hamburgers suggested that the products only shared a proportion of the attitude properties of the other sausage products in the factor.

Hypothetical product 4 consisted of all the lamb cuts, the hogget cuts and leg of pork. The loadings for the lamb cuts were all very similar, but the hogget cuts had loadings ranging from 0.54 for hogget neck chops to 0.41 for leg of hogget. The double loading of the hogget cuts with both the mutton cuts and lamb cuts suggests that the hogget cuts possessed certain attitudes that identified them with mutton and certain attitudes that identified them with lamb. Intuitively, this makes sense since a hogget is a 2-tooth sheep and in age lies somewhere between lamb and mutton. The inclusion of leg of pork in the lamb factor indicated that this cut possessed certain characteristics which were similar to the lamb cuts.

The continental sausage products comprising garlic sausage, salami, frankfurters and black pudding made up Hypothetical Product 5. Black pudding with a loading of 0.64 was seen by the consumers to be slightly different to the other three continental sausage products.

The beef cuts with loadings ranging from 0.59 for stewing steak to 0.46 for wienersnitzel indicated a high degree of similarity between the beef cuts on most of the attitude variables. Wienersnitzel as was seen in Figure 12.4 was quite different to the other beef cuts and this was

confirmed by the low loading of 0.46 in the beef cut factor. Fish and chicken did not appear in any of the Hypothetical Products; however they came closest to being included in the beef cut hypothetical product with loadings of 0.39 and 0.32 respectively. Fish and chicken are clearly seen to be quite different to the other 43 meat cuts which were included in the survey, as evidenced by their non-inclusion in any of the factors.

12.6 DISCUSSION OF RESULTS

Q-Factor analysis of the 45 meat cuts on the basis of "meat quality on buying" attitudes, "meat quality on eating" attitudes and "meat quality on cooking and serving" attitudes showed that it was possible to categorise the 45 meat cuts into seemingly different product groupings of cuts, i.e. into Hypothetical Product groupings and within these hypothetical groupings, although the meats had similar attitude profiles, there were differences between the cuts that showed up in their attitude profiles.

12.6.1 Grouped Meats

An examination of the Factor structures of the Q-Factor Analyses of the "Buying", "Eating", and "Cooking and Serving" attitudes showed that there were certain cuts of meat that were always grouped into the same hypothetical groupings on all three attitude structures, whereas other cuts, such as porterhouse steak, tended to wander from one product grouping to another depending on the attitude structure under examination.

The products that tended to remain in the same hypothetical grouping when the 45 meat cuts were Q-Factor analysed on the "Buying", "Eating" and "Cooking and Serving" attitudes have been presented in Table 12.8.

12.6.1.1 Sheepmeats: All the mutton cuts appeared together in their own Hypothetical Product grouping for each of the attitude structures. The lamb cuts likewise always appeared together in a Hypothetical Product grouping, but unlike mutton were sometimes grouped with other cuts, eg. in the "Buying" attitudes where the pork and ham cuts and also chicken were grouped in the same grouping. The hogget cuts

Table 12.8 Hypothetical Product Groupings Appearing in Successive Q-Factor Analyses

"Meat Quality on Buying" Attitudes

Hypothetical Product 1	Hypothetical Product 2	Hypothetical Product 3	Hypothetical Product 4	Hypothetical Product 5	Hypothetical Product 7	Hypothetical Product 8
Lamb forequarter	Mutton neck chops	Garlic sausage	Luncheon	Beef tongue	Hogget loin chops	Ham steaks
Leg of lamb	Mutton loin chops	Salami	Beef heart	Hogget forequarter	Ham-on-the-bone	Ham-on-the-bone
Lamb loin chops	Leg of mutton	Frankfurters	Pork sausage	Lambs' kidney	Leg of hogget	Sliced ham
Lamb neck chops	Mutton forequarter	Black pudding	Saveloys	Lambs' liver	Hogget neck chops	
			Ham & chicken	Beef tripe		

"Meat Quality on Eating" Attitudes

Hypothetical Product 1	Hypothetical Product 2	Hypothetical Product 3	Hypothetical Product 4	Hypothetical Product 5	Hypothetical Product 7	Hypothetical Product 8
Sliced ham	Mutton neck chops	Luncheon	Beef tongue	Lamb neck chops	Garlic sausage	Hogget loin chops
Ham steaks	Mutton loin chops	Saveloys	Beef heart	Lamb loin chops	Salami	Leg of hogget
Ham-on-the-bone	Mutton forequarter	Ham & chicken	Beef tripe	Lamb forequarter	Frankfurters	Hogget forequarter
	Leg of mutton	Beef sausages	Lambs' kidney	Leg of lamb	Black pudding	Hogget neck chops
		Pork sausages				

"Meat Quality on Cooking and Serving" Attitudes

Hypothetical Product 1	Hypothetical Product 2	Hypothetical Product 3	Hypothetical Product 4	Hypothetical Product 5	Hypothetical Product 7	Hypothetical Product 8
Ham-on-the-bone	Mutton loin chops	Leg of lamb	Luncheon	Salami	Beef tongue	Hogget loin chops
Sliced ham	Mutton neck chops	Lamb forequarter	Saveloys	Garlic sausage	Beef heart	Leg of hogget
Ham steaks	Leg of mutton	Lamb loin chops	Beef sausages	Black pudding	Beef tripe	
	Mutton forequarter	Lamb neck chops	Ham & chicken	Frankfurters	Lambs' kidney	
			Pork sausages		Lambs' liver	

were slightly different to the other two sheep meat grouping. For the "Buying" and "Eating" Q-Factor analyses, the hogget cuts occupied their own unique Hypothetical Product grouping, but not so with the Q-Factor analysis of the "Cooking and Serving" attitudes where it was seen that the hogget cuts were split between the mutton and lamb Hypothetical Products, i.e. the hogget chop cuts were grouped with the mutton cuts and the leg and forequarter with the lamb cuts.

The results of the Q-Factor analyses would seem to suggest that consumers did not think in terms of the size of cut that could be obtained from the various aged animals, with lamb giving small cuts, hogget medium-sized cuts and mutton large-size cuts. Instead they appeared to think quite clearly in terms of species. This observation is borne out by the data presented in Figure 12.6 where the mean attitude scores for the four lamb cuts, the four mutton cuts and the four hogget cuts have been presented. The attitude profiles were very similar except displaced, with the consumers scoring the lamb cuts more positively than the hogget cuts which in turn were scored more positively than the mutton cuts.

The differences in the attitude profiles of the lamb, hogget and mutton cuts was reflected in the number of households consuming lamb cuts, over 50%, compared to the proportion of households consuming the mutton cuts, less than 30% of households. If the three meats continue to be marketed along traditional lines then it is difficult to see how the consumption of mutton and to a lesser extent hogget will be increased.

12.6.1.2 Sausage Products: As with the sheepmeat cuts, the two types of sausage products, i.e. the traditional sausages and the continental sausages occupied separate and unique Hypothetical Product groupings when Q-Factor analysed on the "Buying", the "Eating" and also the "Cooking and Serving" attitudes.

An examination of Figure 12.7 where the mean score profile of all the traditional smallgoods, i.e. luncheon, beef sausage, pork sausage, ham & chicken and saveloys has been compared with the mean score profile for the continental smallgoods, i.e. garlic sausage, salami, frankfurters and black pudding, shows that the profiles for the two product groupings were quite similar but displaced with the "Continental" sausage products

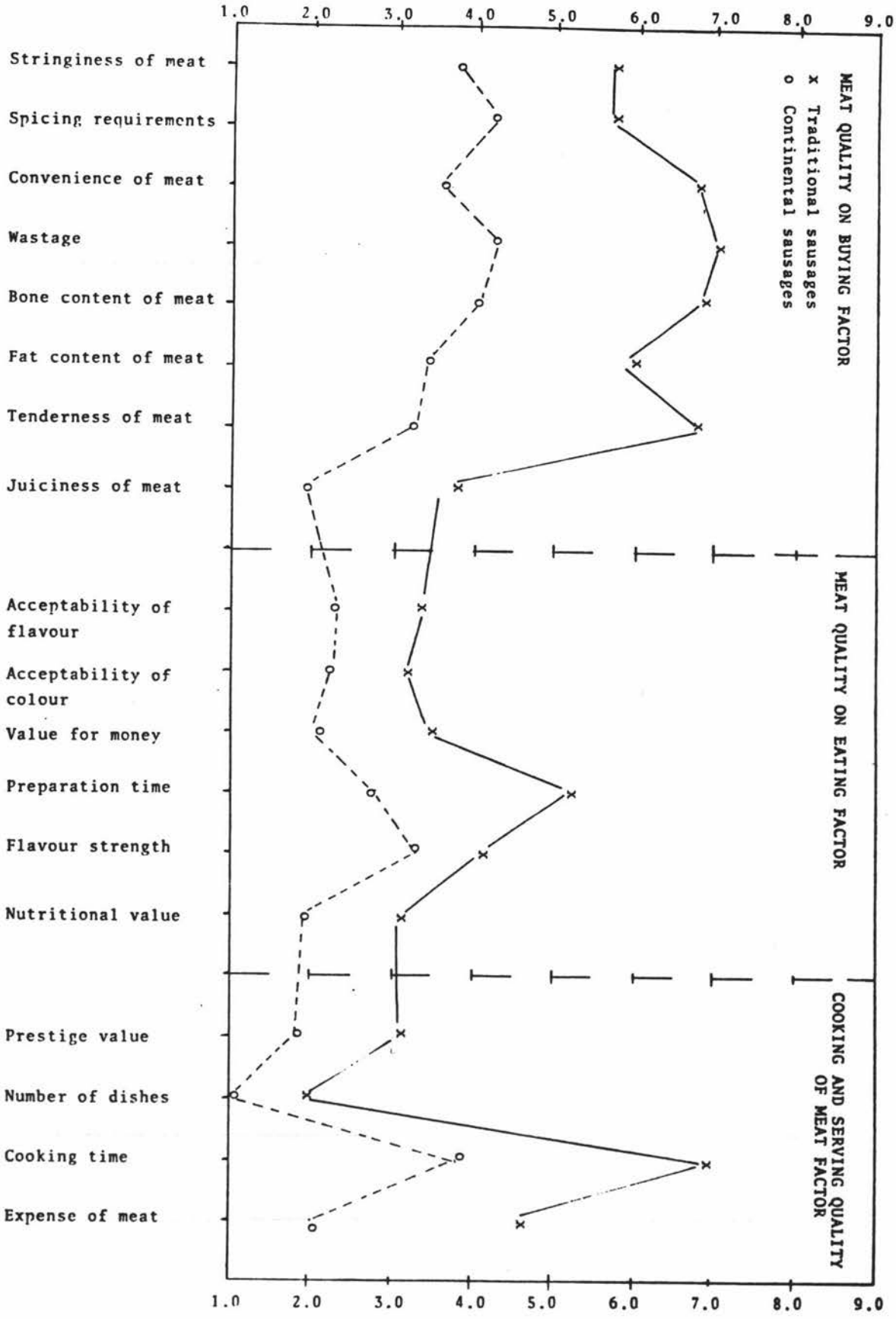

Fig. 12.7 Profile for Traditional and Continental Sausages on all 18 Attitudes.

being downgraded quite markedly on most attitudes in comparison to the "Traditional Sausage Products". These negative attitudes were translated into market penetration with less than 20% of the households contacted in the survey consuming continental sausage products, compared to over 70% of the households who consume Traditional sausage products.

Continental smallgoods have been available in New Zealand for 25 years, but prior to 1970 were mainly consumed by European migrants and New Zealanders who had travelled extensively overseas. In the early 1970's the larger companies attempted to increase the consumption by extensive advertising and promotion. The low market penetration by the end of the 1970's as determined by the present survey together with the negative attitudes towards the products by a majority of respondents would seem to suggest that the products were not likely to see rapid increases in consumption.

It is quite clear that the products have to be positioned closer to traditional smallgoods before there is likely to be a rapid increase in sales. The negative attitudes have to be overcome by product and promotional changes to expand the sales of the products.

12.6.1.3 Offal Products: The offal products, i.e. beef hearts, tripe, beef tongue, lambs' kidney and to a lesser extent lambs' liver always appeared together in a unique hypothetical product grouping for each of the Q-Factor analyses of the "Buying", "Eating" and "Cooking and Serving" attitudes. The consumers appeared to think in terms of "offal" for all of the offal cuts, except for lambs' liver, rather than of the individual offal types. The respondents' attitudes towards the offal products were extremely negative, even more so than towards the Continental smallgoods.

The negative attitudes were reflected in the very low per capita consumption of offals in New Zealand and it is unlikely that consumption will be increased unless something is done to change the character of the products. Liver pate provides a potential key to the problem of increasing per capita consumption of the offal cuts. It is a product that has an 'up-market' image amongst consumers that has come about as a result of organ disintegration to hide the original appearance, flavour changes with wine and spices, embellishments with spices on the surface

of the pates and of course the promotion and the marketing of the product as a consumer product rather than as a meat cut. The same thing could possibly be done with the other organ meats to increase the consumption of these products.

12.6.1.4 Ham Cuts: The only other cuts to appear together in consecutive Hypothetical groupings in Table 12.8 were the three ham cuts, i.e. ham steaks, sliced ham and ham-on-the-bone. However, only when the 45 meats were Q-Factor analysed on the "Buying" attitudes did the three products occupy their own hypothetical product grouping. With the Q-Factor analysis of the "Eating" and "Cooking and Serving" attitudes the three ham cuts appeared in hypothetical groupings that contained the three pork cuts, the two bacon cuts and also porterhouse steak.

In the minds of the consumers the ham cuts would appear to have very similar "Eating" and "Cooking and Serving" attributes to the other more prestigious meat cuts, but a unique set of "Buying" attributes that clearly set them apart from even the other pig meat cuts.

12.6.2 Wandering Products

Table 12.9 showed all the meat cuts that moved from one Hypothetical Product grouping to another depending on which set of attitudes the 45 meat cuts were being Q-Factor analysed under.

12.6.2.1 Pig meats: The pig meat cuts, particularly the pork cuts, represented an intermediate grouping, neither occupying a unique hypothetical grouping as was the case with the mutton cuts, traditional sausages, offals and Continental sausage nor being quite as amorphous as the beef cuts, chicken and fish.

They usually appeared together in the same hypothetical grouping. The one exception was the "Buying" attitudes where the ham cuts occupied their own unique hypothetical product grouping, the bacon cuts were not included in any factor and the pork cuts were grouped together with the lamb cuts, ham-on-the-bone and chicken. The pork cuts appeared to bear a close resemblance to the lamb cuts on the "Buying" attitudes, but on the "Eating" attitudes and "Cooking and Serving" attitudes all the pig meats were grouped together in the same hypothetical grouping

Table 12.9 Products Appearing in Different Hypothetical Product Groupings.

"Meat Quality on Buying" Attitudes

Hypothetical Product 1	Hypothetical Product 2	Hypothetical Product 3	Hypothetical Product 6	Hypothetical Product 8	Hypothetical Product 9
Leg of Pork	Hogget neck chops	Ham & Chicken	Stewing steak	Fish	Rump steak
Pork chops			Topside		Wienersnitzel
Ham-on-the-bone			Corned beef		
Chicken					

"Meat Quality on Eating" Attitudes

Hypothetical Product 1	Hypothetical Product 3	Hypothetical Product 4	Hypothetical Product 5	Hypothetical Product 6	Hypothetical Product 9
Leg of pork			Hogget neck chops	Rump steak	
Pork chops	Hamburger	Shellfish		Stewing steak	Chicken
Pork pieces				Beef mince	Fish
Shoulder bacon				Topside	
Corned beef				Porterhouse steak	
Middle bacon				Wienersnitzel	
Leg of lamb					
Porterhouse steak					

"Meat Quality on Cooking and Serving" Attitudes

Hypothetical Product 1	Hypothetical Product 3	Hypothetical Product 4	Hypothetical Product 6
Pork chops	Topside	Wienersnitzel	Chicken
Pork pieces	Corned beef	Hamburgers	Fish
Leg of pork	Porterhouse steak		Beef mince
Middle bacon			Stewing steak
Shoulder bacon			Middle bacon
Porterhouse steak			
Shellfish			
Rump steak			

possibly indicating low product differentiation on the basis of these two attitude structures.

At the time of the study very little promotion effort had been expended by the Pig Industry to differentiate pork,ham and bacon and so it was not really surprising to see the pig meats grouped together on most of the attitude structures. However, it would be very interesting to conduct the survey now that the Pig Meat Industry has introduced the Trim Pork campaign together with a succession of very expensive advertising and promotional campaigns, aimed at creating a clear differentiation between pork and bacon. However, no extensive promotional work has been aimed at the ham products.

The Trim Pork campaigns have been aimed at conveying the impression of a wide range of delectable pork cuts, but this has not been the case for the bacon campaigns which have been narrow in their scope concentrating merely on the generic term bacon rather than trying to convince consumers and manufacturers alike that there are a whole host of products which could be produced varying in size, flavour, smoke-strength, salt level and moisture level. An expanded demand for bacon could be created by producing a range of products to meet the requirements of specific market segments.

12.6.2.2 The Other Meat Products: The beef cuts, chicken, fish and shellfish and indeed hamburgers were seen in a quite different light by the consumers compared to all the other cuts. It is very difficult to draw any conclusions about chicken, fish and shellfish since generic names were used rather than a range of fish names, shellfish names and indeed chicken cuts. However, the beef cuts, with the exception of the "Eating" attitudes where they were all grouped in a single factor, tended to be grouped in a range of hypothetical products. With the beef cuts, the consumers tended to think in terms of the properties of the cuts rather than grouping them all together in a single hypothetical product grouping which could be called beef. For example, rump and porterhouse steaks tended to be grouped together, usually with the pigmeat cuts. The larger cuts, i.e. corned beef and topside, were grouped together as were the casserole-type cuts of beef mince and stewing steak.

The reasons for the beef cuts being evaluated by the consumers on an individual basis rather than along meat species lines as with the sheep meat cuts, sausage products, offals and to a lesser extent the pig meat cuts are not readily apparent. An examination of the meat displays in supermarkets evidenced a far larger selection of beef cuts than of any of the other meat species. Moreover, the national per capita per annum consumption of beef was almost double that for any other meat species. So on the one hand it could be argued that as a result of the large selection of beef cuts available to the respondents they had to develop a more detailed impression of the beef cuts to be in a position to make rational purchasing decisions, hence the dispersion of the beef cuts amongst a number of the hypothetical products. However, it could equally be expected that the respondents, faced with a large selection of beef cuts, would simply lump them all together in a single factor or hypothetical product grouping, just because the evaluative and memory storage tasks were too great. However, the respondents did not do this and so the latter hypothesis would not appear to be the case.

It is conceivable that another reason for the dispersion of the beef cuts in a number of hypothetical factors was due also to the way that the beef cuts and sheep meat cuts in particular have been purchased by consumers in the past. Traditionally consumers have purchased a side of lamb, hogget or mutton, and as a consequence have obtained all the lamb,

hogget or mutton cuts at the one time. Now a beef animal is substantially larger than a lamb and was not usually purchased as a whole carcase, a side or even a hindquarter at the one time, and so consumers tended to buy individual beef cuts when purchasing their beef meat. As a consequence, they built up a more detailed knowledge of beef cuts than they did about lamb, mutton or hogget cuts.

The third possible reason for the difference in the way that the consumers thought about beef cuts compared to the other meats was probably due to experience. As was stated earlier, the national per capita per annum consumption of beef was almost double and in some cases treble or even more than that for any other meat species and so it would appear to be inevitable that consumers would build up a greater knowledge and experience base concerning the range of beef cuts compared to the cuts from other meat species.

12.6.3 General Considerations

The above reasons are merely conjecture as to why the respondents viewed the beef cuts, chicken, fish and shellfish differently from the other meat cuts. A potential key to the successful marketing of the sheep meat cuts, sausages, pig meat cuts etc. would appear to lie in an understanding of the reasons for these differences particularly between beef and the other meats.

However, it is quite clear that a considerable marketing, advertising and product development effort would be needed to hide the difference between lamb, hogget and mutton and the similarities between the cuts from the one species, i.e. neck, loin, forequarter and leg cuts. The cuts want to be promoted on the unique properties that they possess and also the unique consumer benefits that each product provides. An expansion of the number of cuts currently available from sheep meat would also appear to be necessary if sheep meats consumption is to be expanded. The same observations made for the sheep meats would also appear to be valid for the three pig meat types, i.e. pork, bacon and ham, i.e. an increase in the number of cuts and more specific marketing. The marketing effort can best be summarised by the concept of consumer marketing, i.e. each meat cut should be marketed as an individual product with its own unique set of attributes and consumer benefits rather than the commodity marketing approach which has been used in the past for meat.

12.7 DISCUSSION ON Q-FACTOR ANALYSIS

The fact that Q-Factor analysis proved to be a very effective method of segregating the 45 meat cuts into broadly similar groupings of meats based on the consumers' attitude profiles for the 45 meat cuts means that the technique could be used in a number of ways for new product development and marketing studies. For instance it could be used to segregate products into categories on the basis of:

* Consumption patterns;
* Usage patterns;
* Cooking and serving patterns:
* Functional characteristics; and
* Processing characteristics to name but a few areas of potential use.

The technique could be used in new product development where the objective could be to either produce an 'Ideal Hypothetical Product' or to produce a new product outside of a particular 'Hypothetical Product' category. This could be done in either the initial product development stages of concept testing where the objective is to identify new potentially successful products or it could be used at the test marketing stage when the researcher wants to know whether the product has been perceived by the consumers as had been intended.

The technique could be used to categorise consumers into various sub-groups based on their socio-economic characteristics, attitudes, beliefs, lifestyles or combinations of the variables. The technique lends itself to any task that requires the categorisation of a set of products, people, objects or whatever based on the assessment of these items over a number of attributes.

12.8 CONCLUSION

12.8.1 Q-Factor Analysis

* Q-Factor analysis of the 45 meats on the basis of the 18 attitudes, and the three groupings of attitudes, i.e. 'Meat Quality on Buying', 'Meat Quality on Eating' and 'Meat Quality on Cooking and Serving' showed that it was possible to subdivide the meats into 7 groups for the 18 attitudes taken altogether and into 9 groups for each of the attitude subsets.

* The groupings of meats within hypothetical factors was based on the similarity of the attitude profiles for the respective products in each group and not on the similarity of the factor structures. Products with very similar loadings tended to have very similar attitude profiles, whilst products within a hypothetical factor with large differences in loadings between the cuts tended to have different mean scores in one or more of the attitudes.

* Products representing the different hypothetical products had differently-shaped attitude profiles and also different factor structures.

* The most suitable method of analysing attitudes is to determine the main factors (in this case three factors - buying, eating and cooking and serving), Q-sort the products on these main factors, and then study the product characteristic profile for each group of products.

12.8.2 Meat Cuts

* The groupings of the meats tended to be along species lines when all 18 attitudes were taken together, although the hogget cuts were grouped with both the lamb and the mutton cuts indicating that hogget shared some of the attitude properties of lamb and some of the attitude properties of mutton.

* The groupings of the meats on the subset of attitudes was not quite as clear-cut as it was for all 18 attitudes. There appeared to be 3 distinct groupings. The first of these was along species lines and it was observed that the mutton, hogget, lamb, offals, traditional sausage products and continental sausage products occupied their own unique

hypothetical product groupings. The second type of grouping was not really a grouping at all and was represented by the beef cuts, which tended to be dispersed amongst a number of hypothetical product groupings. The third grouping, typified by the pork cuts, was intermediate between the two extremes.

* Fish and chicken were not grouped with any of the red meats when factor analysis was carried out on the 18 attitudes. However, when Q-Factor analysis was carried out on subsets of attitudes, the chicken and fish were grouped in one or other of the hypothetical groupings.

* The fact that meat cuts could be grouped into hypothetical product groupings on the basis of attitude, and the seeming uniqueness of the factor matrix structures of individual meat cuts together with the different loadings of products within hypothetical product groupings would seem to suggest that the respondents in the present survey imagined each meat cut as possessing a unique set of attributes.

* This product uniqueness has very important implications for the marketing of meat. It means that the meat cuts should be marketed in exactly the same way as other consumer items are marketed and close attention should be paid to the strengths and weaknesses of each meat cut. It also has very important implications for new meat product development since the product developer must be aware of what attributes of a product have to be improved. If the intention is to produce a more desirable mutton cut then one objective might be to improve the negative aspects of the mutton cuts whilst not affecting the attributes which identify the product with other mutton cuts. It could be that the intention is to produce a beef-like product from mutton, in which case the new mutton product would have to mimic the tracer characteristics of beef if the consumers are to be convinced that the new product based on mutton is indeed like beef.

CHAPTER 13

ATTITUDES TOWARDS MEAT CUTS OF LOW, MEDIUM AND HIGH MEAT CONSUMERS AND DIFFERENT SOCIO-ECONOMIC GROUPS

In Chapter 4 it was shown that there were differences in the per capita consumption of meat of households of different ages, and households of differing income. In Chapter 5 it was also shown that it was possible to subdivide the 92 respondents into three equal sub-groups based on their total meat consumption, and beef, sheep meat and pig meat consumption.

The aim of the present study was to examine the attitudes of respondents from different aged households and different income backgrounds to establish whether the differences in per capita consumption of specific meat cuts between the various socio-economic groups could be partly explained by their difference in attitude.

Similarly with the three different meat consumption groups, i.e. the low, medium and high meat (beef, sheep meat and pig meat) consumers; the aim of the study was to establish whether the membership of the three groups could be partly explained by the members' attitudes to meat in general and to specific meat cuts in particular.

13.1 INTRODUCTION

Hughes (1976b), Gendall (1978) and Baron et al. (1981) have argued that attitudes are "pre-dispositions to behave in particular ways" and that a favourable attitude to a product therefore increases the probability that it will be purchased whilst an unfavourable attitude increases the probability that an alternative is bought. However, attempts by these authors to assess the contribution of attitudes to the prediction of meat consumption have not been particularly successful. As Baron et al. (1981) state in their report, "the attempt to relate consumption to the factors which might influence it such as income, family size and perceived levels of five attitude characteristics was less successful than had been hoped and only moderate explanatory ability was achieved in the model." They blamed the poor results on the inherent measurement errors

in the survey procedure, the inexactitudes of attitude measurement and the rather simple linear model used to describe the attitude data.

Hughes (1976b) used discriminant analysis in an attempt to group people into different consumption groups on the basis of attitudes, social class, age, and size of family and achieved up to 42% predictive reliability for the 6 cuts of meat used in the survey. However, both Baron et al (1981) and Hughes (1976b) used factor score coefficients derived from 'meat in general' to estimate the contribution of attitudes to either the prediction of consumption or predicted membership of consumption groups in Hughes' case. It was demonstrated in Chapter 12 that the approach adopted by Hughes (1976b) and Baron et al. (1981) of using 'meat in general' factor score coefficients to estimate the contribution of attitudes to meat consumption could possibly be improved by the use of factor score coefficients for individual meats which were derived from the factor analysis of the attitude data pertaining to the individual meats.

In Chapter 5 it was shown that it was possible to divide the respondents into low, medium and high consumers of beef, sheep meat and pig meat. The low consumers of either beef or sheep meat or indeed pig meat tended to also have very low consumption levels of all the other meats as well and so had a low overall total meat consumption. The trend was not quite so clear-cut for the medium users. It was also shown that the high consumers of beef or sheep meat or pig meat were also very high consumers of all the other meats compared to the other two groups. So in spite of the problems encountered by Hughes (1976b), Gendall (1978) and Baron et al. (1981), it was decided that the attitude structure of low, medium and high consumers of all meat, beef, sheep meat and pig meat would be studied together with the age of the respondent and income to see whether there was any significant difference in attitude structure between the various groups, as had been demonstrated for meat consumption. Age of the respondent and income were included because there appeared to be some differences in the consumption of certain cuts as a result of the effect of these two socio-economic variables (see Chapter 4).

13.2 SURVEY PROCEDURE

The survey questionnaire and the sample and the interviewing procedure and therefore the data are identical to those outlined in Chapter 11.

13.2.1 Analytical Procedure

The sample was sequentially broken into three groups, firstly on the basis of total meat consumption; secondly on the basis of total beef consumption, thirdly on the basis of sheep meat consumption and finally on the basis of pig meat consumption. The three groups were high, medium and low consumers of the above meat categories. Low total meat consumers were defined as people who ate less than 66 kg of meat/capita/annum. Medium meat-consumers were defined as people who ate between 66 and 120 kg of meat and those consuming over 120 kg of meat were defined as high consumers of meat. The basis for the assignment of the respondents to the various meat-consumption groups is shown in Table 13.1.

Table 13.1 Basis for the Assignment of Respondents to Various Meat-Consumption Groups

Meat	Low meat Consumers kg/capita/annum	Medium meat Consumers kg/capita/annum	High meat Consumers kg/capita/annum
Total meat	$\leq$66.0	66.1 - 120.0	$\geq$120.1
Total beef	$\leq$12.0	12.1 - 17.0	$\geq$ 17.1
Total sheep meat	$\leq$15.0	15.1 - 24.0	$\geq$ 24.1
Total pig meat	$\leq$ 6.0	6.1 - 15.0	$\geq$ 15.1

The sample of respondents was ar bitrarily divided into the various groupings to provide approximately 30 people for each meat sub-group. The attitudes of the three meat consumption sub-groups towards each of the 45 meat cuts were then analysed by the SPSS (Version 9) Breakdown procedure to see if there were any significant differences between the three meat consumption groups for any of the 45 meats on any of the following 18 attitudes:

stringiness; spicing requirements; wastage; convenience; fat content; bone content; tenderness; juiciness; acceptability of colour; acceptability of flavour; flavour strength, value for money; preparation time; nutritional value; prestige; number of dishes; cooking time and expense.

The procedure was repeated for the two socio-economic variables, i.e. age of respondent and income of principal income earner to see whether there were any differences in attitudes between households with respondents of differing ages and with differing income of the principal income earner for any of the 45 meats on any of the 18 attitudes.

The SPSS Breakdown procedure was used to analyse the sub-groups. The Breakdown procedure automatically prints the sum, mean, standard deviation, variance and number of cases in each sub-group. With the statistics option it is possible to obtain a one-way Analysis of Variance and also a test of linearity (i.e. a test for linear trend).

One-way Analysis of Variance allows the user to statistically test whether the means of sub-samples into which the sample data are broken are significantly different from each other, i.e. the user is testing the null hypothesis that (Ho):$\mu_1 = \mu_2 = \ldots \mu_k = \mu$. If the means are not significantly different then it is assumed that the difference or deviations which occur are the result of sampling error. Conversely if the means are significantly different then the null hypothesis is rejected that the true subpopulation means are equal. The actual testing is done by comparing the computed F ratio (F = between-groups mean square/within-groups mean square), which is reported in the Analysis of Variance table, to the known sampling distribution of the F ratio.

13.3 RESULTS

13.3.1 High, Medium & Low Total Meat Consumers' Attitudes to 7 Beef Cuts

An examination of the attitude responses by the three groups showed that there were no significant differences in attitude between the three groups for the following attitudes: flavour acceptability, number of dishes, nutritional content and prestige.

There was a significant difference between the groups for the following four attitudes (see Table 13.2): fat content, cooking time, expense and value for money. With fat content, the low meat consumers gave all the 7 beef cuts lower scores than either the medium or high meat consumers. However, only with porterhouse steak, stewing steak and beef mince were the differences in scores between the three meat-consumption groups significant. The medium meat consumers generally had a more positive attitude than either the high or low consumers of meat.

The difference between the groups was significant for cooking time for four of the 7 beef cuts, namely porterhouse steak, stewing steak, topside and corned beef. As with fat content the low meat consumers gave each of the 7 beef cuts a lower score on cooking time than either the medium or high meat consumers. The medium meat consumers tended to have the most positive attitude of the three groups to cooking time.

With regard to expense, the scores for wienersnitzel, porterhouse steak and stewing steak were significantly different for the three groups, with the low meat consumers scoring all the cuts with lower scores than the other two meat-consumption groups. With the exception of wienersnitzel, the medium consumers gave lower expense scores for all the beef cuts than the high meat consumers.

Wienersnitzel, rump steak, porterhouse steak, topside and corned beef were all scored significantly lower for 'value for money' by the low meat consumers than by the other two groups. With wienersnitzel, rump steak and topside the medium consumers gave the meats higher scores for 'value for money' than the high meat consumers whilst the converse was true for the other four beef cuts.

With the remaining attitudes, i.e. colour acceptability, preparation time, stringiness, spice requirement, wastage, bone content, tenderness, juiciness and convenience, only a single meat showed a significant difference in attitude score on any one of the attitudes. Scores for the 7 beef cuts showing significantly different attitude scores have been shown in Appendix 13.1.

Table 13.2 Significantly Different Attitudes between Low, Medium and High Total Meat Consumers to 7 Beef Cuts

7 BEEF CUTS

Attitude	Wienersnitzel	Rump Steak	Porterhouse Steak	Stewing Steak	Topside	Beef Mince	Corned beef
Stringiness	-	-	++	-	-	-	-
Spicing requirement	-	-	++	-	-	-	-
Wastage	-	-	++	-	-	-	-
Convenience	-	-	-	-	-	+	-
Fat content	-	+	+++	+	-	+	-
Bone content	-	-	++	-	-	-	-
Tenderness	-	-	++	-	-	-	-
Juiciness	-	-	++	-	-	-	-
Acceptability of flavour	-	-	-	-	-	-	-
Acceptability of colour	+	-	-	-	-	-	-
Flavour strength	-	-	-	-	-	-	-
Value for money	+	+	+++	-	++	+	++
Preparation time	+	-	-	-	-	-	-
Nutritional value	-	-	-	-	-	-	-
Prestige	-	-	-	-	-	-	-
Number of dishes	-	-	-	-	-	-	-
Cooking time	-	+	++	++	++	-	++
Expense	++	+	++	++	-	+	-

*Key + significance levels = 0.1 to 0.05
++ significance levels = 0.049 to 0.01
+++ significance levels = 0.009 to 0.000
- No significance.

In the case of wienersnitzel the medium consumers had a significantly greater score on colour acceptability and preparation time than either the low or high consumers whose scores on the two attitudes were almost identical.

With beef mince the high consumers had a significantly higher score than the medium consumers who in turn had a significantly higher score than the low meat consumers for convenience.

For some unknown reason, porterhouse steak was viewed negatively on 10 of the 18 attitudes by the low meat consumers. In addition to being scored negatively by the low meat consumers on fat content, cooking time, expense and value for money, porterhouse steak was also downgraded on stringiness, spice requirement, wastage, bone content, tenderness and juiciness by the low consumers. Even the medium consumers scored the meat negatively on all attitudes but stringiness, compared to the high meat consumers.

13.3.2 High, Medium and Low Total Meat Consumers' Attitudes to 4 Lamb Cuts:

An examination of the attitude responses by the three meat consumers for the four lamb cuts showed that there were no significant differences in attitude between the three groups on the following attitudes: stringiness, spicing requirement, tenderness, flavour acceptability, flavour strength, nutritional content, preparation time, number of dishes and prestige. However, the low meat consumers generally scored all four cuts low on each of the above attitudes compared to the other two groups whose attitude scores were basically the same.

The attitudes on which there were significant differences between the groups for one or more of the cuts are shown in Table 13.3.

The two cuts to show the greatest difference between the groups were lamb forequarter and leg of lamb. Lamb forequarter was downgraded by the low meat consumers on all of the attitudes in Table 13.3 compared to the other two groups. With the exception of expense the medium meat consumers also scored lamb forequarter lower than the high meat consumers on all the remaining attitudes although the difference in score

Table 13.3 Significantly Different Attitudes Between Low, Medium and High Total Meat Consumers to 4 Lamb Cuts

	4 LAMB CUTS			
Attitude	Forequarter	Neck chops	Loin chops	Leg of lamb
Stringiness	-	-	-	-
Spicing requirement	-	-	-	-
Wastage	++	+	-	-
Convenience	+++	-	-	-
Fat content	+++	-	+	++
Bone content	++	-	-	+
Tenderness	-	-	-	-
Juiciness	+	-	-	-
Acceptability of flavour	-	-	-	-
Acceptability of colour	+	-	-	-
Flavour strength	-	-	-	-
Value for money	+++	-	-	++
Preparation time	-	-	-	-
Nutritional value	-	-	-	-
Prestige	-	-	-	-
Number of dishes	-	-	-	-
Cooking time	+++	+	-	+
Expense	+++	-	-	+

*Key + significance levels = 0.1 to 0.05
++ significance levels = 0.049 to 0.01
+++ significance levels = 0.009 to 0.000
- No significance.

between the low and medium was generally greater than the difference between the medium and high meat consumers groups (see Appendix 13.2).

In the case of leg of lamb, it was downgraded by the low meat consumers on all of the attitudes, but only significantly on fat content and value for money compared to the other groups. The medium meat consumers generally had a more positive attitude towards leg of lamb and indeed towards neck chops and lamb loin chops on all attitudes compared to the other two groups.

13.3.3 High, Medium and Low Total Meat Consumers' Attitudes to 4 Hogget Cuts

The number of attitudes on which one or more of the hogget cuts had a significantly different attitude loading for the three meat -consumption groups was far greater than for lamb. The only two attitude constructs not registering significantly different loadings were stringiness and preparation time. The remaining attitudes together with the attitude loadings by each group for each hogget cut are presented in Table 13.4.

As with lamb forequarter, the low meat consumers scored all the attitudes for hogget forequarter significantly lower than the other two meat-consumption groups. Moreover, the medium consumers scored all the attitudes relating to hogget forequarter with lower scores than the high meat consumers, though the difference between the low and medium groups was greater than the difference between the medium and high meat consumers (see Appendix 13.3).

With leg of hogget a significant linear relationship between the scores accorded by the low, medium and high meat-consumers was observed for the attitudes of wastage, convenience, fat content, juiciness, flavour acceptability, value for money and cooking time. Significant attitude differences were also observed for expense and nutritional value.

Unlike the lamb chops, the two hogget chop cuts had significantly different scores between the three groups on fat content, tenderness and expense for neck and loin chops and prestige for loin chops. With the above attitudes the low meat consumers had the lowest score, followed by the medium meat consumers followed in turn by the high meat consumers. With flavour acceptability the medium meat consumers scored both the

Table 13.4 Significantly Different Attitudes between Low, Medium and High Total Meat Consumers to 4 Hogget Cuts

Attitude	4 HOGGET CUTS			
	Forequarter	Neck chops	Loin chops	Leg of Hogget
Stringiness	-	-	-	-
Spicing requirement	+	-	-	-
Wastage	+++	-	-	++
Convenience	+++	-	-	++
Fat content	+++	++	+++	+++
Bone content	++	-	-	+
Tenderness	+++	++	++	-
Juiciness	+++	-	-	++
Acceptability of flavour	++	+	+	++
Acceptability of colour	+	-	+	+
Flavour strength	++	-	+	-
Value for money	+	-	-	+
Preparation time	-	-	-	-
Nutritional value	++	-	-	+
Prestige	+	-	+	+
Number of dishes	-	-	-	-
Cooking time	+++	-	-	+
Expense	+++	+	+	++

*Key + significance levels = 0.1 to 0.05
++ significance levels = 0.049 to 0.01
+++ significance levels = 0.009 to 0.000
- No significance.

chop cuts with lower scores than either the low or high meat consumers, although the high meat consumers had the most positive attitude of the two groups.

13.3.4 High, Medium and Low Total Meat Consumers' Attitudes to 4 Mutton Cuts

Table 13.5 includes the attitudes on which one or more of the mutton cuts showed a significant difference in attitude score between the three meat -consuming groups. The high meat consumers scored all the attitudes relating to mutton forequarter with higher scores than the other two groups. The medium consumers also scored all but tenderness and flavour acceptability with significantly higher scores than the low consumers of meat.

Leg of mutton was significantly scored down by the low meat consumers on only fat content and expense, although for all the other attitudes the low meat-consuming group scored leg of mutton with lower scores than the other two groups (See Appendix 13.4).

A significant linear relationship was evident for the two mutton chop cuts on fat content and expense with the scores increasing linearly from the low meat consumers to the high meat consumers. With flavour acceptability, the high meat consumers scored both cuts significantly higher than the other two groups whose scores were very similar.

13.3.5. High, Medium and Low Total Meat Consumer's Attitude to 4 Selected Pig Meat Products

The four selected pig meat cuts were pork chops, leg of pork, ham-on-the-bone and ham steaks. An examination of Table 13.6 indicates that with the leg of pork there were not quite as many attitudes on which the three groups differed significantly on compared to the other three pig meat cuts. In the case of leg of pork the groups only differed significantly, and then only at a significance level of 90%, on the attitudes of spicing requirement and cooking time. With these two variables the medium and high meat consumers tended to score leg of pork with very similar scores that were significantly higher than the low meat consumers scores (see Appendix 13.5).

Table 13.5 Significantly Different Attitudes Between Low, Medium and High Total Meat Consumers to 4 Mutton Cuts

	4 Mutton Cuts			
Attitude	Forequarter	Neck chops	Loin chops	Leg of mutton
Stringiness	-	-	-	-
Spicing requirement	-	-	-	-
Wastage	+	-	-	-
Convenience	++	-	+	-
Fat content	++	-	+	-
Bone content	-	-	-	-
Tenderness	+	+	-	-
Juiciness	-	-	-	-
Acceptability of flavour	+	++	++	+
Acceptability of colour	-	-	-	-
Flavour strength	-	-	-	-
Value for money	-	-	-	-
Preparation time	-	-	-	-
Nutritional value	-	-	-	-
Prestige	-	-	-	-
Number of dishes	-	-	-	-
Cooking time	+	-	-	-
Expense	++	+	++	+

*Key + significance levels = 0.1 to 0.05
++ significance levels = 0.049 to 0.01
+++ significance levels = 0.009 to 0.000
- No significance.

Table 13.6 Significantly Different Attitudes Between Low, Medium and High Total Meat Consumers to 4 Pig Meat Cuts

Attitude	Pork chops	Leg of pork	Ham-on-the-bone	Ham steaks
Stringiness	-	-	+	++
Spicing requirement	+	+	++	-
Wastage	++	-	++	+
Convenience	-	-	-	-
Fat content	++	-	++	-
Bone content	++	-	-	-
Tenderness	-	-	-	++
Juiciness	-	-	+	+
Acceptability of flavour	-	-	-	-
Acceptability of colour	-	-	-	-
Flavour strength	-	-	-	-
Value for money	++	-	+	++
Preparation time	-	-	-	-
Nutritional value	-	-	-	-
Prestige	-	-	+	+
Number of dishes	-	-	-	-
Cooking time	++	+	-	+++
Expense	+	-	-	++

*Key + significance levels = 0.1 to 0.05
++ significance levels = 0.049 to 0.01
+++ significance levels = 0.009 to 0.000
- No significance.

Pork chops, the other pork cut, showed quite a different pattern of significant differences between the groups compared to leg of pork. In addition to significant differences on cooking time and spicing requirement there were differences on wastage, fat content, bone content, value for money, cooking time and expense. With the exception of value for money, a variable included in the meat quality on eating factor, most of the differences were evident for the 'meat quality on buying' factor attitudes and the 'meat quality on serving and cooking' attitudes. These general observations for pork chops were also evident for ham-on-the-bone and ham steaks. In other words the respondents were generally agreed about the eating properties of the pig meat cuts, but not in agreement about either the 'meat quality on buying' attitudes or the 'meat quality on cooking and serving' attitudes.

If a comparison is made between ham-on-the-bone and ham steaks it can be seen that there were significant differences for ham-on-the-bone on the following variables: stringiness; spicing requirement; wastage; fat content; juiciness; value for money and prestige i.e. the significant differences in attitude scores between the groups were mainly to be found on the 'meat quality on buying' attitudes whereas with ham steaks the significant differences in attitude scores between groups were to be found not only for the 'meat quality on buying' attitudes, but also on the 'meat quality on cooking and serving' attitudes of cooking time, prestige and expense.

A very interesting and potentially significant trend was evidenced in the attitude scores of the three meat-consuming groups. If a comparison (See Appendix 13.5) is made of the attitude scores of the high meat consumers and the low meat consumers for pork chops, leg of pork, ham-on-the-bone and ham steaks it can be seen that for practically every attitude included, the high meat consumers scored each attitude higher than the low meat consumers. So not only did the low meat consumers eat less pig meat than the high meat consumers, they also had a less positive attitude towards the four pigmeats than the high meat consumers.

However, if the attitude scores of the medium meat consumers are compared with those of the high and low meat consumers, for example with pork chops, stringiness, wastage, fat content, prestige and cooking time were scored similarly by the medium meat consumers and the high meat

consumers. With the attitudes of spicing requirement and tenderness the medium meat consumers scored pork chops with very similar scores to the low meat-consumers' scores. Whilst with bone content, juiciness, value for money and expense the medium meat consumers gave these attitudes scores which were approximately halfway between the score of the low meat consumers and the high meat consumers.

With meats like ham-on-the-bone, the medium meat consumers actually scored stringiness, spicing requirement, wastage, tenderness, juiciness, prestige, cooking time and expense with higher scores than either of the other two groups. It would appear that the medium consumers comprised a high proportion of respondents who were quite discriminating in their assessment of the attibutes of the eight pig meat cuts. The low meat consumers had correspondingly low attitude scores for all the pig cuts whilst the high meat consumers had a predictably high attitude scores for all the pig cuts, but the medium meat consumers were not so predictable in their attitude assessment.

13.3.6 High, Medium and Low Total Meat Consumers' Attitudes to Fish, Shellfish and Chicken.

According to Table 13.7 fish showed a significant disagreement between the three meat -consumption groups on only two attitudes: flavour acceptability and cooking time.

Chicken on the one hand showed a highly significant disagreement between the groups on spicing requirement and marginally significant differences ($d = 0.1$) for the attitude constructs of fat content, juiciness, value for money and prestige.

Shellfish, on the other hand, showed significant differences in attitude scores between the three meat eating groups on 12 of the 18 attitude constructs. The only attitudes not to show a significant difference between the groups were: spicing requirement, convenience, bone content, tenderness, prestige and number of dishes. The significant difference between the three meat-consumption groups appeared to be mainly associated with the meat quality on eating attitudes i.e. juiciness, flavour acceptability, colour acceptability, flavour strength and value for money.

Table 13.7 Significantly Different Attitudes Between Low, Medium and High Total Meat Consumers to 3 White Meat Cuts

Attitude	Fish	Shellfish	Chicken
Stringiness	-	++	-
Spicing requirement	-	-	+++
Wastage	-	+	-
Convenience	-	-	-
Fat content	-	++	+
Bone content	-	-	-
Tenderness	-	-	-
Juiciness	-	++	+
Acceptability of flavour	+	++	-
Acceptability of colour	-	++	-
Flavour strength	-	+	-
Value for money	-	++	+
Preparation time	-	++	-
Nutritional value	-	+	-
Prestige	-	-	+
Number of dishes	-	-	-
Cooking time	+	++	-
Expense	-	++	-

*Key + significance levels = 0.1 to 0.05
++ significance levels = 0.049 to 0.01
+++ significance levels = 0.009 to 0.000
- No significance.

An examination of Appendix 13.6 where the actual attitude scores for each group for each of the cuts has been presented shows the attitude scores for fish by the low and high meat-consumers. It can be seen that the low meat consumers were quite positive in their attitude assessments. In fact the low meat consumers scored stringiness, flavour acceptability, colour acceptability, flavour strength, nutritional content and prestige with higher scores than the high meat consumers; whilst the other 12 attitudes, i.e. the 'meat quality on buying' and 'meat quality on cooking and serving' attitudes were scored more positively by the high meat consumers than the low meat consumers.

An examination of the scores by the medium meat consumers for fish showed that as with pork some of their assessments were similar to the high meat consumers others with the low meat-consumers still others between the high and low groups, and in the case of stringiness, cooking time and expense more positive than the other two groups. Interestingly enough the medium meat consumers had a significantly lower score for the acceptability of fish flavour than either of the other two groups.

The attitude responses of the low meat consumers towards shellfish were totally dissimilar to fish and more like their responses to meat with the responses on all 18 attitudes being much lower than for the high meat consumers. Clearly the positive attitudes of the low meat consumers did not carry over to shellfish. With shellfish the attitude scores of the medium group tended to lie midway between those of the low and high meat consumers, the one exception being colour acceptability where the scores of the medium and high groups were identical.

The attitude responses by the three groups to chicken were more like their responses to fish than to shellfish or the other red meats. On some attitude constructs such as spice requirement, juiciness and flavour acceptability, the low meat consumers had significantly lower attitude scores and there appeared to be a linear relationship for the scores on juiciness and spice requirement with increasing meat consumption. Whilst with such attitudes as stringiness, colour acceptability, flavour strength, nutritional content and prestige in particular, the low meat consuming group had a more positive attitude towards chicken than the high meat consumption group. As with fish, the medium consumption groups's assessments varied depending on the attitude construct

under examination. In some cases they had scores similar to the high meat consumers', with other attitudes their scores were similar to the low meat consumers and sometimes their scores were either higher or lower than the other two groups.

In Chapter 5, it was observed that the high per capita meat consumers tended to consume more shellfish per capita than the other two groups and this difference in consumption would appear to be reflected in the positive scores accorded shellfish by the high meat consumers.

It was also shown in Chapter 5 that the consumption levels of fish and chicken whilst slightly lower for the low meat consumers were not significantly different between the three meat consumption groups. This similarity in consumption levels between the three groups appears to be reflected in the same attitude scores accorded the fish and chicken by the three groups. The attitude scores of the low meat consumers towards fish and chicken represented a marked change in attitude compared to the other red meats where the low meat consumers' attitude scores were generally much lower than the high meat consumers' attitude scores.

13.3.7. High, Medium and Low Total Meat Consumers' Attitudes to Beef Tongue, Beef Tripe, Lamb's Kidney and Lamb's Liver

The results of this analysis are presented in Table 13.8. There was not a single attitude construct for on which the three groups differed.

Moreover there were very few significant differences in attitude for the other three meats included in the Table. Beef tripe, beef tongue and lamb's kidney all showed significant differences (d = 0.05) on the two main meat quality on eating attitudes of flavour acceptability, and colour acceptability. In addition to the above two attributes, beef tripe also showed a marginally significant difference (d = 0.1) between the groups attitude scores for preparation time.

An examination of Appendix 13.7 where the actual scores have been presented for the attitudes on which the groups differed shows firstly theat the attitude scores accorded the offal products by all three groups were far more negative than they were for any of the meats discussed to date. In Chapter 5 it was shown firstly that with the exception of liver less than 15% of the households consumed the offal cuts and secondly that the

per capita consumption of the offal cuts were among the smallest of the 45 meats included in the survey and thirdly that the per capita per annum consumption of the four offal cuts were not significantly different between the groups. All three observations made in chapter 5 appear to have been reflected here in Chapter 13 where the three groups scored all 18 attitude constructs quite negatively compared to most of the other meats included in the survey.

An examination of the attitudes scores of the high and low meat consuming groups shows that the high meat consuming group had a more positive attitude to all four offal cuts than the low meat consumption group.

However, an examination of the medium meat consumers' attitudes towards liver show that they had signficantly lower scores for flavour acceptability, colour acceptability, and preparation time than either of the other two groups. With lamb's kidney, their attitude scores were approximately midway between the other two groups. With beef tripe, the medium group's attitude scores tended more towards those of the low meat consumer's attitudes, whilst their attitudes for flavour acceptability and colour acceptability of beef tongues were lower than those of the other two groups. Once again the attitude scores indiciate the discrimination shown by the medium meat consumers compared to the other two groups whose attitude scores are largely entrenched and tended to reflect their meat consumption.

Table 13.8 Significantly Different Attitudes Between Low, Medium and High Total Meat Consumers to 4 Offal Cuts

Attitude	Beef tongue	Beef tripe	Lambs Kidney	Lamb's liver
Stringiness	-	-	-	-
Spicing requirement	-	-	-	-
Wastage	-	-	-	-
Convenience	-	-	-	-
Fat content	-	-	-	-
Bone content	-	-	-	-
Tenderness	-	-	-	-
Juiciness	-	-	-	-
Acceptability of flavour	++	++	+	-
Acceptability of colour	++	+++	++	-
Flavour strength	-	-	-	-
Value for money	-	-	-	-
Preparation time	-	+	-	-
Nutritional value	-	-	-	-
Prestige	-	-	-	-
Number of dishes	-	-	-	-
Cooking time	-	-	-	-
Expense	-	-	-	-

*Key + significance levels = 0.1 to 0.05
++ significance levels = 0.049 to 0.01
+++ significance levels = 0.009 to 0.000
- No significance.

13.3.8. High, Medium and Low Total Meat Consumers Attitudes To 4 Sausage Products

As can be seen from Table 13.9 only salami had two attitudes on which the three groups differed significantly and like the offal products these consisted of the two main 'meat quality on eating' attitudes of flavour acceptability and colour acceptability.

Pork sausage, the sausage product consumed by over 70% of the households only showed significant attitude differences between the groups in spicing requirement and acceptability of colour. It was interesting to observe that the three meat consumption groups' scores differed significantly on colour acceptability for all four sausage products. It is difficult to know whether the consumers were concerned with just the colour of the product or whether it was a concern for the overall appearance of the products which would include colour, texture and fat content.

With luncheon and saveloys, the three groups differed significantly (d = 0.05) in attitude scores on spicing requirement, fat content, tenderness, flavour acceptability, colour acceptability and expense. With saveloys they also differed in attitude scores for nutritional value as well.

The attitude scores for the three meat consuming groups for the four sausage products are shown in Appendix 13.8.

A comparison of the attitude scores of the low and high meat consumers for pork sausage showed that the attitude scores of the low meat consumers were significantly lower (d = 0.05) than the high meat consumers for the attitudes of spicing requirement and colour acceptability. The low meat consumers also had lower attitude scores on fat content, flavour acceptability and expense than the high meat consumers and higher attitude scores on tenderness and nutritional content. The medium meat consumers tended to score similarly to the high meat-consumers on most attitudes except fat content and tenderness, where they were actually higher than the other two groups. For flavour acceptability they scored the products lowest.

Table 13.9 Significantly Different Attitudes Between Low, Medium and High Total Meat Consumers To 4 Sausage Products

	4 SAUSAGE PRODUCTS			
Attitude	Pork sausage	Luncheon	Saveloys	Salami
Stringiness	-	-	-	-
Spicing requirement	++	+	++	-
Wastage	-	-	-	-
Convenience	-	-	-	-
Fat content	-	++	+++	-
Bone content	-	-	-	-
Tenderness	-	++	+	-
Juiciness	-	-	-	-
Acceptability of flavour	-	+	++	+
Acceptability of colour	+	++	++	+
Flavour strength	-	-	-	-
Value for money	-	-	-	-
Preparation time	-	-	-	-
Nutritional value	-	-	++	-
Prestige	-	-	-	-
Number of dishes	-	-	-	-
Cooking time	-	-	-	-
Expense	-	+	++	-

*Key + significance levels = 0.1 to 0.05
++ significance levels = 0.049 to 0.01
+++ significance levels = 0.009 to 0.000
- No significance.

A comparison of the low and high meat consumers' attitudes towards luncheon showed that the high meat consumers had significantly more positive attitudes towards luncheon than the low meat consumers on all 18 attitudes. However, the medium meat consumers tended to score the attitudes of fat content, tenderness, colour acceptability and expense more positively than either of the other two groups. A similar pattern of attitude scores was also evidenced for the three groups for saveloys.

It was shown in Chapter 5 that the low meat consumers had a significantly higher per capita consumption of salami than the other two groups. This was the only sausage product on which there were significant differences in consumption between the groups. This higher per capita consumption of salami by the low meat consumers appears to have been reflected by their attitude scores for these products as they scored salami more positively than the other two groups on the important meat quality on eating attitudes of flavour acceptability and colour acceptability. With the other attitudes, i.e. spicing requirement, fat content, tenderness, nutritional content and expense, the low meat consumers gave lower scores than the high meat consumers. As with all the other meat cuts, the medium meat consumers' attitudes varied, sometimes similar to the high meat consumers and sometimes similar to the low meat consumers, depending on which attitude was under investigation.

13.4 BEEF, SHEEP AND PIG MEAT EATING ATTITUDES TO ALL THE 45 MEAT CUTS

13.4.1 High, Medium and Low Beef Consumers' Attitudes to All the 45 Meat Cuts

The attitudes on which there were significant differences between the high, medium and low beef consumers were identical to those that have been listed for each of the meats in the sections dealing with the high, medium and low total meat consuming attitudes. The one difference related to the attitudes of flavour acceptability and value for money for each of the sheep meat cuts. In Sections 13.3.2, 13.3.3 and 13.3.4 relating to the sheep meats it was seen that the low meat consumers generally had a more negative view of flavour acceptability and value for money than the medium group, who in turn had a more negative view than the high meat consumers. With the high, medium and low beef consumers the trend was reversed. The low beef consumers had significantly

higher scores for both flavour acceptability and value for money than either the medium or high beef consumers who tended to score the two attributes similarly for all 12 sheep meat cuts.

13.4.2 High, Medium and Low Sheep Meat Consumers' Attitudes To All the 45 Meat Cuts

The attitudes on which there were significant differences between the three sheep meat consumers were identical to those listed for the high, medium and low total meat consumers. The low sheep meat consumers generally had a more negative aspect to all the sheep meats and also all the other meats including the 7 beef cuts.

13.4.3 High, Medium and Low Pig Meat Consumers' Attitudes to All the 45 Meat Cuts

As was shown in Chapter 5, the low total meat consumers tended also to have a low per capita consumption level of all the other meats. Similarly with the medium total meat-consumers. This group generally consumed a medium quantity of all the other meats and the high meat-consumers ate large quantities of all meats. Consequently, if the sample is broken into low, medium and high total meat consumers, the same individuals tend to be grouped in the same three groups if the sample is broken down by consumption of beef, sheep meat or pig meat. As a consequence it was not unexpected when the sample was broken into low,medium and high pig meat consumers to see the same pattern of meat cut significance as had been observed for the three total meat-consumption groups, the three beef-consumption groups and the three sheep meat-consumption groups.

13.5 ATTITUDES TO MEAT CUTS OF SOCIO-ECONOMIC GROUPS

13.5.1 Attitudes of High, Medium and Low Income Groups to All the 45 Meat Cuts

The 92 respondents were subdivided into three income groups. The low income group was defined as those households whose major income earner earned less than $8,000/annum. The medium income group was defined as those households in which the major income earner earned between $8,000-$14,000/annum and the high income group earned over $14,000/annum.

No significant differences in attitude between any of the groups was observed for any of the 45 meats, although the medium income group tended to have a more positive attitude toward most meats, except the pork cuts where the high income group had the most positive attitude. The low income group had the most negative view for all meats except for the offal and sausage products where the attitudes of all three groups tended to be very similar.

13.5.2 Attitudes of the Under-30's and Over 30's to All the 45 Meat Cuts

As there was such a large number of respondents in the under-30's category and an insufficiently large total sample size to examine each of the age categories, it was decided that the sample would be subdivided into two approximately equal halves with the under-30's in one group and the over 30's in the second.

As with the income data, no statistically significant differences in attitude between the two groups were observed for any of the 45 meats. Both groups tended to have very similar attitudes to all the beef cuts, all the lamb cuts and all the pork cuts, chicken and fish. However, the older age group had a more positive attitude towards the hogget and mutton cuts than the younger age group. The younger age group also tended to have a more positive attitude towards most of the traditional sausage products. However, in neither case were the differences statistically significant.

13.6 DISCUSSION OF RESULTS

It was shown in Chapter 5 that if the 92 respondents were divided into three arbitrary but equal groupings based on either their total meat consumption or their consumption of either beef, or the sheep meats or pig meat, then the low meat consumers of any one of the groupings would have a correspondingly low consumption level of practically all the meats. Similarly with the high meat consumers of one of the major meats that they too would have a concomittantly high consumption level of most of the other meats. The middle group tended to generally eat an amount of each meat that was midway between that of the high and low groups. Although if the groupings were based on sheep or pig meat consumption,

the middle group tended to consume as much beef as the high meat consumers.

In this Chapter, it has been shown that for all meats except chicken, fish and to a lesser extent salami, that the low meat consumers appeared to have a more negative attitude towards the 45 meat cuts on all 18 attitudes than the high meat consumers. Not all of the differences between the groups were significant, though it appeared that for most meats, low meat consumption appeared to be matched with an equivalently low attitude score and vice versa for the high meat consumers. Disregarding the medium meat consumers, it would be quite easy to postulate the existence of a linear relationship between meat consumption and attitude score and hence substantiate the view that attitudes are indeed 'pre-dispositions to behave in a particular way', i.e. low attitude scores generally indicated low total meat consumption, particularly if the attitudes in question were the 'meat quality on eating' attitudes, and the reverse was true for high attitude scores. However, once the medium meat consumers' attitude scores were introduced into the equation the whole question of attitudes being a reflection of meat consumption behaviour was not quite so clear-cut. The reason for the added complexity was mainly due to the fact that the medium meat consumers did not appear to be quite so rigid in their attitudes as was the case for the other two groups. The medium meat consumers appeared to be prepared to assess each meat on its merits and as a consequence, their attitude scores tended to range quite wildly. Sometimes their scores were similar to the low meat consumers' scores, at other times similar to the high meat consumers' scores. Sometimes their scores were some-where in between the low and high meat consumers' attitude scores and still other times when their scores were either the highest or the lowest of the three groups. The medium meat consumers appeared to be quite discriminating in their attitude assessments of the meats.

This discrimination by the medium meat consumers has some very important implications for the meat industry and/or product development within the meat industry. The implications can best be discussed under the following headings:

* Indicator Group
* Market Success of New Products

13.6.1 Indicator Group

It is acknowledged that an extremely small sample size was obtained for the present study. This small sample size in turn introduced problems when it came to dividing the sample into statistically significant sub-groupings as it was not possible to divide the sample into pre-determined meat-consumption groupings, but rather groupings based on the arbitrary rule of one-third of the respondents going into each meat-consumption sub-grouping. As a consequence of this, people with per capita per annum consumption levels of 50-66 kg/annum were included in the low meat-consumption group. In spite of their inclusion in the low meat-consumption group it was demonstrated that this group had a far more negative attitude towards meat than the high meat consumers, although not always a more negative attitude toward meat than the medium meat consumers.

It was shown in Chapter 1 that the National average per capita per annum consumption level of all meat, and in particular the sheep meats, had declined quite rapidly over the latter part of the 1970's and early years of the 1980's. The meat industry in New Zealand (and indeed in other countries as well, because the phenomenon of declining red meat consumption levels is not unique to New Zealand), would like to know whether the national average per capita per annum consumption level will continue to fall over the next 5 years, remain static or possibly increase.

If attitudes are indeed predispositions to a particular behavioural pattern then it is unlikely that either the low or the high meat consumers will alter their meat consumption patterns in a major way over the next 5 years or so unless something untoward were to happen, because, as has been shown in this Chapter, the low and high meat consumers tended to adopt a rigid set of attitudes towards most meats. However, the medium meat consumers appeared to be less rigid in their attitudes towards meat and indeed quite discriminating and as a consequence of this it is likely that this group could be reasonably easily persuaded to alter its attitudes and therefore its meat-consumption behaviour. The degree to which they would alter their attitudes and therefore their behaviour would depend on a large number of factors: included among these would be credibility of the originator of the message, his or her authority, the nature and content of the message and

finally the people's ability to absorb, understand and act on the message - this would all depend on the frequency with which the message was repeated.

It would appear that the medium meat consumers' attitudes toward meat should be followed on a yearly basis to assess the attitude changes over time. It would not be necessary to assess their attitudes to all meat cuts, but only to indicator cuts such as porterhouse steak, stewing steak, legs of hogget, mutton and lamb, pork chops, chicken, fish and luncheon. If this group were to gradually develop a more negative attitude towards most meat then this could have severe implications for the local meat industry as it could result in a further decline in the national average per capita per annum consumption of meat with all the attendant repercussions of such an eventuality. The reverse is true if their attitudes were to become more positive.

The frequency with which the attitudes of this medium-consumption group should be monitored is largely dependent on what happens in the market place. However, a yearly survey would appear to be the base minimum.

Unfortunately, at this stage there is no reliable information available to help in the identity of the members of this medium-consumption group. The survey sample was far too small to accomplish the above and as a consequence there would appear to be a need for a much larger survey with the objective of characterising the members of this group in terms of their socio-economic characteristics as well as their psychographic characteristics.

13.6.2 Market Success of New Products

It is rare that a food product will appeal to all age-groups, socio-economic groups, ethnic groups etc. - chocolate is probably the exception - and as a consequence with new product development it is necessary to segment the market on some relevant basis to the product and produce a new product for the identified target market. With the present study it has been shown in Chapter 5 that segmentation of the meat market on the basis of socio-economic characteristics was not particularly relevant for most meat cuts. Baron *et al*. (1981), Hughes (1976b) and Baron *et al* (1973) would appear to substantiate these findings. The only

relevant segmentation of the market for the present study would appear to be on the basis of meat-consumption levels.

The question then arises: "Which market segment should the new product be aimed at?" The obvious group to aim the new meat product at is the high meat consumers, as they generally consume large quantities of all cuts, also have a very positive attitude towards most cuts and do not appear to be particularly discriminating in what they consume. However, there are no guarantees that the new meat product will be eaten by either the low or the medium meat consumers. Moreover, it is likely that the potential market for the new meat product could be limited if neither the medium nor low meat consumers purchased the new meat product.

An alternative strategy might be to aim the new product at the low meat consumers, though this approach has potential limitations because although the high meat consumers have a high probability of purchasing the new meat product, this need not be the case for the medium meat consumers. The potential market size would be increased by this strategy, but the increase may not be much greater than by simply aiming the new meat product at the high meat consumers because the low meat consumers consume small quantities of each meat cut. The two exceptions to the above would be new meat products based either on fish or chicken where the low meat consumers appeared to consume almost as much of these two meats as the high meat consumers.

It would appear that the best segmentation strategy for new meat product development would be to aim the new meat product at the medium meat consumers as this approach should have a high probability of picking up the high meat consumers as well, but not necessarily the low meat consumers. The potential market size as a result of the adoption of this last strategy should be the greatest of the 3 options. However, given the highly discriminating attitudes of this medium group, it is likely that the attention to the details of product design, concept, formulation, production, quality assurance and marketing will need to be greater than might be necessary for a product aimed at the high meat-consuming group.

13.7 CONCLUSIONS

* Significant differences in attitude scores were observed between the three meat consumption groups, i.e. high, medium and low total meat consumers for all meats.

* The attitudes on which the differences were significant between the groups appeared to be unique for each meat, i.e. a generalised pattern of significant differences between the meats was not observed even for meat cuts sourced from one meat species.

* Significant attitude differences were not observed for any of the meats for either income groupings, or groupings based on the age of the respondent.

* The same pattern of significant differences in attitude scores observed for groupings based on total meat were evident for groupings based on either total sheep meat consumption, or total beef consumption or total pig meat consumption.

* In general the low meat consumers tended to score all but two meats more negatively than the high meat consumers. The two exceptions were chicken and fish, where the attitude scores by the low meat consumers for the two important 'meat quality on eating' attitudes of flavour acceptability and colour acceptability were higher than either the medium or the high meat consumers.

* The attitude assessments of the medium meat consumers tended to be highly variable and not rigid like that of the high and low meat consumers. The medium meat consumers appeared to be highly discriminating in their assessments, scoring each meat on its merits.

* The medium meat consumers would appear to hold the key to the future of the local meat industry as it will depend on whether this group's attitudes become more negative, remain constant or, hopefully, become more positive over time. If its attitudes were to become more negative then it seems likely that the national per capita per annum meat consumption will continue to decline over the foreseeable future and the reverse seems true for a positive change to its attitudes.

* The medium meat consumers would also appear to hold the key to the success of any new products, for it is this group at which new products should be targeted. However, additional information is required to more clearly characterise the members of this group in terms of its socio-economic and psychographic characteristics.

* The construction of any model to predict meat-purchasing behaviour from attitude assessment would appear to have been made quite difficult by the variability in the attitude assessments of the medium meat consumers.

PART 5

The aim of this section of the study was to summarise the data from the preceding chapters in model form so that the more important aspects of the study could be identified for product improvement and also for new product development. The models developed from the data are presented in Chapter 14.

Chapter 15 summarises the information obtained from the large number of techniques that were used in the study with the objective of identifying the most appropriate techniques which could be used for further studies on consumer behaviour and attitudes so as to develop ideas for meat product development and for meat promotion.

CHAPTER 14

CONSUMER BEHAVIOUR MODELS FOR MEAT CONSUMPTION AND PREFERENCE AND PROPORTION OF HOUSEHOLDS CONSUMING MEAT IN PALMERSTON NORTH

According to Baron and Carpenter (1976) "consumer studies have taken two distinctive approaches which have often been carried out as if in ignorance of each other or at best with only token recognition." They argue that economists have tended to use demand analysis concentrating on the effects of price, income and family structure on the consumption of 'beef' or 'lamb' or other 'aggregated commodities'. The alternative approach is less aggregated, concentrating on consumer requirements or attitudes to specific characteristics of meat, frequently ignoring price and possibly income.

The aim of this chapter was to examine the economic, socio-economic aspects of consumer behaviour together with the consumer attitudes towards meats so that a more unified approach could be taken towards the behaviour of consumers in Palmerston North towards meat.

The first objective of the present chapter was to study the relationships of the dependent variables:

* per capita consumption of meat;
* the proportion of households consuming each meat cut; and
* consumers' meat preferences

with a number of predictor or independent variables such as: price; the socio-economic characteristics of income, household composition and age of respondent; each of the dimensions obtained from the MDS analysis of the 41 meat cuts substitutability space; the three Factors obtained from Factor Analysis of the attitude data to meat in general,i.e. the 'meat quality on buying' Factor, the 'meat quality on eating' Factor and the 'meat quality on cooking and serving' Factor; and finally the 18 individual attitudes - stringiness of the meat; spicing requirement of the meat; the wastage associated with the meat; the convenience; the fat content; the bone content; the tenderness; the juiciness; the acceptability of the flavour; the acceptability of the colour; the flavour strength; the value for money; the preparation time; the cooking time; the nutritional value; and finally the prestige and the number of dishes that can be prepared from the meat cut. Also the relationships between

preference and consumption, and proportion of households consuming each meat cut were studied.

The second objective of the present chapter was to explore the relationship between each of the 3 dimensions obtained from the MDS analysis of the 41 meat cuts substitutability space, firstly with the 3 Factors obtained from the Factor Analysis of the 18 attitudes towards meat in general and secondly with the 18 individual attitudes listed above.

14.1 CONSUMER DEMAND MODELS

The study of the relationship of consumer demand with different consumer, product and market variables has resulted in several different types of demand models including economic, product characteristics, and attitude models.

14.1.1 The Economic Demand Model

Historically, economics was the first discipline that studied consumer behaviour. In the economist's view, the consumer is a rational consumer, knowing all the different products, their prices, qualities and other attributes; the consumer compares all possible combinations of product that he/she can buy with his/her income and ultimately chooses the combination that maximised his/her total utility. The utility function with respect to goods or products can be explained by the following function:

$$U = \sum_{j=1}^{n} U_j x_j$$

where U_j = Utility of product j (j=1,2,3,...,n)
x_j = the quantity of product j

For many products with a commodity character (eg. potatoes, cheese, milk and bread) very useful demand analysis based on the classical economic theory of consumer behaviour have been carried out (Wierenga, 1980a). However, the theory appears to break down when consumer choices are to be made within a product category (eg. the choice of a specific brand of product) have to be explained, because the choice has to be made from

what economists consider as essentially the same product. With the utility function defined in terms of products, the classical economic theory has little to say about the selection of brands within a single product category (Wierenga, 1980b, p. 269).

14.1.2 The Product Characteristics Demand Model

Lancaster (1971) put forward a major extension of the theory by shifting from a utility function in terms of products to a utility function in terms of characteristics. According to Lancaster, products comprised bundles of characteristics (eg. size, shape, chemical composition). The consumer, according to Lancaster, was supposed to be ultimately interested in the characteristics and not in the product as such. In Lancaster's theory, utility is a function of the level of the various characteristics, obtained from some combination of products, x, i.e.

$$U = U(Z_1, Z_2, \ldots, Z_k)$$

where Z_k = the amount of characteristic k (k=1,2,...,r)

and products are related to the characteristics according to:

$$Z = Bx$$

where Z = an r-dimensional vector of characteristics,

x = an n-dimensional vector of products,

B = an (rxn) 'matrix of consumption technology'.

For example, when characteristic 1 is protein, product 1 is meat, then B_{11} is the amount of protein per quantity unit of meat.

Lancaster's (1971) characteristic approach can indicate something about the preferences for a new product (brand) in an existing product category, given that a new product (brand) is a new combination of 'old' characteristics. However, as with the classical theory, Lancaster's approach is concerned with the utility derived from the purchase of a combination of different products. However, with preference models, particularly new 'ideal' meat products, one is concerned with the selection of a single choice from a set of alternatives. According to Wierenga (1980a), Ratchford (1979, pp. 79-80) showed that Lancaster's model can be adapted to fit the single choice selection situation. Ratchford showed that a product with two characteristics, 1 and 2, and a linear function according to Lancaster's model a consumer will choose that alternative product j for which:

$$U_j = w_1 b_{1j} + w_2 b_{2j} - w_3 P_j \qquad \text{is a maximum}$$

where U_j = the utility of product j (j=1,2,3,...,n),

w_1 and w_2 are the coefficients of the characteristics of the utility function,

b_{1j} and b_{2j} are the amounts of characteristic 1 and 2 in alternative product j,

w_3 is the coefficient in the utility function for all other goods (other than the product category from which the choice has to be made),

P_j is the price of alternative product j.

If instead of using b_{1j} and b_{2j} the amounts of characteristics 1 and 2 in alternative j, y_{1t} and y_{2t} are used to indicate ratings of product j on dimension t the equation becomes:

$$U_j = w_1 y_{1t} + w_2 y_{2t} - w_3 y_{j3}$$

where y_{j3} = the dimension 'price'.

This last equation represents one of the basic multi-dimensional choice models, i.e. the linear compensatory model (Wierenga, 1980a).

Ratchford has also shown that when non-linear utility functions are used, other utility models (eg. the ideal point model) can be derived from Lancaster's model.

14.1.3 Expectancy-value Demand Models

Motivation research drew attention to the importance of symbolic, non-economic aspects of products and their effect on consumer demand. At about the same time as the motivation research school was enunciating its concepts of consumer behaviour, the social psychologists, particularly Rosenberg (1956) and Fishbein (1963), put forward the expectancy-value models which recognised that more than one attribute or evaluative criterion is used by consumers to evaluate a choice alternative. The expectancy-value model can be described by the following equation:

$$A_j = \sum_{t=1}^{m} w_t B_{jt}$$

where A_j = attitude towards product j (j-1,2,...,n)
W_t = weight or importance of evaluative criterion t
B_{jt} = evaluative belief with respect to the utility of product j to satisfy evaluative criterion t
m = number of attributes.

If one were to replace the B_{jt} with y_{jt} and if attitude A_j is conceived of in the sense of utility or preference then it is clear that the equation above is equivalent to Ratchford's which was derived from economic theory. Both equations represent a linear compensatory model.

The expectancy-value models have received much attention in consumer behaviour research (Wilkie and Pessemier, 1973). Lehman (1971) modified the expectancy-value model by arguing that the utility is not so much dependent on the absolute level of the attribute as on the difference between the absolute level and the 'ideal' level. This version, the 'attribute-adequacy' model can be considered as the counterpart of the 'ideal-point' model.

14.1.4 Choice Alternative Model

The view of consumer behaviour of Engel, Kollat and Blackwell (1982) showed that the consumer's demand behaviour was more complex than has been assumed in most studies. They viewed the consumer as an imperfect problem solver. According to Engel et al., the consumer's behaviour is not irrational but purposeful and goal-oriented, where the goals are more than economic. Moreover, the consumer has limited information about alternatives and often his/her view or perceptions are biased. The consumer's memory and information processing capabilities are also limited. Furthermore a consumer can only spend a very limited amount of time on each individual decision. Within these limitations of information, cognitive skills, memory capacity and time the consumer has to solve his/her problems of choice.

Engel et al. (1982) used the Fishbein-Rosenberg model to establish the consumer's overall attitude or choice alternatives:

$$A_j = \sum_{t=1}^{m} w_t B_{jt}$$

where A_j = attitude towards alternative product j (j=1,2,...,n)

w_t = weight or importance of attribute t

B_{jt} = belief with respect to the ability of product j to satisfy attribute criterion t

m = the number of salient attributes.

14.2 RELEVANCE OF CONSUMER BEHAVIOUR MODELS TO MEAT CONSUMPTION

Economists, including agricultural economists, have favoured an approach broadly described as demand analysis which has concentrated on the effects of price and income and family structure on consumption of 'beef' or 'lamb' or other aggregated commodity. There have been numerous attempts to expand these analysis. For example, Rhodes and Kiehl (1956) presented a classical demand theory for meat which recognised some of the basic product characteristics such as lean and fat, influencing demand for the aggregate meat, and Lancaster (1971) has presented a theory of demand in terms of product characteristics which would avoid the aggregated commodity approach. It is thus recognised that consumer behaviour patterns are more complex than those represented in most of the basic consumer analysis.

However, as Baron and Carpenter (1976) point out, it is worth noting that often when such models were empirically estimated using surveys of a cross-section of consumers at a point in time, only a small proportion, perhaps 20%, of observed variation in consumer behaviour was explained.

Attempts to model consumer behaviour towards meat using attitudes appear to have been no better than the economists' attempts. Baron et al. (1981) reported that their study on the relationship between beliefs about meat characteristics on consumption "proved somewhat disappointing". For the 12 cuts examined in their study only a small proportion of the variation in consumption was explained, i.e. the r^2 values ranged from 0.12 for stewing beef to 0.31 for bacon joint. However, the Baron et al. (1981) study used Factor Score coefficients for five Factors rather than the original attitude scores as the predictor variables for their model. Hughes (1976b) attempted to quantify the impact of attitudes on consumption. Unfortunately his survey data only permitted a weak test, as he failed to record income or allow for the need to vary

the diet. Within these limitations he suggested that attitudes do influence consumption, but are less important than socio-economic characteristics.

14.3 SELECTION OF PROCEDURE FOR MODEL BUILDING IN THE PRESENT STUDY

14.3.1 Choice of Variables

Independent variables, such as price and socio-economic characteristics were included in the analysis because they have been traditionally used by economists in their models of demand analysis.

The three Factors, i.e. 'meat quality on buying', 'meat quality on eating' and 'meat quality on cooking and serving' from the Factor Analysis of the 18 attitudes towards meat in general were included because similar variables had been used by Baron et al. (1981), Gendall (1978) and Hughes (1975b) in their models relating attitudes to meat consumption. The argument for using Factors rather than individual attitudes was based firstly on the fact that Factors are uncorrelated, unlike individual attitudes which may be correlated, and this avoids problems of multi-colinearity when the data is analysed by Regression Analysis. The second reason for using Factors rather than individual attitudes was the fact that the Factors are supposed to explain as much of the Variance in the model as the individual attitudes (Green, 1975).

The three dimensions obtained from the MDS analysis of the 41 meat cuts substitutabilities space were included in the analysis because MDS can uncover dimensions (attributes) of products that may not be discovered by other analytical techniques such as the Semantic Differential, a traditional method of determining attitudes (Anderson, 1975). One or more of the dimensions should be included in the model if attitudes other than those included in the 18 chosen attitudes have been utilized by the respondents to gauge the substitutabilities of the meats one for another, and they are significant in predicting meat consumption preference or the proportion of households purchasing each meat cut.

Preference was included in the analysis as it has been implicated as a most important determinant of changes in meat consumption (Baron and

Carpenter, 1976), although few studies have included preference in predictive studies of consumption.

The 18 attitudes, i.e. stringiness, spicing requirements, wastage, convenience, fat content, bone content, tenderness, juiciness, colour acceptability, flavour acceptability, flavour strength, value for money, preparation time, cooking time, number of dishes that can be prepared from the meat, prestige rating of the meat, and nutritional value were included in the analysis in case one or more of the individual attitudes adequately predicted either per capita consumption of each cut, or preference ranking of each cut, or the proportion of households consuming each meat cut.

The variable, proportion of households purchasing each cut, was included in the analysis as it is just as important to discover the variables governing the market potential of a product, i.e. the number of households consuming a product, as it is to discover the variables governing per capita consumption of each cut, as total annual sales of a product, meat, or meat cut is given by the product of the number of households purchasing the product and the amount (kg/household/annum) consumed each year by each household.

An analysis to establish the determinant variables of meat cut preference was also included, firstly because numerous workers, Williams and Stout (1964), Weidenhamer et al. (1969), Price and Schweigert (1971), Baron et al. (1973) and Hughes (1976b) have all shown that tenderness, flavour, juiciness and aroma are implicated in consumer meat preference. The second reason for undertaking the analysis related to the fact that the MDS analysis of the 15 meat and 41 meat cuts data (Chapter 7) suggested that meat's and meat cuts' preference was unidimensional, i.e. that three were no variables underlying preference.

14.3.2 Method of Modelling

Multiple Regression was used to analyse the relationship between the variables. Multiple Regression represents an extension of the more usual bivariate regression model. The general form of the (unstandardized) regression is:

$$Y' = A + B_1X_1 + B_2X_2 + \dots + B_kX_k$$

where Y' = represents the estimated values of Y

A = the intercept

B_1 = the regression coefficients

The constant A and coefficients B_1 are selected in such a way that the sum of the squared residuals $E(Y - Y')^2$ is minimized. This least squares criterion implies that any other values for A and B_1 would yield a larger $E(Y - Y')^2$. Selection of the optimum constant A and coefficients B_1 using the least-squares criterion also implies that the correlation between the actual Y values and the Y' estimated values is maximised, while the correlation between the independent variables and residual values $'Y - Y')^2$ is reduced to zero.

Multi-colinearlity, which refers to the situation in which some or all of the independent variables are highly intercorrelated, can cause problems with respect to the following interrelated aspects of regression analysis -

: If at least one of the independent variables is a perfect linear function of one or more other independent variables in the equation, the coefficients may not be uniquely determined.

: Estimates of the regression coefficients from sample to sample fluctuate markedly.

When extreme multi-colinearlity exists there is no acceptable way to perform regression analysis using the given set of independent variables.

Two suggested solutions by Nie et al. (1975) are: to create a new variable which is a composite scale of the highly intercorrelated variables and to use the new scale variables in the regression equation in place of its components; or use only one of the variables in the highly correlated set to represent the common underlying dimensions.

14.4 EXPERIMENTAL PROCEDURE

14.4.1 Data Used

The analysis had to be restricted to a treatment of population means for each variable, rather than individual respondent values. Firstly because the SPSS version operating on the Massey University Prime Computer could only accommodate 1000 variables, whereas the data for the present analysis could have included over 5000 variables if individual responses to each variable had been included in the analysis. The second reason for using the population or sample means rather than individual respondent values related to the computation of some of the variables. For instance, the scale values for each of the 41 meat cuts substitutability dimensions and also the Thurstone Case V Interval Scale preference values for the 41 meat cuts and the proportion of households consuming each meat cut were determined for the whole sample and not individual respondents.

14.4.2 Multiple Regression Method

The population means for each of the 41 meat cuts for the following variables: consumption; proportion of households consuming each meat cut; preference; socio-economic variables; the 3 dimensions resulting from the MDS analysis of the 41 meat cuts substitutability space; the 3 Factors resulting from the Factor Analysis of the 18 attitudes relating to meat in general; the 18 individual attitudes; and the 1980 and June 1985 prices for the 41 meat cuts were analysed by the SPSS Version 9 Multiple Regression procedure using the forward and backward step procedure for eliminating variables. Separate analyses were conducted using the 1980 and June 1985 meat prices. As the results for the respective analyses were very similar in terms of the attitudes and variables that were included as predictor variables in the respective equations, only the results with the 1985 prices have been included in the text. The B_i coefficients were different for the equations based on the 1985 prices compared to the 1980 prices.

In the first analysis the population mean/capita/annum consumption of each of the meat cuts was made the dependent variable and the remaining variables listed above were included in the analysis as the predictor variables. A number of runs were carried out with various combinations and permutations of the various variables. For instance one run inc-

luded the 3 MDS dimensions and the socio-economic variables, whilst another run included the 3 Factors and the socio-economic variables. The complexity of the models was sequentially increased until all the variables listed in the preceding chapter were included in the analysis. The model that included only the 3 MDS dimensions accounted for only 12% of the variance, whilst the model that only included the 3 Factors accounted for 18% of the variance. The model that accounted for the highest proportion of the variance in the dependent variable has been reported in the text.

In the second analysis, the proportion of households consuming each meat cut was made the dependent variable and the remaining variables listed above were included in the model as the predictor variables.

Preference, i.e. the Thurstone Case V Interval Scale preference values, for the 41 meat cuts was used as the dependent variable in the third analysis, whilst the remaining variables were included in the model as the predictor variables.

In the final modelling, each of the dimensions from the MDS analysis of the 41 meat cut substitutability space were included as the dependent variable with the remaining variables being included in the model as the predictor variables.

Various combinations of predictor variables were included in the analysis of the proportion of households model, the preference model and the characterisation of each of the 3 MDS dimensions in exactly the same way as was reported for the consumption model. The model accounting for the greatest proportion of variance has been reported in the text.

14.4.3 Statistical Criteria for Selection of Variables to be Entered into the Regression Equation

To avoid numerical difficulties, all variables were tested for tolerance prior to entry into an equation. A variable's tolerance is the proportion of the variance remaining after the effects of the independent variables already in the equation were partitioned out.

With stepwise Multiple Regression, variables to enter the model were selected according to the probabilities of F-to-enter and F-to-remove

(PIN and POUT). These probabilities were functions of the magnitude of the F values and the degrees of freedom. The default values were PIN = 0.05 and POUT = 0.1. It is possible to select PIN and POUT values of 0.1, 0.2 or higher. However, as the values are increased so the model includes more and more of the predictor variables. As the PIN and POUT values are made smaller, so only those variables that contribute significantly in a statistical sense to the equation are entered and retained. Moreover, when the PIN and POUT values are large the extra variables that are included in the model explain a very small proportion of the variance in the dependent variable. Therefore in the present study the following values were used: PIN = 0.05, and POUT = 0.10, because only significant variables would be included in the model with the above values for PIN and POUT, i.e. the intention was to develop models that would explain as much of the variance in the dependent variables with as few predictor variables as possible.

14.5 MODEL TO PREDICT PER CAPITA CONSUMPTION OF THE MEAT CUTS

14.5.1 Model

The results of the stepwise Multiple Regression analysis using the population mean per capita consumption level of each meat cut as the dependent variable showed that only three independent variables were significant, as shown in Table 14.1.

The analysis indicated that per capita consumption of each meat cut could be given by the following equation:

$$Y_1 = 1.50 + 1.02 \text{ Preference} - 0.20 \text{ Price} + 0.71 \text{ Prestige} \quad \text{...Equation 14.1}$$

where Y_1 = Consumption of each meat cut (kg/capita/annum);

Price = Price of each meat cut ($/kg);

Preference = Preference rating of each meat cut derived from the Thurstone Case V Interval Scale;

Prestige = Prestige rating of each meat cut on a 9 point Semantic Differential Scale.

Table 14.1 Relationship between Consumption (kg/capita/annum) of the Various Meats and Preference, Price and Attitudes

Variable Name	Variables in the Model				
	B	SE B	Beta	T	Sig.T
Preference of cut	1.02	0.48	0.40	2.12	99.59
Price of cut	-0.20	0.07	-0.34	-3.34	99.96
Prestige of cut	0.71	0.30	0.46	2.38	99.77
Constant	1.50	0.86		1.74	99.10

Multiple R = 0.78
R^2 = 0.61
Adjusted R^2 = 0.58
Standard error = 1.30
F = 19.56
Significance of F = 99.99

Equation:

Y_1 = 1.50 + 1.02 Preference - 0.20 Price + 0.71 Prestige.

14.5.2 Discussion

The equation clearly follows a typical demand function where the quantity of meat demanded per period is negatively related to the price of the meat. The equation accounted for 61.3% of the variance in the data. This was substantially higher than has been reported in other studies (Rhodes et al., 1956; Lancaster, 1966; Baron et al., 1981). However, unlike these other studies, the socio-economic variables of household composition, age of respondent and income of principal income earner did not contribute to the present model for predicting per capita consumption of the various meat cuts.

The order of addition of the three predictor variables to the model was preference, price and lastly prestige, clearly indicating that preference was the most important variable in explaining per capita consumption of the cuts. The R^2 values sequentially rose from 0.49 to 0.55 and

then to 0.61 as each of the above variables was added to the model.

Leibenstein (1950) dealt with a number of issues relating to consumer demand theory and in particular something he called the 'bandwagon' effect. He defined the 'bandwagon' effect as "the desire of people to purchase a commodity in order to get into the swim of things; in order to conform with the people they wish to be associated; in order to appear to be fashionable or stylish; or in order to appear to be one of the boys." The inclusion of prestige in the present model has a hint of the 'bandwagon effect' where high prestige scores indicated that the meat cut can and should be served to guests, i.e. conforming with people they wish to be associated, and low prestige scores indicate that the cut should only be served to family members. The inclusion of 'prestige' also helps to possibly explain the observation that people on incomes in excess of $20,000 in the 1985 survey ate no additional meat, but increased their consumption of the more expensive cuts, i.e. they were conforming to a style or fashion that they believed was expected of them, although preference would have a very large bearing on their consumption of the more expensive meats also.

Baron (1976) indicated that there has been considerable controversy over the use of consumer acceptability studies and consumer preference studies to predict meat consumer behaviour. Hughes argued that people do not always buy the things they prefer and therefore consumer acceptability studies are more useful than consumer preference studies as acceptability studies deal with actual purchases. The present study helps to answer this controversy and provide some insight into why consumers do not always purchase what they prefer. Clearly price and the aspect of prestige, i.e. whether they have guests to feed, affect their choices and therefore what they purchase.

14.6 MODEL TO PREDICT THE PROPORTION OF HOUSEHOLDS THAT WILL CONSUME EACH MEAT

14.6.1 Model

The results of the stepwise Multiple Regression analysis using the proportion of households consuming each cut as the dependent variable only showed that three independent variables were significant as shown in Table 14.2. The analysis indicated that the proportion of households consuming each cut could be given by the following equation:

$$Y_2 = -39.68 + 8.79 \text{ Tenderness} + 6.89 \text{ Expense} + 6.91 \text{ Value for money}$$

....Equation 14.2.

where:

Y2	=	Proportion of households consuming each meat cut;
Tenderness	=	Belief concerning the tenderness of the cut;
Expense	=	The perceived price or expense of the meat cut;
Value for money	=	The perceived value for money of the cut.

With the present study the bi-polar adjectives for each of the scales were each arranged so that low scores indicated unsatisfactory performance of the meat cuts on that particular attitude while positive scores indicated desirable or satisfactory attributes on that particular attitude. In the case of the attitude variable 'expense' a low score indicated that the respondents thought that a particular meat cut was expensive, while with high meat scores the respondents indicated that they thought that the meat was inexpensive. Normally with price or expense high scores indicate high prices. If the expense attitude scores are transformed, i.e. if we let P'_o, the perceived price = (9-Expense) then equation 2 for the model becomes:

$$Y_2 = 22.33 + 8.79 \text{ Tenderness} - 6.89 \text{ Perceived Price} + 6.91 \text{ Value for money}$$

....Equation 14.2_1

where

Perceived price	=	The corrected perceived expense of the cut on the 9 point Semantic Differential Scale.

Table 14.2 Relationship between Proportion of Households Consuming Each Cut and Attitudes

Variable Name	Variables in the Model				
	B	SE B	Beta	T	Sig.T
Tenderness of cut	8.79	1.38	0.50	6.37	99.99
Expense of cut	6.89	1.41	0.25	4.89	99.99
Value for money of cut	6.91	1.57	0.34	4.41	99.99
Constant	-39.68	4.04		-9.81	99.99

Multiple R = 0.97
R^2 = 0.94
Adjusted R^2 = 0.93
Standard Error = 6.44
F = 186.82
Significance of F = 99.99

Equation:

$$Y_2 = -39.68 + 8.79 \text{ Tenderness} + 6.89 \text{ Expense} + 6.91 \text{ Value for Money}$$

Equation 14.2

14.6.2 Discussion

With this transformation the model follows a typical linear demand function. However, instead of recognising the real prices of the various meat cuts, the model includes the perceived price or expense of each cut. The equation for the prediction of the proportion of the households consuming each meat cut accounted for 94% of the variance in the data - clearly very high and much higher than the consumption model reported in Section 14.5. As with the consumption model, the socio-economic variables of household composition, age of respondent and income of the principal income earner were not included in the model, nor were the 3 Factors for meat in general.

The model is very similar to Ratchford's (1979), (see Section 14.1.2) modification of Lancaster's model, i.e.:

$$U_j = w_1 b_{1j} + w_2 b_{2j} - w_3 P_j$$

where the consumer will choose that alternative product j for which the equation is a maximum. However, perceived price rather than the actual prices are used in the model.

14.7 MODEL TO PREDICT CONSUMERS' MEAT CUT PREFERENCES IN PALMERSTON NORTH

14.7.1 Model

The results of the stepwise Multiple Regression analysis using the Thurstone Case V Interval Scale preference values for each of the 41 meat cuts as the dependent variable and the 18 attitudes, the three Factors (i.e. 'meat quality on buying', 'meat quality on eating' and 'meat quality on cooking and serving'), and the three dimensions that were obtained from the MDS analysis of the 41 meat cuts substitutability space as the predictor variables are shown in Table 14.3.

The analysis indicated that the consumers' preferences for each of the 41 meat cuts could be given by the following equation:

$$Y_3 = -1.61 + 0.38 \text{ Flavour} - 0.14 \text{ Bone} + 0.20 \text{ Juiciness} \quad \text{...Equation 14.3.}$$

where Y_3 = The Thurstone Case V Interval Scale preference values for the meats, ranging from -1.55 for beef heart to 1.37 for chicken, the most preferred meat.

Flavour = Flavour acceptability score of each meat cut on the 9-point Semantic Differential Scale, values ranged from 6.6 for leg of ham to 0.8 for beef heart.

Bone = Bone content of each meat cut (perceived) on the 9-point Semantic Differential Scale, values ranged from 7.4 for stewing steak to 1.9 for mutton neck chops.

Juiciness = Perceived juiciness score of each meat cut on the 9-point Semantic Differential Scale, values ranged from 6.1 for porterhouse steak to 1.2 for beef tripe.

With the present study the scales for each of the attitudes were arranged so that low scores on an attribute meant a poor performance on a particular attribute implied negative connotations about the cut, but bone content is normally thought of in terms of a low score indicating the absence of bone, whilst high scores indicate the presence of a large quantity of bone. Consequently, if equation 3 is transformed to accommodate normal perceptions to bone the equation becomes:

$$Y_3 = -2.87 + 0.38 \text{ Flavour} + 0.14 \text{ Bone}_1 + 0.20 \text{ Juiciness} \quad \text{... Equation } 14.3_1.$$

where Bone_1 = The transformed perceived bone content of the cuts.

The model accounted for approximately 91% of the variance in the dependent variable. The variable, flavour acceptability, alone accounted for 85% of the variance in the data which indicates how important flavour is in the determination of people's meat preferences in Palmerston North, at least.

The preference model was the only model that would have been changed if the criteria controlling the addition of extra variables had been relaxed from 95% confidence levels to 90% confidence limits, i.e. the PIN number from 0.05 to 0.10 and the POUT number from 0.10 to 0.18. Relaxation of the PIN number from 0.05 to 0.10 enabled the variable price and expense of the meat to be included in the model - both with positive scores indicating that people's preferences are affected by price as well. Leibenstein (1950) referred to this as the 'snob' effect. The modified equation to describe preference is shown below:

$$Y_4 = -0.9 + 0.29 \text{ Flavour} + 0.11 \text{ Bone}_1 + 0.15 \text{ Juiciness} + 0.12 \text{ Price} + 0.06 \text{ Perceived Price} \quad \text{....Equation } 14.4.$$

This model accounted for 94.5% of the variance in the data.

Table 14.3 Relationship between Consumers' Preferences for the Meat Cuts and Attitudes

Variable Name	Variables in the Model				
	B	SE B	Beta	T	Sig.T
Flavour acceptability	0.38	0.07	0.74	5.52	99.99
Bone content of cut	-0.15	0.03	-0.31	-4.96	99.99
Juiciness of cut	0.20	0.09	0.32	2.12	97.00
Constant	-1.61	0.14		-11.17	99.99

Multiple R	=	0.95
R_2	=	0.91
Adjusted R_2	=	0.90
Standard error	=	0.25
F	=	121.20
Significance of F	=	99.99

Equation:

$$Y_3 = -1.61 + -0.38 \text{ Flavour} - 0.15 \text{ Bone} + 0.20 \text{ Juiciness}$$

14.7.2 Discussion

The model for predicting consumers' meat cut preferences appears to be similar to the Rosenberg/Fishbein generalised attitude formula used by Engel et al. (1982) (Section 14.1.4) which is given by the equation:

$$A_j = \sum_{j=1}^{n} w_j B_{jt}$$

With the present model the A_j values are the predicted preference ratings for the 41 meat cuts ranging from -1.55 for beef heart the least-liked meat to 1.37 for chicken, the most-liked cut. The w_j weights are equivalent to the weights for flavour, bone and juiciness obtained from the present study for the 41 meat cuts. The B_{jt} refer to the three beliefs, flavour, bone and juiciness which according to the present model satisfactorily predict the consumers' preferences for the 41 meat cuts.

The model clearly shows that the sensory attributes of meat, i.e. flavour and juiciness are the more important determinants of meat preference, though the instrumental/functional attributes, i.e. the bone content (reflects the degree of pre-processing) are also important in determining preference. If the criteria for variable selection are relaxed (i.e. PIN value of 0.10 rather than 0.05) then the expressive or symbolic attributes (price and expense) are also important in the formation of consumers' preferences for the various cuts of meat.

The model confirms earlier work (Price and Schweigert, 1971; Williams and Stout, 1964) that the eating characteristics, flavour and juiciness are important in determining people's preferences, though the present study did not indicate that tenderness and aroma were important in determining people's meat consumer preferences as in the earlier studies.

There appears to be little definitive work on the consumer tolerance of bone according to Baron and Carpenter (1976). The Rhodes et al. (1955) study appears to be one of the few, and they showed that only about a quarter of the respondents gave evidence that the amount of bone may have influenced their overall preference for beef roasts, and that the amount of bone contributed only 7.2% of the explained variance of overall rating of steaks. With the present study the bone content accounted for 1.5% of the variance in the model to predict consumer preferences for the 41 meat cuts.

The model suggests that an increase in the bone content, rather than decrease, would improve the preference ratings of some of the cuts. This finding is quite unexpected. It was certainly true that for the pork and ham cuts, the leg cuts and, for pork, the chop cut as well were more highly preferred than the boneless cuts such as pork pieces, sliced ham and the ham steaks. The bone-in leg cuts of lamb, hogget and mutton were also the more preferred cuts from the respective animals. Whole chicken, with a reasonably high bone content, was the most preferred of all the meats in the study.

14.8 CHARACTERISATION OF THE THREE DIMENSIONS OBTAINED FROM THE MDS ANALYSIS OF THE 41 MEAT CUT SUBSTITUTABILITY SPACE

14.8.1 Characterisation of Dimension 1

The results of the stepwise Multiple Regression analysis using the scale values for each of the meats on Dimension 1 as the dependent variable and all the independent variables are presented in Table 14.4.

The analysis indicated that Dimension 1 of the MDS analysis of athe 41 meat cut substitutability space could be explained by the following equation:

$$Y_5 = -0.50 + 0.43 \text{ Colour} - 0.26 \text{ Fat} \qquad \text{.... Equation 14.5}$$

where Y_5 = MDS Scale values for Dimension 1 for the 41 meat cuts;
Colour = Acceptability of the meat colour score of the meat cuts on the 9-point Semantic Differential Scale;
Fat = Perceived fat content score for the meat cuts on the 9-point Semantic Differential Scale.

Table 14.4 Relationship between Dimension 1 and Attitudes

Variable Name	Variables in the Model				
	B	SE B	Beta	Sig.T	
Colour acceptability	0.43	0.06	0.91	6.98	99.99
Fat content of cut	-0.26	0.06	-0.61	-4.63	99.99
Constant	-0.50	0.23		-2.16	96.00

Multiple R = 0.75
R^2 = 0.56
Adjusted R^2 = 0.54
Standard Error = 0.41
F = 24.64
Significance of F = 99.99

Equation:

$$Y_4 = -0.50 + 0.43 \text{ Colour} - 0.26 \text{ Fat}$$

The model explained approximately 56% of the variance in the data and the acceptability of the colour accounted for 32% of the variance in the data with fat content explaining a further 24%, i.e. the two variables were almost of equal importance in the model.

Neither of the 3 Factors were included in the model, which would suggest that the solution obtained from the MDS analysis of the 41 meat cut substitutability space produced a completely different solution to the Factor Analysis of the 18 attitudes relating to the 41 meat cuts.

Relaxation of the PIN and POUT values did not affect the solution.

14.8.2 Characterisation of Dimension 2

The results of the stepwise Multiple Regression analysis using the scale values for each of the meats on Dimension 2 as the dependent variable and all the independent variables are shown in Table 14.5.

The analysis showed that the scale values for the 41 meat cuts could be represented by the following equation:

$$Y_6 = -0.63 + 0.35\ \text{Wastage} - 0.37\ \text{Convenience} + 0.63\ \text{Expense} - 0.29\ \text{Versatility} - 0.22\ \text{Nutrition} \quad \text{.... Equation 14.6}$$

where

Y_6	=	The scale values for each of the 41 meat cuts on Dimension 1;
Wastage	=	Perceived wastage associated with each of the cuts on a 9-point Semantic Differential Scale;
Convenience	=	Perceived convenience of the 41 meat cuts on a 9-point Semantic Differential Scale;
Expense	=	Perceived expense of each of the 41 cuts on a 9-point Semantic Differential Scale;
Versatility	=	Number of dishes that could be prepared from each of the 41 meat cuts on a 9-point Semantic Differential Scale;
Nutrition	=	Perceived nutritional content of each of the 41 meat cuts on a 9-point Semantic Differential Scale.

Table 14.5 Relationship between Dimension 2 and Attitudes

Variable Name	Variables in the Model				
	B	SE B	Beta	T	Sig.T
Wastage of cut	0.35	0.07	0.87	5.05	99.99
Convenience of cut	-0.37	0.06	-1.08	-6.07	99.99
Expense of cut	0.62	0.07	0.95	8.52	99.99
Versatility	-0.29	0.06	-0.62	-4.73	99.99
Nutritional content	-0.22	0.06	-0.47	-3.66	99.20
Constant	-0.63	0.23		-2.75	97.00

Multiple R = 0.88
R^2 = 0.78
Adjusted R^2 = 0.75
Standard error = 0.29
F = 24.50
Significance of F = 99.99

Equation:

$$Y_5 = -0.63 + 0.35 \text{ Wastage} - 0.37 \text{ Convenience} + 0.62 \text{ Expense} - 0.29 \text{ Versatility} - 0.22 \text{ Nutrition.}$$

The relationship helped to explain 78% of the variance in the data. The variable 'wastage' accounted for 27% of the variance, followed by the remaining variables which accounted for between 12-13% of the variance in the dependent variable.

The Factor 'meat quality on cooking and serving attitudes' consisted of all the variables that were included in the model to predict Dimension 2 as well as the two attitudes 'preparation time' and 'cooking time'. It would appear that the above-mentioned Factor was similar to Dimension 2 from the composition of the attitudes included in each of the dimensions or factors.

Extraction of the 'cooking and serving' Factor or Dimension could be expected from the analysis in the light of the question that was posed

to the respondents when they were asked to assess the substitutability of the 41 meat cuts one for another. The respondents were asked to imagine that they had gone to the refrigerator to get cut A from the refrigerator for the main meal, only to find cut B. They were asked to assess how substitutable cut B would be for the intended meal. The main thrust of the question related to issues dealing with how the meal was to be prepared, cooked and served.

As with Dimension 1 relaxing the PIN and POUT values did not materially affect the solution, i.e. no additional variables were included in the solution.

14.8.3 Characterisation of Dimension 3

The results of the stepwise Multiple Regression using the scale values for each of the meats on Dimension 3 as the dependent variable and all the independent variables as the predictor variables are presented in Table 14.6.

The analysis showed that the scale values for each of the meats on Dimension 3 could be represented by the following relationship:

$$Y_7 = 0.83 - 0.47 \text{ Nutrition} - 0.54 \text{ Consumption} + 0.65 \text{ Flavour} - 0.46 \text{ Colour} \quad \text{.... Equation 14.7}$$

where:

Y_7	= The scale values for each of the 41 meat cuts on Dimension 3;
Nutrition	= Perceived nutritional content of each of the 41 meat cuts on a 9-point Semantic Differential Scale;
Consumption	= Per capita consumption of each of the 41 meat cuts (kg/capita/annum);
Flavour	= Acceptability of the meat flavour of each of the 41 meat cuts on a 9-point Semantic Differential Scale;
Colour	= Acceptability of the meat colour of each of the 41 meat cuts on a 9-point Semantic Differential Scale.

The model only accounted for 48% of the variance in the data - poor by comparison with the other models, although the value of the F statistic was highly significant (99.98%).

Table 14.6 Relationship between Dimension 3 and Per Capita Consumption of the Meats and Attitudes

Variable Name	Variables in the Model				
	B	SE B	Beta	T	Sig.T
Nutritional content	-0.47	0.11	-1.05	-4.35	99.98
Consumption	-0.54	0.15	-0.46	-3.65	99.92
Flavour acceptability	0.65	0.18	1.77	3.61	99.91
Colour acceptability	-0.46	0.20	-1.04	-2.28	97.14
Constant	0.83	0.24		3.54	99.08

Multiple R = 0.69
R^2 = 0.48
Adjusted R^2 = 0.42
Standard error = 0.43
F = 8.17
Significance of F = 99.98

Equation:

Y_6 0.83 - 0.47 Nutrition - 0.54 Consumption + 0.65 Flavour - 0.46 Colour

The attitudes making up Dimension 3 bore no relationship to the attitude composition of any of the 3 Factors, i.e. 'meat quality on buying', 'meat quality on eating' and 'meat quality on cooking and serving'. The inclusion of the per capita consumption as one of the predictor variables made the interpretation of the Dimension most difficult.

Changing the PIN and POUT values did not affect the solution.

14.8.4 Discussion of Axis Identification

Dimension 1 appeared to relate to the overall appearance of the meat as a result of the inclusion in the model of 'acceptability of the colour' and 'fat content', factors that are likely to affect consumers at the point of purchase and influence their selection of packs of the same cut.

Dimension 2 was very similar to the Factor 'meat quality on cooking and serving' and a Dimension relating to these aspects would have been expected from the MDS nalysis in view of the task that the respondents were asked to perform whilst evaluating the substitutability of the cuts one for another.

Dimension 3 included attitudes relating to the 'nutritional content of the meat cuts', the per capita consumption of the cuts and 'the colour acceptability of the cuts' which were all loaded negatively onto the model as well as the attitude variable 'acceptability of the flavour' which had a positive loading in the model. If the model were rearranged to leave consumption as the dependent variable then the model appears to suggest that 'flavour acceptability' if it is high will lead to increased consumption, i.e. that people will consume cuts of meat that are not always high in nutrition or acceptable as far as colour goes.

The fact that 2 of the 3 dimensions which resulted from the MDS analysis of the 41 meat cut substitutability space consisted of different attitudes to any of the 3 Factors supports Anderson's (1975) contention that MDS analysis is able to isolate product attributes of importance to the consumer which may not be obtained by the more traditional approaches of identifying important product attributes such as the Semantic Differential.

However, with the present study none of the 3 Dimensions from the MDS analysis were included in either the model to predict per capita consumption of each of the meat cuts, or the model to predict the proportion of households consuming each meat cut, or indeed the model to predict consumer preferences for the meat cuts. This would suggest that in the case of the present study, the dimensions that were extracted from the MDS analysis of the 41 meat cut space were not important determinants of either per capita consumption of the 41 meat cuts, or the proportion of households purchasing each of the cuts, or indeed the preference ratings of the 41 meat cuts.

14.9 DISCUSSION

For the purposes of the discussion, the models describing per capita consumption of the meats, preference of the meats, and the proportion of the households consuming the meats are summarised below:

Meat cut consumption = 1.50 + 1.02 Preference - 0.20 Price + 0.71 Prestige .... Equation 14.1

Preference = 0.26 + 0.38 Flavour + 0.14 Bone + 0.20 Juiciness .... Equation 14.3

Proportion of households consuming each meat cut = 22.39 + 8.79 Tenderness - 6.89 Perceived Price + 6.91 Value for Money .... Equation 14.2

The preference model and the consumption model are clearly linked as the preference variable appears in the consumption model as a predictor variable in the per capita consumption model. The proportion of households consuming each meat cut model is not linked to either of the other two models, although the form of the model is very similar to the consumption model, i.e. both are typical demand functions. However, the proportion of households model is largely dependent on the beliefs that consumers have concerning the expense and value for money of the various cuts. In relation to new product developement the models suggest that if a successful product is to be developed then the researcher should concentrate on the following aspects, whilst not neglecting other areas: price; prestige; flavour acceptability; juiciness; bone content; tenderness; the perceived expense of the products and finally the relative value for money of the new product.

To help with the discussion the per capita consumption, proportion of households consuming each cut, preference, and attitude scores for a selected number of cuts has been presented in table 14.7.

14.9.1 The Importance of Price

The price of the 41 meat cuts that were included in the study ranged from $2.00/kg for mutton neck chops to $15.76/kg for salami, though the majority of the cuts were priced between $3.00 - $6.00/kg. An

Table 14.7 Comparison between Selected Cuts on Variables Included in the Three Models

Meat	Proportion Households	Consumption (kg/capita/annum)	Preference Scores	Price ($/kg) 1985	Tenderness Scores	Expense Scores	Value Score	Flavour Scores	Juiciness Scores
Chicken	91.2	5.9	1.37	4.45	6.7	4.3	6.3	6.3	5.5
Stewing steak	78.0	3.2	-0.14	5.70	6.1	4.1	5.2	5.0	5.1
Porterhouse steak	69.2	3.2	0.99	9.31	6.2	2.7	5.1	6.1	6.1
Leg of lamb	63.7	3.6	0.87	4.57	5.9	3.2	4.7	5.2	5.0
Pork sausages	60.4	1.6	-0.47	2.61	5.6	4.2	3.6	3.8	3.9
Lamb loin chops	59.3	2.3	0.41	4.97	4.9	3.4	4.4	4.9	4.9
Leg of ham	52.7	10.3	1.29	7.35	6.0	2.0	4.1	6.6	5.1
Leg of pork	51.7	7.8	1.12	6.07	5.2	1.9	4.2	5.7	4.3
Leg of mutton	26.4	2.5	0.03	3.00	3.5	2.4	3.3	3.6	3.1
Salami	17.6	0.3	-0.68	15.76	3.3	2.0	2.0	2.3	1.9
Frankfurters	11.0	0.2	-1.07	3.45	3.2	2.2	1.8	2.1	2.3

examination of Table 14.7 shows that with the exception of the highly preferred cuts such as the legs of pork and ham and porterhouse steak, per capita consumption was highest for the cuts that were priced between $4.00 - $6.00. If the intention of the researcher is to produce a new meat product that will be consumed by a high proportion of the households a price in the $4.00 - $6.00 (1985 prices) will also help with this objective. However, if the researcher is utilising one of the more highly preferred meats such as chicken, ham and pork then it may be possible to price the product above the $6.00 range and still achieve high per capita consumption, though only achieving a relatively low market penetration, i.e. only 50-60% of the households consuming the product. It would appear to depend on the meat used in the new product.

From the model it is clear that the researcher will have to price the new products correctly if the predicted consumption levels are to be achieved. This will necessitate very careful consumer research during the development and test marketing phases of the new product development programme.

14.9.2 The Importance of Prestige

Whilst preference explained the majority of the variance in the consumption model, prestige contributes a very much higher proportion of the effect on the determination of the per capita consumption of each of the cuts. The values for the 41 meat cuts on the Thurstone Case V Interval Scale for preference ranged from -1.55 for beef heart to 1.37 for chicken, the most preferred of all the meats in the study. Whereas the prestige ratings ranged from 0.8 for beef hearts to 6.8 for leg of ham. It would be easier to raise the 'prestige' ratings of a cut by 1.0 unit than the 'preference' ratings, hence the conclusion that 'prestige' has a greater effect on consumption than preference.

Prestige is a symbolic attribute of a food which is very much tied up with the mores and culture of a society (Wieranga, 1983). The 'prestige' rating of a food can be changed by the way it is presented, packaged, formed, promoted. From a new product development perspective it would appear that if per capita consumption for the new meat product is to be high, then the prestige rating of the product should be as high as possible. The study showed that sausage products, including salami, had very low 'prestige' ratings. Moreover, any product that was minced,

diced and stewed also received very low 'prestige' ratings. This would appear to suggest that the consumers expected the meats to have a whole muscle, intact cut, appearance if they were to be accorded a high 'prestige' rating.

New meat products should clearly give the impression of being intact whole muscle, i.e. minimally processed if they are to be accorded high 'prestige' ratings. Thenew products will also need to be presented, packaged and promoted in such a way that convinces the majority of the consumers that the new meat has that 'special' something that sets it apart from the majority of meat products and also that the opinion leaders are eating the new product.

14.9.3 Importance of Flavour

According to the preference model the product developer can make a significant contribution to the preference and thereby the per capita consumption of the meats by firstly improving the flavour, secondly improving the juiciness and succulence and thirdly by ensuring that the product has minimal bone removed.

Palmerston North respondents scored all the offal products with a very low 'flavour acceptability' score indicating that they did not like the flavour of products such as tripe, tongue, liver and kidneys. Moreover, they scored all the sausage products including salami with very low 'flavour acceptability' scores - indicating that they clearly did not like the highly-seasoned flavours of these products compared to the more meaty flavour of the whole muscle cuts. The respondents also downgraded the sheep meats and in particular the mutton cuts for 'flavour acceptability'. fish, chicken, pork and ham and beef were the more acceptable flavours as far as the consumers were concerned.

From a product development perspective, the new products should have flavours akin to fish, chicken, ham, pork or beef if they are to be accorded high 'flavour acceptability' scores and hence increase the preference ratings for the cuts and in turn influence per capita consumption of the cuts.

14.9.4 Importance of Juiciness

With regard to juiciness, the beef cuts were generally accorded the highest juiciness scores together with the ham cuts. The sheep meat cuts, particularly the mutton cuts were scored 1 to 2 units lower in juiciness than the beef cuts. The sausage poducts, particularly the continental sausage products, were given very low scores for juiciness.

For a new product to receive a high preference rating the model suggests that the juiciness score should be increased to as high a level as possible. However, it is conceivable that there must be some optimal level, in line with the ideal point model. However, the study failed to identify such a relationship, but instead implied that the juiciness level should be increased to as high a level as is possible if the preference rating for the new products are to be highly preferred.

14.9.5 Importance of Bone

According to the preference model, the bone content of a cut should be maximised if its preference rating was to be high. An examination of the preference ratings for the sheep meat cuts and also the pork cuts shows that the leg cut of each species had the highest preference rating, followed in order by the loin chop, forequarter and then the neck chop. With the exception of the forequarter the sequence of prefrence suggests decreasing preference for increasing bone to meat ratio - something that the model failed to account for.

Athol Hutton, General Manager of Waitaki N.Z.R. at the August, 1985 IBM Business Fellows Lecture Series, quoted from his company's research findings in the U.S.A. that the American consumer wanted to see a boneless leg of lamb retain the shape and conformation of a bone-in leg. It would seem that the American consumers were concerned with the identify status of their foods. The same sort of attitudes could be evident in the present survey regarding the need for retention of bone in the meat cuts to improve their preference rating.

From a new meat product development perspective it would appear that little or no bone should be removed from cuts if their preference ratings are to be retained and in the case of reformed products, it would appear that if the meat were to be formed with a small proportion of

bone, then this would increase the preference rating of the new product and hence increase its per capita consumption.

14.9.6 Importance of Tenderness

According to the proportion of household model, the number of households that consume a cut could be increased if the meat cuts were made consistently more tender. Fish was given the highest tenderness score (7.5) and tripe the lowest with a score of 1.7. Chicken, ham, the beef steak cuts and leg of pork and lamb were also given reasonably high tenderness scores. The chop cuts of all species and the mutton cuts and continental sausages were all given low tenderness scores.

The product developer can affect the tenderness rating of a meat product by the judicious use of electrical stimulation, ageing, mechanical tenderisation with tumblers/massagers and similar devices and even by enzymic tenderisation. Increasing the tenderness rating of a product by even a single unit would clearly improve the market penetration of a product by almost 9%.

14.9.7 Importance of Expense and Value for Money

According to the model the proportion of households that consume a cut could be increased by increasing the perceived value of the cut and by decreasing the perceived price or expense of a cut. On the 9-point Semantic Differential Scale for 'expense', none of the cuts had a score that exceeded 4.5, which meant that all the meat cuts included in the survey were seen to be expensive. Chicken, with a scoreof 4.3, stewing steak and pork sausages were seen to be the least expensive of all the cuts, whilst leg of pork, leg of ham, porterhouse steak and the continental sausages were all seen to be very expensive. The meat cuts that were seen as comparatively inexpensive generally scored very well on the number of dishes that could be prepared from the meat attribute, whilst the more expensive cuts scored poorly on the versatility attribute. It would appear that for a meat cut to score well on the 'expense' attribute then the respondents must be able to prepare a numbr of dishes from the product. Therefore the product developer, in conjunction with the development of the new product, should also develop a number of dishes that can be made from the new meat product so that the respondents view the new meat cut as being 'value for money' and

comparatively inexpensive because of its versatility, i.e. the number of dishes that can be prepared from the product.

With respect to the attribute 'value for money', chicken, fish, the beef cuts, pork cuts and leg of lamb all scored well on this attribute. The remaining sheep meat cuts and in particular the mutton cuts all scored 1 to 2 units lower on this attribute than the beef cuts. The sausage products and in particular the continental sausages all scored badly on this attribute as well. It was also evident that the leg cut of each species had the highest rating, followed by the loin chop, forequarter and the neck chop. The attribute appeared to be connected with the bone content, i.e. the respondents, while they wanted a certain amount of bone, did not want too much.

14.10 RELEVANCE OF THE MODELS TO HIGH, MEDIUM AND LOW CONSUMERS OF MEAT

In Chapter 5 it was shown that it was possible to sub-divide the sample into three groups based on their total meat intake, i.e. high, medium and low meat consumers. In Chapter 13 it was shown further that the three groups had different attitudes to the meats consistent with their consumption patterns, i.e. the low meat consumers scored practically every cut of meat more negatively on most attitudes than the medium meat consumers who in turn tended to be more negative in their attitudes than the high meat consumers.

The attitudes important in the three models, the predited and actual values for per capita consumption, preference and proportion of households consuming meat for the whole sample, and the low, medium and high meat consumers are presented in Table 15.8 for the mean of the 45 cuts.

As can be seen from the Table, the models were able to predict both the preference scores and the proportion of households consuming meat with a good degree of accuracy. However, the consumption model, whilst indicating total per capita consumption of meat was lowest for the low meat consumers at 86.8 kg/capita/annum, slightly higher for the medium meat consumers at 95.3 kg/capita/annum and highest at 109.0 kg/capita/annum for the high meat consumers, was different to the actual consumption figures of the low (43.8 kg/capita/annum) and the high meat

Table 14.8 Predicted and Actual: Per Capita Consumption; Preferences; and Proportion of Households to Meat for the Whole Population, High, Medium and Low Consumers of Meat in Palmerston North in 1979

	Population	Low Meat Consumers	Medium Meat Consumers	High Meat Consumers
Expense	2.98	2.24	3.14	3.21
Prestige	2.83	2.48	2.78	2.94
Value for money	3.78	3.17	3.84	4.17
Flavour acceptability	4.13	3.94	3.85	4.58
Juiciness	3.85	3.13	3.90	4.22
Tenderness	4.88	4.09	4.94	5.22
Bone content	5.09	4.15	4.97	6.07
Price ($/kg [1985])	6.16	6.16	6.16	6.16
Per capita consumption (kg/capita/annum)				
Predicted	101.2	86.8	95.3	109.9
Actual	99.3	45.3	92.4	173.7
Meat preference score				
Predicted	-0.03	-0.10	-0.12	0.06
Actual	-0.02	-0.13	-0.09	0.06
Proportion of households				
Predicted	49.9	33.7	52.0	57.4
Actual	49.9	35.1	49.8	58.1

Note: Mean values for the 45 meat cuts were used hence the preference and proportion of household scores are lower than would be expected for individual cuts.

consumers (173.7 kg/capita/annum), though very similar for the predicted consumption figures of the medium meat consumers. The fact that the predicted consumption levels for both the high and low meat consuming groups was different to the actual figures is not altogether unexpected since a few households had exceedingly high meat intakes and as a result tended to raise the consumption figure for the high meat eaters to an exaggerated high; the same effect could be expected with the low meat-consuming group, i.e. a small group of the households had a very small meat intake, thus dragging down the remaining members of the group. However, in spite of these effects, the consumption model still tended to under-estimate the meat consumption of the high meat consumers and over-estimate the meat consumption of the low meat consumers. This could be expected since the model only accounted for 61% of the variance in the per capita consumption of the 41 meat cuts. There are clearly other factors which are important determinants of meat consumption. There may have been other attitudes not included in the model which could be of importance in meat consumption. Lifestyle characteristics could also be important as shown in Chapter 6. Finally socio-economic variables could also be important, in spite of their non-inclusion in any of the models presented in this section. Their non-inclusion in the present model could have been due to the nature of the sample that was collected for the 1979 survey on which this chapter is based, because the sample was biased towards the households with above-average income consisting of 4-member households with the respondents in the 20-40 age bracket. As a consequence of this bias, the dummy variables for each of the socio-economic variables showed little or no difference between the 41 meats.

However, the model did predict total meat consumption for the whole sample with reasonable accuracy. The predicted value was also very similar to the national average total per capita consumption of meat (N.Z. Annual Yearbook, 1984).

14.11 MEAT PRODUCT DEVELOPMENT

Product development can involve product improvement as well as the development of a completely new product. From an examination of the results from the present study, there are a number of meat cuts and meat

products which need improving. From the viewpoint of New Zealand's national economy, the meat in greatest need of improvement is mutton as the country is experiencing great difficulties in finding markets for carcase as well as boneless mutton. Not only should some of the cuts be improved, but there is a need to also develop completely new products from mutton as well.

However, the results from the present study also show that there are considerable difficulties associated with mutton as the consumers appeared to have morenegative attitudes towards mutton than most of the other species. From a success point of view it would be easier to take a raw material like chicken or pork which already have very positive consumer attitudes to the meat, than to take mutton as the starting raw material for new product development. However, the intention of the present study was to examine mutton as the raw material ingredient for both product improvement and new meat product development.

14.11.1 Improvement of an Existing Product

As an example, leg of mutton was chosen. Per capita consumption of mutton in New Zealand used to be approximately 36 kg/capita/annum in the early 1960's, but by 1978 per capita consumption had dropped to approximately 19 kg/capita/annum (N.Z. Department of Statistics: Annual Yearbooks, 1960-1984). In 1985, approximately 48% of households in Palmerston North consumed some cut ofmutton. How is this drop in per capita consumption to be reversed, and in particular how could the per capita consumption of the leg cut of mutton be increased, and how could more households be convinced to start consuming the cut?

According to the models, per capita consumption could be increased by increasing the preference rating of the cut, dropping the price and increasing the prestige rating of the cut. The number of households consuming the cut could be increased by increasing the tenderness, increasing the perceived value and reducing the perceived price of the cut. The preference rating of the cut could be improved by improving the flavour, retaining the bone, and increasing the juiciness.

Concentrating on the preference aspects first: Drew (private communication, 1985) has shown with lamb and to a lesser extent mutton that carcases which contain less than 8% 'chemical' fat have a flavour

similar to beef. The same worker has also shown that diet modification can also affect the flavour of sheep meat. Grain feeding for 6-10 weeks prior to slaughter can reduce the strong sheep flavour typical of New Zealand grass-fed sheep. It would appear then that with a combination of genetic selection for lean carcases, together with the correct feeding regime, it may be possible to modify the flavour of mutton to produce a product that has the flavour characteristics of lamb and possibly even beef. If this does not work, then it may be necessary to inject either a synthesised beef, chicken, pork, ham or other flavour into the leg of mutton to modify the flavour and improve the product's flavour attributes and hence its preference.

The juiciness rating of the cut could be improved by multi-needle injection of a very dilute salt brine with flavourings, followed by tumbling to give meat characteristics similar to ham. The addition of less than 1% salt and 0.3% sodium tripolyphosphate, followed by tumbling would reduce the cooking loss of the meat and hence improve its juiciness. This too would improve the product's preference rating and hence per capita consumption.

Little can be done to the product to improve its bone content as the product already has the necessary bone attributes to have a high preference score.

With regard to increasing per capita consumption of the cut, the suggested changes with regard to the attributes affecting preference should also affect per capita consumption. However, price is also a major determinant of per capita consumption. But in view of the cost escalations in the meat industry, a price drop is unlikely. The only other determinant of per capita consumption is the prestige rating of the cut. This would need to be improved if consumption were to increase. This could be achieved in a number of ways:

* change of name to eliminate any reference to mutton;
* incorporation of other products with the cut which have a high prestige rating of their own, i.e. association with these other products could raise the prestige rating of mutton;
* preparation of a number of dishes from the cut which have high prestige associations;

* decoration of the cut to give it an above-average appearance rating, such as a glaze using honey;
* finally advertising and promotion should be used to convey the necessary prestige associations for the product.

Convincing more households to purchase the cut could be achieved by increasing the tenderness of the cut. This could be done by electrical stimulation of the carcase, prior to fabrication, followed by multi-needle injection and massaging to break the tissue further andhence improve the tenderness of the product by disrupting the collagen sheaths around the muscle. The perception of value for money and price would need to be dealt with by the promotion and advertising function of the company with the express aim of showing that the leg cut of mutton (improved) is as cheap and of comparable value for money as most other meats consumed by the respondents.

According to the models, total consumption of leg of mutton should be improved by way of more households purchasing the cut and secondly by an increased per capita consumption of the cutas a result of the suggested improvements.

14.11.2 New Meat Product from Mutton

Many of the aspects dealt with in the previous section hold for the development of a completely new meat product from mutton. According to the respondents mutton suffers from a number of drawbacks. These include: the flavour - most respondents do not like it; the colour - most respondents thought it unacceptable; the fat content - it was thought to be too fatty; the tenderness - it was generally thought to be too tough; the juiciness - it was thought to be a dry meat compared to most beef cuts and lamb cuts; it lacked prestige; and was thought to be too expensive and poor value for money. The high collagen content of mutton is also a problem, but this was not listed by the respondents.

The respondents clearly preferred the chicken, pork, fish, ham, beef and to a lesser extent the flavour of lamb. The aim of the programme should be to produce a new product from mutton with one of the more acceptable flavours. As outlined in the previous section, this could be achieved partly by genetics and partly by feeding. However, it could also be achieved by mincing boneless mutton through a 1 mm plate and then heat

treating the particles in M.I.R.I.N.Z. Low Temperature Rendering system being careful not to denature the proteins. This will mean rendering at a temperature between 45-50°C for up to 3 minutes to avoid denaturing the actin and myosin. The protein fraction could then be centrifuged in a scroll centrifuge to remove the protein fraction for further processing. The fat fraction could be retained for production of tallow.

The protein fraction could then be further sub-divided in a mill and then fed into a counter-current surimi process. The objective of such a process would be to remove the soluble proteins such as myoglobin which are responsible for the colour and also the non-protein fraction which contains a large portion of the flavour. This fraction could be concentrated to produce a meat extract concentrate or powder. The colour- and flavour-reduced fraction, i.e. mutton surimi, could then be further processed to produce re-formed chops, leg cuts with bone-in, to enhance the preference rating of the product.

The aim of the restructuring should be to produce a product that has the appearance of an intact muscle derived from a meat other than mutton, such as lamb, beef, pork and even chicken. The product could be flavoured with a beef, pork or chicken flavour to further enhance the preference rating of the new meat cut.

If the new product looked, tasted and appeared to be derived from one of the more highly preferred cuts such as chicken and pork, then the per capita consumption for the cut should be high and provided it was presented, packaged and promoted correctly, then a high proportion of households should also purchase the new mutton product on a regular basis.

14.12 CONCLUSIONS

14.12.1 Techniques

Forward stepwise Multiple Regression proved to be a most effective method for developing models to predict per capita consumption of the 41 cuts, preference for the 41 cuts and also proportion of households consuming each of the 41 cuts.

The model to predict per capita consumption of meat was a demand analysis model which indicated that per capita consumption of each of the cuts was dependent on preference for the cut, the price of the cut and the prestige rating of the cut. The model took the form:

$$\text{Consumption} = 1.50 + 1.02\ \text{Preference} - 0.20\ \text{Price} + 0.71\ \text{Prestige}$$

.... Equation 14.1

The model whilst highly significant, only accounted for 61% of the variance in the dependent variable indicating that variables other than those that were included in the study were of importance in predicting per capita consumption of meat. However, the model did explain a greater proportion of the variance than other studies reported in the literature.

The per capita consumption model was able to predict pr capita consumption of the various meat cuts of the medium meat consumers with a reasonable degree of accuracy. However, it tended to under-estimate consumption by the high consumers of meat and over-estimate the consumption of the low consumers of meat.

The model to predict the preference ratings for the 41 meat cuts on a Thurstone Case V Interval Scale had the form of a typical Fishbein/Rosenberg attitude model as advocated by Engel et al. (1982). The model predicted that the preference ratings for a meat could be increased by improvements in the flavour acceptability of the meats and the juiciness - two sensory attributes of a food - and also by an increase in the bone content, i.e. a retention of the bone for cuts containing bone. The model took the form shown:

$$\text{Preference} = -2.87 + 0.38\ \text{Flavour} + 0.14\ \text{Bone} + 0.20\ \text{Juiciness}$$

.... Equation 14.3

The preference model accounted for over 90% of the variance in the predicted variable and the model could account not only for the whole sample, but also the preference ratings of the high, medium and low consumers of meat.

The model to predict the proportion of households that consume each meat cut, like the consumption model took the form of a demand analysis-type model. However, the predictor variables were all attitudes - tenderness, value for money and perceived price. The model accounted for over 93% of the variance in the dependent variable and could account not only for the whole population, but also the high, medium and low consumers of meat.

The model predicted that if the tenderness rating of a meat cut could be improved, or if the consumers could be convinced that a cut had a higher perceived value for money or that it was not as expensive as it seemed to be, then more households should be encouraged to puchase the cut. The model took the form:

Proportion of households eating = 22.23 + 8.79 Tenderness - 6.89 Perceived Price + 6.91 Value for money .... Equation 14.2

All three models confirmed King's (1973) view that a meat cut must be salient to people's needs and desires and that the product must be relevant to both the functional and non-functional requirements of the consumer. All three models included tangible as well as intangible attributes of meat products as predictor variables.

14.12.2 Meat Product Concepts

The three models did not specify which meats should be used as a basis for new meat product development. However, the three models provided the necessary guidelines for both product improvement and new meat product development.

As an example for product improvement, leg of mutton was arbitrarily selected. The models indicated that if the preference rating and prestige rating for leg of mutton were improved then the per capita consumption of this cut should be improved.

The preference model indicated that if the flavour and juiciness of the cut were improved and the bone content retained, then the preference rating of the cut should be improved. The proportion of households model indicated that if the tenderness, value for money and perceived

expense were improved then the cut should be purchased by more households.

In line with these indications for improvement of the leg cut, the product should be obtained from lean mutton carcases that have been fed a grain diet for up to 8 weeks prior to slaughter to reduce the strong mutton flavour. The fat content of the carcases should be less than 10% chemical fat. The leg should be multi-needle injected wih a mild brine containing less than 1% salt and 0.3% sodium tripolyphosphate. The leg should then be tumbled or massaged to tenderise the product and also ensure that the cut takes up moisture. The tumbling should not break up the tissue. The product should then be honey glazed or marinated to give the product a 'prestige' rating by associating the product with products that already have 'prestige' ratings. The product could then be packaged to give it an appropriate up-market image. The promotion and advertising should concentrate on aspects of presige, value for money and perceived expense to convince the consumers that the cut has a high prestige image, represents value for money and is not as expensive as many other cuts of meat.

As an example of a completely new meat product a comparison was made between mutton and the more preferred cuts of meat such as chicken, pork and beef. From this analysis it was shown that if mutton was size-reduced to give a fine mince and that this mince was first treated in a MI.R.I.N.Z. Low Temperature Rendering system to remove the fat and then processed through a fish surimi process to remove much of the colouring material as well as the non-protein nitrogen, which is largely responsible for the non-fat flavour components of mutton, it would be possible to end up with a raw material that would have lost most of the defects of mutton and which could then be processed into a number of products. It could be reformed to give large meaty chops with the original bone still on. Provided the product still looked like an intact piece of meat the product, according to the models, should have a high per capita consumption and be purchased by a number of households because the product would not have many of the defects of the starting raw material.

CHAPTER 15
THE STUDY IN PERSPECTIVE

The study set out with six very clear aims in mind and the intention of this last chapter is to review the findings of the study in terms of the aims and in the light of results, where applicable, by other researchers in the field.

15.1 FACTORS AFFECTING CONSUMPTION OF MEAT

15.1.1 Income

Watkins, as early as 1936 showed that the amount of food that was purchased and consumed by households in the U.S.A. was highly dependent on the amount of disposable income. Rhodes et al. (1956) again demonstrated the relationship between food consumption and income. Other studies carried out in many other parts of the world have also demonstrated that meat consumption is dependent on income. These include: Yandle (1967) and Brodie (1977) in New Zealand; the two Australian Bureau of Agricultural Economics studies on meat consumption in Sydney (1967) and Melbourne (1970); Hughes (1976b) and Baron (1981) in the U.K.; Koopahi (1978) in Iran.

The dependency of income on meat consumption was also evident in the present study. However, it was also observed that once the income of the principal income earner had reached a certain level - $14,000 for the 1979 survey and $18,000 for the 1985 survey - then consumers would switch to the more expensive cuts such as the steaks and pork cuts rather than increase their per capita consumption of meat with increased income. A similar result was observed in the two Australian Bureau of Agricultural Economics studies (1967, 1970); Hughes' (1976b) study and also Brodie's (1977) study in Christchurch.

Although income appeared to be an important determinant of the amount and types of meat consumed by Palmerston North householders, the variable was not included in the model to describe per capita consumption of the various cuts. This was attributed to the fact that the 1979 survey sample was biased towards the above-average income householders where the respondent was mostly in the 20-29 age group, i.e. because the model

was an aggregated model and no income differences were evident for the different meats, income was not included in the model to describe per capita consumption.

15.1.2 Age of the Respondent

In the present study the range and per capita consumption of most of the cuts was shown to be least for both the under-20's and over-60's age groups. The 20-29 age group appeared to consume more roasts and less convenience meats compared to most of the other age groups. The group consuming the widest range and highest per capita consumption of all age groups was the 40-49 age group. The 50-60 age group was shown to consume a relatively high proportion of pork compared to other age groups.

Hughes (1976a) found in the U.K. that per capita meat consumption was lowest for the under-20's and over-60's and highest for the 40-50 age group - results that were very similar to the present study.

Kuehn (1975) showed that per capita beef consumption was highest in West Virginia when the principal income earner was aged between 45-54 years of age, and pork per capita consumption was highest in households in which adult members were over 55 - a similar finding for pork to the results of the present study. Jeremiah (1981) showed in Alberta that the greatest number of servings of beef purchased per week was by households with adult members in the 35-49 age bracket. However, Jeremiah (1981) also found that the percentage of consumers consuming pork decreased in a linear fashion with age after adult household members reached the age of 35.

15.1.3 Household Composition

Size of Household:

The survey found that with some cuts, such as all the lamb cuts and expensive steak cuts, per capita consumption was shown to increase with increasing household size. Brodie (1977) found that per capita consumption of the grilling steaks increased as household size increased. However, Brodie found no clear relationship emerged between household size and consumption of pork and lamb chops. The two Australian Bureau of Agricultural Economics studies (1967, 1970) found that per capita consumption of most meats and in particular the steaks

tended to fall with increasing household size, although beef stewing steak and beef mince increased in per capita consumption as the household size increased.

With the present study, the overriding trend was for an increase in per capita consumption of most meats as the household sizes increased from 2 to 5 persons and to then plateau thereafter with increasing household sizes. Brodie (1977) reported the same trend.

Kuehn (1975) showed that as household size increased in West Virginia so per capita beef consumption decreased noticeably, but decreases in per capita consumption of pork were small. Jeremiah (1981) showed that per capita beef consumption was highest for the largest households.

Hughes (1976a) concluded that household size, age of the respondent and socio-economic class were the most important determinants of per capita meat consumption in the U.K.

Age of children:

Few, if any, studies appear to have considered the effect of the age of the child on per capita consumption of meat. The present study showed that:

* Households with children under 2 tended to eat slightly less meat per capita than households with no children under 2. Roasts of various sorts tended to be consumed more often and convenience meats less often in households with children under 2.

* Total per capita meat consumption tended to rise as the number of children in the household increased. Consumption of lambs' liver and kidney, rump steak, porterhouse steak and corned beef also increased with increasing numbers of children in the household.

* Total meat consumption per capita was significantly less for households with children over the age of 10, though per capita meat consumption tended to increase with increasing numbers of children. Less convenience meats and roast meats were served in households with children over the age of 10, and per capita

consumption of most of the sausages was highest for households with children over the age of 10.

15.1.4 Price

Watkins (1936) demonstrated a relationship between the price of food and per capita consumption and since then many economists have highlighted the importance of price in per capita consumption of meat as evidenced by emergence of the demand models for food (Rhodes et al., 1956; and Lancaster, 1966, amongst many).

In more recent times, Jensen (1973) has found that price was an important variable influencing purchasing decisions between fresh and frozen meat. Bernholdt (1974) also found that high cost was the major reason for the poor consumer acceptance of frozen red meats. Ahn et al. (1981) found that high price and poor quality were the major deterrents to the consumption of sausage products in Japan and that total consumption would increase if the selling price were reduced. Branson et al. (1981) found that the major cause of reduced beef intake (61%) was higher beef prices in the U.S.A. Koopahi (1978) found that per capita consumption of lamb in Iranian urban households was highly dependent on price, though beef and poultry per capita consumption was shown to be less sensitive.

Therefore, the inclusion of price in the model to predict per capita consumption of the 41 meat cuts was to be expected. Moreover, 60% of the respondents of the 1985 survey reported that price of meat was a major determinant for the decreases that they had made to their per capita consumption of meat. The study really only confirmed the great body of information that has built up over the years regarding the importance of meat prices in per capita consumption of the various meats.

15.1.5 Attitudes to Meat Cuts

In the present study it was shown that it was possible to divide both the 1979 and 1985 survey samples into high, medium and low per capita consumers of meat and that each group had a corresponding consumption of all meats. It was further shown that the high meat consumers had a more positive attitude to most of the 45 meat cuts than the low meat consumers, on most of the 18 attitudes included in the survey. However, the

medium meat consumers appeared to be highly critical in their appraisal of the 45 meats on the 18 attitudes. In some cases the medium meat consumers scored the cuts with scores that were more negative than the low meat consumers whilst in other cases they accorded the meats scores which were more positive than the high meat consumers.

Whilst there were slight differences in the socio-economic status of the low meat consumers compared to the high and medium consumers, i.e. the low meat consumers were mainly drawn from households where the principal income earner was on a salary equivalent to the average weekly wage and households generally consisted of three members, whereas the high and medium meat consumers came from households that had above average annual incomes and generally consisted of 4-member households. These differences were not large enough to characterise the members of each group and so further studies should be conducted with the aim of characterising the three groups on the basis of lifestyle and socio-economic status. Some of this has been collected in the 1985 survey, but has not been analysed.

15.1.6 Preferences

The model to predict per capita consumption of the various cuts showed that preference had the largest effect in influencing per capita consumption of meat. Jeremiah (1982) has shown that preferences and acceptability are major determinants of the meats that people will buy.

15.1.7 Other Factors

The 1985 survey showed that there were a number of factors that were important determinants of the respondents' per capita consumption. The respondents listed the following reasons in order of importance for the changes which they had made to their per capita consumption over the period 1979-1984: change in family age (38.3%); concern for family health (38.3%); more vegetarian meals (24.3%); awareness of meat alternatives (22.6%); changed lifestyle (17.6%); less family income (11.0%); to stay in shape (10%); doctor's advice (6%); fewer roasts (6%); and more income (6%).

Brodie (1977) found that changes in taste (8%), health (4%), the need for variety (4%), family getting older (4%) as reasons that Christchurch respondents gave for the changes they had made to their meat consumption

patterns over the period of one year. Branson (1981) found that only 15% of those shoppers buying less meat than 3 years ago were doing so because of either health or diet considerations.

Jeremiah (1982) in an extensive review of the factors affecting meat consumption has also shown that geography, nationality, tradition and environment could also have an effect on per capita consumption of meat.

15.2 FACTORS AFFECTING MEAT PREFERENCES

The preference model developed from the results of the survey showed that consumer preference for the 45 cuts included in the survey was dependent on the acceptability of the flavour, the juiciness, and the presence of the original bone in the cut.

Jeremiah has shown in the 1982 review that a considerable amount of research has been aimed at studying either the factors affecting consumers' meat preferences in the retail outlets or alternatively their meat-eating preferences. The present study concerned itself with the determinants of overall preference, rather than one or other of the two above scenarios.

Barton (1970) showed that the acceptability of meat purchases in New Zealand were dependent on their tenderness, juiciness, and flavour and a minimum amount of waste from bone and fat - very similar findings to the present study. Van Syckle (1958) found that Washington respondents considered that the acceptability of their meat purchases were dependent upon the perceived tenderness and flavour of their meats. Riordan (1974) and Robinson (1972) both showed that over 60% of their respondents indicated that toughness was the main problem affecting the acceptability of their beef purchases. Various other workers have also indicated that tenderness was the main determinant of eating satisfaction and thereby the major problem associated with the acceptability of beef purchases (Jeremiah, 1981; Rhodes et al., 1958; Lasley et al., 1955; Van Syckle et al., 1958; Rhodes et al., 1964; Brady, 1957; Brayshaw et al., 1967) followed by flavour (Jeremiah, 1981; Lasley et al., 1955, and Riordan, 1974).

15.3 FACTORS AFFECTING THE NUMBER OF HOUSEHOLDS THAT WOULD CONSUME EACH CUT OF MEAT

The model developed to predict the proportion of households that would consume each cut was shown to be dependent on the tenderness, perceived price and value for money of the cuts, with tenderness the most important determinant.

Larzelere (1956) found that price differentials influenced consumer selections of meat purchases. Marsh (1958) in Britain was able to show that consumers selected specific cuts primarily for economy (value for money) and then for leanness. Woods et al. found that Louisiana consumers selected specific cuts for anticipated palatability, versatility of use, ease of preparation and to satisfy family preferences. Danner (1959) also showed that consumers selected round steak and ground beef for their ease of preparation, economy, versatility of use and anticipated palatibility.

15.4 COMPARISON OF METHODS TO MEASURE PREFERENCE

The aim of the comparison was to ascertain whether the Semi-structured Linear scale developed by Stone et al. (1974) for use in sensory analysis could be modified and used for determining consumer preferences for meats rather than the well-established Thurstone Case V Method and Thurstone's more General Method. The Thurstone Methods, because they used paired comparison for obtaining preferences suffered from two major disadvantages:

* The time needed by respondents to compare the large number of pairs if there were a number of stimuli involved in the comparison;
* The fact that the methods could not be used to derive an interval scale if the number of triads in the data exceeded some minimum number (Kendall, 1962).

The study showed that the Semi-structured Linear Scale was just as reliable as the two Thurstone methods in recovering both the original rank order in the data for the 15 meats and also in producing a linear

interval scale that could be transformed into a Thurstone Case V Interval scale by simple linear transformation.

Whilst the Semi-structured Linear Scale proved to be as effective as the two Thurstone Methods in recovering the rank order of the 15 meats and also their arrangement along an interval scale, further work should be carried out with the method to establish firstly the number of stimuli, products etc. that respondents could cope with at any one time and secondly the validity of the scale, i.e. the freedom of the scale from systematic error when respondents are faced with the same ranking task over n repeats. Finally the procedure should be evaluated as a possible replacement for the Semantic Differential Scale in attitude studies as the method could save the respondents a considerable amount of time in their evaluations, particularly of a large number of products as was the case for the present study.

15.5 MULTIDIMENSIONAL SCALING

15.5.1 Preference Measurements

The study showed that it was possible to obtain an n-dimesional configuration if preference 'dominance' data was analysed by KYST II using a monotonic regression function. However, it was also shown that this configuration was highly dependent on the arrangement of the meats in the data matrix and that the configuration would finally degenerate into a uni-dimensional configuration if the meats were arranged in descending rank order in the data matrix or if a linear regression function rather than a monotonic regression function were used in the analysis. In other words the study showed that 'dominance' preference measurements resulted in highly unstable n-dimensional configurations which tended to degenerate into a unidimensional configuration.

It was also shown in the study that similarity preference measurements, i.e. with the dominance criteria relaxed, would result in a unidimensional configuration whether the data was analysed with a monotonic or a linear regression function. This was demonstrated for both the 15 meats data and the 41 meat cut data.

For the 15 meats a unidimensional solution was characterised by a sinusoidal arrangement of the meats along the preference axis, and with the 41 meat cuts a unidimensional solution was characterised by an arrangement of the 41 meats on a horseshoe. Coxon (1982) and Kruskal and Wish (1978) have extensively documented the causes and characteristics of MDS unidimensional solutions.

The study showed that it was not possible to analyse preference data with KYST II without resulting in a unidimensional solution. It was concluded therefore that preference in this study was a unidimensional continuum and not a multidimensional continuum as Kendall (1962) and others have suggested. However, the subsequent Multiple Regression analysis showed that the preference ratings for the 41 meat cuts was dependent on three independent variables: flavour; juiciness and amount of bone in the cuts, i.e. that preference was a multidimensional continuum as had been theorised by Kendall (1962).

It would appear therefore that if any data that embodies the concept of dominance in the arrangement of the meats, eg. something is longer than other objects or has a stronger flavour is analysed by KYST II it will result in a unidimensional arrangement of the objects. Care should obviously be taken by the researcher in defining the comparisons that the respondents have to perform. If there is any implication, in the comparison, of dominance then some other more appropriate analytical method such as Multiple Regression should be used to uncover the underlying dimensions as MDS analysis may result in a unidimensional solution.

15.5.2 Substitutability (Similarity) Measurements

The study showed that substitutability measurements were not susceptible to changes in the order of the meats in the data matrix. Moreover, the data resulted in the same configuration whether monotonic or linear regression functions were used to control the MDS analysis. For these reasons it ws decided that substitutability measurements were a more appropriate form of assessing the similarities between the meats than preference measurements. The use of similarity measurements in MDS have been well documented by Coxon (1982) and Kruskal *et al*. (1978). Multidimensional Scaling has been criticised (Gendall, 1978) for the fact that it produces rather predictable groupings of products and for this

reason is of little value in identifying dimensions of importance in new product studies. The MDS analyses carried out in the present study showed that if in fact the substitutability measurements were made at a general level, i.e. the 15 meats, then the method did produce predictable groupings of the products. However, if the measurements were made at a more specific level, i.e. the 41 meat cuts substitutability data, then the groupings were certainly not predictable. Part of this unexpected configuration of the meats was attributed to the fact that the respondents actually changed their evaluative criteria for assessing the substitutability between the meats as they progressed sometimes from one pair to the next.

It would appear that considerable thought should be given by the researcher when setting the scenario for the evaluation of the similarities between foods and particularly meat. The similarity task should not be as broad-ranging as the substitutability task which was set the respondents in the present study, but should instead be more specific, such as comparing the flavours, or the colours, or the appearance of the various meat cuts and similar tasks. Care should also be taken to ensure that no task which involves a dominance concept in the similarity assessments is used if the objective is to establish the underlying dimensions of the food products that are being used by the respondents in their comparisons.

15.5.3 Ideal Point Methods

Three different methods were evaluated for locating an ideal point in a multidimensional substitutability (similarity) space. The study showed that Fenker's (1972) and Kruskal et al.'s (1973) methods resulted in very similar solutions for a new product in the 41 meat cut substitutability space. Whilst a method developed by the author resulted in a quite different solution to the above researchers' solutions because the configuration of the meats in the 3-dimensional space was changed, particularly on one dimension.

The method developed by the author had the advantage over the other two methods as it identified the dimension most sensitive to changes in preference. Moreover, the method enabled the researcher to construct an ideal point vector, which originated from the point near the intersection of the two axes, i.e. from Fenker's ideal point to a point on the

extremities of the spatial configuration and indicated products of increasing preference as the points moved from Fenker's ideal to the extremities of the spatial configuration.

Wierenga (1980b) in a review of the various preference models claims that MDS studies provide a most appropriate method of identifying new product opportunities. Shocker and Srinivasan (1973), Green and Rao (1972), Green (1975) and many others would concur with this view. However, with the present study, none of the dimensions from the 41 meat cut substitutability space were included in the models to predict either per capita consumption of the 41 meat cuts, or preference, or the number of households that would consume the cuts.

The use of Multiple Regression analysis helped to identify each of the 3 Dimensions obtained from the 41 meat cuts substitutability space.

Dimension 1 appeared to relate to the overall appearance of the meat cuts as a result of the inclusion in the model of 'colour acceptability' and 'fat content'.

Dimension 2 was similar to the Factor 'meat quality on cooking and serving' and included the attitudes: wastage; convenience; expense; number of dishes, and the nutritional content.

Dimension 3 included the attitudes nutritional content and colour acceptabiity, as well as the per capita consumption of the meats, and these were all loaded negatively in the model together with flavour acceptability, which was loaded positively on the model.

In addition to reinforcing the need to carefully select the similarity assessments which would be set for the respondents, the ideal point determinations also stressed the need to firstly identify the product and attitude attributes which are important in either consumption, or preference, or market penetration or whatever area is of interest to the researcher before setting the scenario for the similarity assessments for subsequent MDS analysis. For instance, flavour was identified in the present study as being the most important determinant of meat cut preference. The respondents should have been asked to assess the similarities between the flavours of the 41 meat cuts and also asked to rank

the meats in order of flavour preference. Subsequent MDS analysis followed by ideal point determination would then have resulted in new meat product ideas that would have been positioned in one of the most important determinants of preference, namely flavour. Similarly with prestige, value for money and expense.

15.6 FACTOR ANALYSIS

Factor analysis of the 18 attitudes for meat in general resulted in three Factors which were classified as 'meat quality on buying', 'meat quality on eating' and 'meat quality on cooking and serving'. Subsequent Factor Analysis of the 18 attitudes for the beef cuts, sheep meat cuts, pig meat cuts and sausage products and also on individual meat cuts showed that the Factors listed above for meat in general were not common to any of the meat sub-groups or to individual meat cuts. In fact, the study showed that the Factor Structures for each of the meats and sub-groupings of meats were unique.

Baron et al. (1973), Hughes (1976b), Gendall (1978) and Baron et al. (1981) also used Factor Analysis in their meat studies in an attempt to summarise much of the attitudinal work concerning meat into a few meaningful factors and also to use the information in subsequent modelling studies of meat consumption. Unfortunately all of the studies of these other researchers as well as the present study have tended to include a few different attitudes, i.e. there has not been a consistent use of the same attitudes in every study, and this has made comparisons between the various studies difficult. However, where similar attitudes have been used then the attitudes have been grouped in the same Factors for meat in general. These other studies have not looked at the Factor Structures of either meat sub-groups or individual meat cuts and so no comparisons can be made on this basis between the results of the present study and other studies.

It would appear that if some progress is to be made in the identification and isolation of Factors which could be used to summarise much of the attributes of meat, then studies should use the same attitudes no matter where the study is conducted because once the

attitudes are changed the studies tend to arrive at Factor structures that are different from study to study.

Baron et al. (1981) in their attempt to predict meat consumption from attitude and socio-economic data could only account for between 12% - 33% of the variance in the dependent variable. They used the Factor-score coefficients for meat in general as a summarised form of the attitudes. The present study, because the Factor structures for each of the meat groups and individual meats were unique, would tend to suggest that the approach adopted by Baron et al. (1981) could have been improved if they had used the Factor-score coefficients pertaining to each of the 12 meats in their study.

15.6.1 Q-Factor Analysis

The study showed that it was possible to Factor Analyse the 45 meat cuts on the basis of the 92 respondents' attitudes towards each of the 45 meats. The analysis showed that the meats were grouped into 'Hypothetical Products' on the basis of the attitude profiles for the meats. The Factor-scores for the meats within each of the 'Hypothetical Products' gave an indication of how similar the attitude profiles of each of the meats were to the others and how close the products approached the Hypothetical Product.

For many meat cuts, no matter whether the meats were Factor Analysed on the basis of the 18 attitudes, or the 'meat quality on buying' attitudes, the 'meat quality on eating' or 'meat quality on cooking and serving' attitudes, they tended to remain together in the same 'Hypothetical Product', i.e. there appeared to be little differentiation between the cuts on the basis of attitude. These groups mainly consisted of the sheep meat cuts, the sausage products and the offal cuts. However, the remaining cuts, in particular the more preferred cuts, tended to move from 'Hypothetical Product' to 'Hypothetical Product' depending on what set of attitudes was being used as the basis for the factoring of the meats by the Q-Factor method.

Q-Factor analysis does not appear to have been used in any food studies although Schlinger (1969) has used the technique in advertising studies. Consequently, a comparison of other studies is not possible.

The technique would appear to offer a number of research opportunities, not only in food product development, but also sensory analysis and market research. If the respondents in the 1979 survey had been asked to give their ideal product, or meat cut, ratings on the 18 attitude scales then the method could have been used to identify in which 'Hypothetical Product' the ideal cut or product was located and how similar it was on the basis of the attitudes to any other products at present on the market.

15.7 THE MODELS

Three models were developed from all of the data that was collected in the 1979 survey. The models are summarised below:

Consumption of the various cuts (kg/capita/annum)	= 1.50 + 1.02 Preference - 0.20 Price + 0.71 Prestige
Proportion of households consuming each cut	= 22.33 + 8.79 Tenderness - 6.89 Perceived price + 6.94 Value for money
Preference	= -2.87 + 0.38 Flavour acceptability + 0.14 Bone content + 0.20 Juiciness

The consumption model accounted for 61% of the variance in the dependent variable while the other two models accounted for over 90% of the variance in their respective models. It would appear therefore that preference and the proportion of households that consume each cut have been adequately accounted for by the respective models. Whilst the consumption model accounts for a significantly higher proportion of the variance than other models (Baron et al., 1981; Rhodes et al., 1956) which accounted for no more than 30% of the variance in the data, it would appear that additional research should be conducted to develop a model that accounts for a greater proportion of the variance in per capita consumption of the various meat cuts. Socio-economic characteristics have been included in most other models (Baron et al., 1981) and so these variables will have to receive additional research.

However, changing lifestyle was shown to be a factor in the present study for changes that people had made to their meat consumptions and so psychographics should also be included in further research to see whether they could account for per capita consumption of the various meats. Brodie (1977), Hughes (1976a, b) and Gendall (1978) have all made mention of the fact that the need for a change in the diet is an important factor in meat consumption. This factor should be included in future studies to see whether it is actually an important determinant of per capita consumption of the various meats.

The three models should be extremely important for the product developer and marketer as they have isolated the most important determinants of per capita consumption, overall preference, and the proportion of households that will purchase the various cuts. According to the models, attention should be paid to price, prestige, flavour, juiciness and bone content in order to boost per capita consumption of existing cuts and also their preference ratings. To increase the number of households that are purchasing the various cuts, attention should be paid to the tenderness and value for money, which should be maximised, whilst the perceived price relative to other meats and competing foods should be minimised. The same characteristics should be concentrated on if any new meat cut or product is to be successful.

Lesser, as far back as 1973, stated "that the socio-economic psychological qualities of meat are more obscure than the physical attributes; though they are more interesting because they can be manipulated through marketing programmes." In the same paper he argued for the need to brand meat. The consumption and proportion of households models both contained socio-psychological attitudes which according to Lesser (1973) indicate the very important role that marketing should play in the selling of meat to increase per capita consumption and market penetration of the various cuts. This is something which could be done in New Zealand to boost the consumption of the sheep meat cuts, and sausage products. However, rather than concentrating on the aggregated approach, as the Q-Factor analysis indicated that there was little differentiation in the minds of the consumers regarding the sheep meats and sausage products, efforts should be made to market individual cuts and hence increase the differentiation between the cuts as is the case with the beef cuts.

15.8 RECOMMENDED METHOD FOR CONDUCTING FUTURE MEAT PRODUCT DEVELOPMENT CONSUMER STUDIES

A number of data collection and analytical methods were used in the present study and the information obtained from the various approaches has been summarised by way of the following recommendation to help future researchers from falling into some of the problems that were encountered in the present study.

Future consumer studies should be conducted in stages, rather than attempting to obtain all the relevant information in one survey as a great deal of unnecessary information can be obtained.

Initially a small focus group session should be conducted to obtain all the important physical and socio-psychological information from the consumers regarding the product group that is to be studied. This information should be supported by information gathered from studies reported in the literature.

On the basis of the information gathered from the consumers in the focus group a consumer survey should be planned and conducted. The consumer survey should obtain the following information from the respondents:

* Point of purchase of the various products under study;
* Frequency of purchase of the various products;
* Per capita consumption or household consumption of the various products on a meal basis or a $ value basis;
* The frequency of consumption of the various products on a monthly basis;
* Socio-economic data;
* Psychographic data;
* Consumer preferences for the various products under study. The Semi-structured Linear Scale method or the Paired Comparison method could be used;
* Scoring of the products, together with an Ideal Product, concentrating on the various physical and socio-psychological attributes of the product. The Semantic Differential or the Semi-structured Linear Scales could be used to obtain the scores for the various products.

The data should then be checked, coded, transferred to the computer and then analysed. The normal forms of analysis such as frequencies, means, standard deviations, cross-tabulations etc. should be carried out on the data. As well as these analyses, Multiple Regression, Q-Factor Analysis and PA2 Factor Analysis with iterations should be carried out on the data.

Multiple Regression should be carried out on the attitude data together with the consumption, preference and proportion of households data to summarise the information in model form and hence identify the important determinants of per capita consumption, preference and proportion of households consuming each of the products.

PA2 Factor Analysis with iterations, followed by Varimax and Oblique rotation, should be used on the attitude data to summarise the attitude data in meaningful Factors.

The products and Ideal Product should be Q-Factor analysed on the basis firstly of all the attitudes and then on the basis of each of the Factors to determine which Hypothetical Product the Ideal Product is placed in, as this will enable the researcher to establish which products the Ideal Product is similar to.

The information obtained from the Multiple Regression analysis together with the information from PA2 Factor Analysis and Q-Factor Analysis should then be used to develop a 'product concept' for the new product together with the product specifications.

If there is still insufficient information for design purposes, then a Conjoint Analysis experiment should be carried out to clearly define the characteristics of the new product.

Multiple Regression will have identified the important product attributes which should be used as the basis of the Conjoint Analysis experiment.

From the Conjoint Analysis experiments it should be possible to produce a product concept and product specifications for the new product.

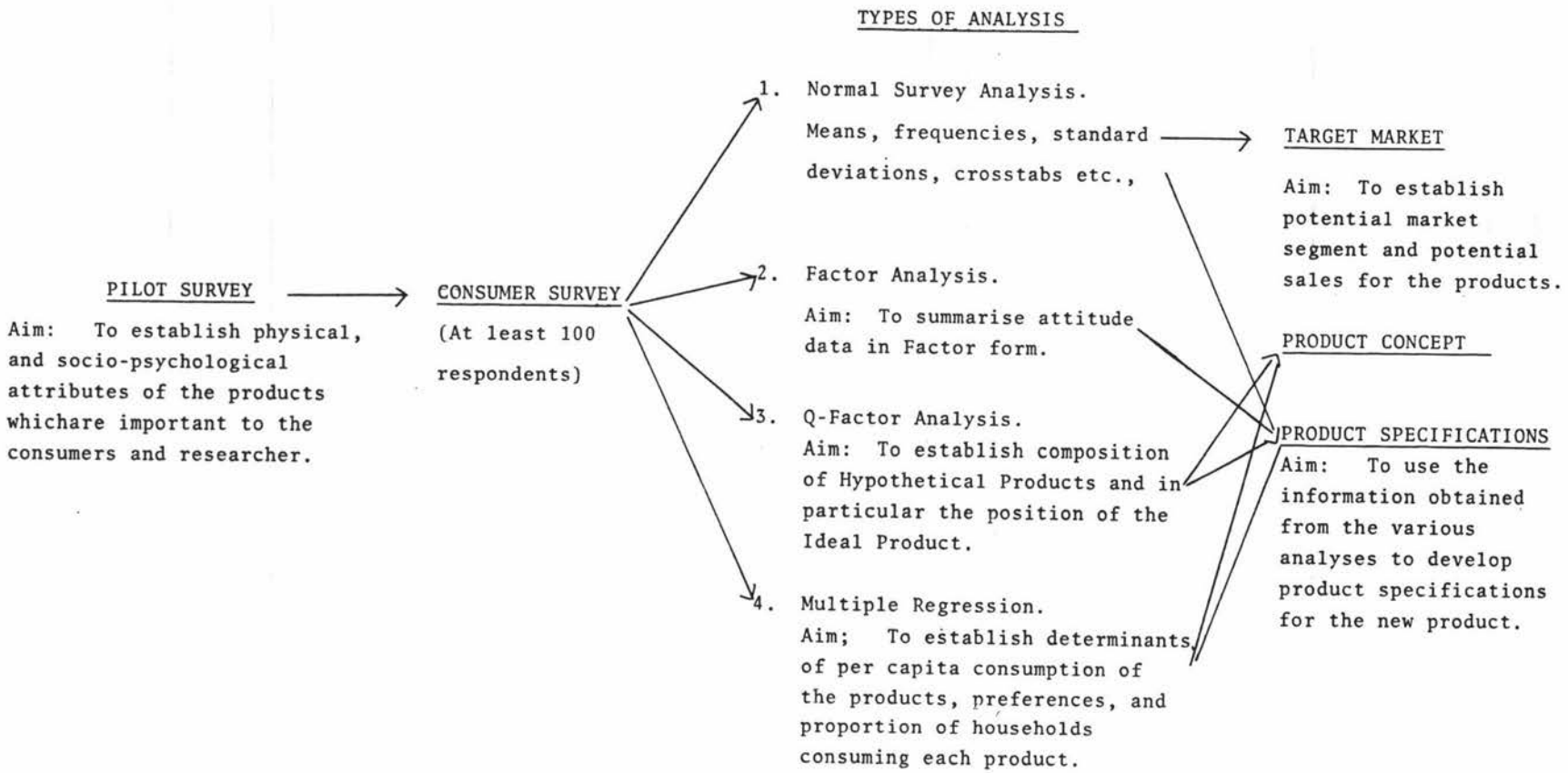

Fig. 15.1 Recommended Procedure for New Meat Consumer Studies.

The new product is then developed according to the product specifications and the product should be regularly tested throughout the development stages according to the criteria obtained from the Multiple Regression Analysis.

The suggested research procedure for future product development consumer studies is provided in schematic form in Figure 15.1.

15.9 CONCLUSIONS

The study showed both the value of different techniques in consumer studies being used to develop concepts for product design, and also the changes occuring in consumer attitudes and behaviour towards meat which could indicate additional areas for product development.

The findings of this study should be regarded as indicative rather than statistically valid because of the non-representative scheme used in the research design. Caution should be used in translating the attitude data and the empirical models developed to the New Zealand population as a whole. Also because of the small number of respondents (92), who answered all three questionnaires, it was impossible to ascertain the amount of variance attributable to the errors in the survey method, the scaling methods used, and the variables themselves. The small sample of respondents meant that socio-economic groupings could not be studied quantitatively. Some error may have been caused in the study because of the time needed to answer the questionnaires and because the respondents answered the questions in stages separated by several days.

Multidimensional Scaling, at least in the context of the present study, was not as satisfactory in identifying meaningful consumer product attributes for new product development as Fator Analysis and Multiple Regression. In part this was attributed to the scenario that

was used to obtain the similarity ratings for the 41 meat cuts. It was felt that the scenario enabled the respondents to use too wide a range of variables to assess the various meat cuts and that future studies should use far more specific scenarios if this technique is to be of use in future product development studies.

The study showed that it was possible to extract three Factors from the 18 attitudes for meat in general which were identified as being 'meat quality on eating', 'meat quality on buying' and 'meat quality on cooking and serving'. The structure of these three factors were shown to be stable when the sample was randomly divided into two halves. However, when the 18 attitudes were Factor Analysed on the basis of 'commodity' groupings of meats, such as the beef cuts - the Factor Structure appeared to be unique to each sub-grouping and indeed different to the Factor Structure for meat in general. Moreover, each meat appeared to have a unique Factor Structure for the 18 attitudes.

The Q-Sort or Q-Factor Analysis method showed that it was possible to group the 45 meat cuts into Hypothetical Products based on the respondents' response set to the attitudes to each of the meats. The Factor Scores for each meat cut established how similar or dissimilar the cuts were to one another in each of the hypothetical products. The Q-Sort technique showed that for many of the meats an arbitrary assignment to 'commodity' groupings such as beef cuts was not the best approach for examining the meats and that the Q-Sort technique based on respondents' attitudes should be a first step in categorising or grouping products prior to an examination of the attitudes to the cuts with the traditional Factor Analytic approach.

The Q-Sort technique would appear to be an excellent method for segmenting both respondents and products based on either attitudes or consumption patterns as the technique groups either the products or respondents on the basis of similar response sets.

The three linear models developed to relate consumption, preference and proportion of households consuming the meat to the other variables are empirical models, the coefficients of which are only of value to the present study. The coefficients would change if a different number of meats were included in the study and/or different scales were used to assess the magnitude of the respondents' attitudes.

No attempt was made to model the respondents' meat preferences as this is an extremely difficult research area and usually involves the construction of exceedingly difficult and complex models. The preference model presented in the study is simply an equation which identifies the variables which appeared to be implicated in the respondents' meat preferences. the importance of the three models lies in the fact that they identified the more important variables which should be considered in the design of new and improved meat products. The validity of the models should be determined in future product development studies.

A comparison of the 1979 and 1985 meat consumption figures confirmed the view that per capita consumption for most meats had declined over the period 1979-1985. Price, changed lifestyles and health considerations appeared to be the major reasons for the respondents' changes in per capita consumption of the various meats. The respondents appeared to have reduced their per capita consumption of the more expensive beef cuts and pork cuts in response to the increased prices of these cuts over the period 1979-1985. The respondents had appeared to consume less of all the roasting cuts from each of the meat species - a response which appeared to have been due to a combination of price and changed lifestyles. Per capita consumption of both mutton and hogget had been shown to decline over the period 1970-1979 and whilst consumption appeared to have stabilised over the period 1979-1985 the respondents' had very negative attitudes to each of the cuts from these two meats. The levelling off in per capita consumption of these two meats over the

period 1979-1985 appeared to have been due to the relative prices for these two meats when compared with beef and pork, i.e. a substitution effect for a decline in per capita consumption of beef and pork by a slight increase in per capita consumption of mutton and hogget. However, the study showed that if the standard of living of the respondents were to improve they would not increase their per capita consumption of either mutton or hogget, but would instead consume more of the expensive beef and pork cuts, more fish, chicken and fruit and vegetables.

There is a trend of declining per capita consumption for hogget, mutton and some sausage products over the period 1970-1979, and a likely probable future decline for these products in future years given the respondents' negative attitudes to these meats. If it is assumed that the standard of living were to improve in future years, the results of the study would suggest that urgent consideration should be given to a new product development programme. The aim of which would be to produce a range of new products based on either hogget or mutton to achieve a substantially higher acceptance by the respondents than is the case for the two meats at present.

The study suggested that if per capita consumption of the new products is to be high then the preference rating and prestige ratings for the new products should be much higher than is the case for either the hogget or mutton cuts and should if possible approach those of chicken or the more expensive beef cuts. The price of the new products should be such to ensure continued demand for the new products. If the preference ratings for the new products is to be high then the study suggested that the products should have a highly acceptable flavour, be juicy and have a small amount of bone present. The study also suggested that if the product were to be consumed in a large proportion of households then the product should be tender, not too expensive and have a high value for money rating. Product concepts for the new products should be developed which incorporate the above

variables and these product concepts could then be tested in small discussion groups to test the validity of the models. Then the products could be developed and tested by large groups of consumers.

APPENDIX 2.1

MASSEY UNIVERSITY
FOOD TECHNOLOGY RESEARCH CENTRE

MEAT PURCHASE

I would like to find out where you buy your meat, how you buy your meat. Please tick the appropriate boxes.

Q1. From which of the following shops do you most often purchase your meat?

	Fresh Meat	Smallgoods	Bacon, Ham
DAIRY	☐	☐	☐
SUPERMARKET	☐	☐	☐
GROCER	☐	☐	☐
BUTCHER	☐	☐	☐
SUBURBAN BULK BUTCHER	☐	☐	☐
CITY BUTCHER	☐	☐	☐
FREEZING WORKS	☐	☐	☐
DELLICATESSEN	☐	☐	☐
FARMER	☐	☐	☐
KILL OWN	☐	☐	☐
OTHER (PLEASE SPECIFY)	☐	☐	☐

Name of the shop that you usually buy your

(a) Fresh Meat _____

(b) Smallgoods _____

(c) Ham and Bacon _____

Q2 When you purchase your meat do you usually buy

	BEEF	PORK	LAMB & MUTTON	SMALL GOODS	BACON & HAM
(a) Enough for 1 day?	☐	☐	☐	☐	☐
(b) Enough for 2-3 days?	☐	☐	☐	☐	☐
(c) Enough for 1 week?	☐	☐	☐	☐	☐
(d) Enough for 1-2 weeks?	☐	☐	☐	☐	☐

(e) Enough for 2-4 weeks?

(f) Enough for 1-2 months?

(g) Other (please specify? _____

Q1 I should like to find out how much of the different meat cuts your household would consume per meal and how often you use each meat cut.

The names of most of the meat cuts that are on sale in the shops can be found on the next page. Please could you go down the page and tick all the boxes that correspond to the meats that you presently purchase. Could you add at the bottom of the page the names of any meat cuts that you use which are not on the sheet of paper.

(a) Please would you tell me how much of each meat cut you would use for each meal? For example, when you have sausages for a meal you might use 500 grams, in which case you would enter 500 grams in the "amount consumed per meal" column.

(b) Now could you tell me how often you use the different meat cuts. For example, you might have lamb chops twice every week, in which case you would enter 2/week in the "frequency of consumption" column. However, you might only have ham-on-the-bone once a year in which case you would enter 1/year.

MEAT		AMOUNT CONSUMED PER MEAL	FREQUENCY OF CONSUMPTION
Wienerschnitzel	☐		
Rump Steak	☐		
Porterhouse Steak	☐		
Stewing Steak	☐		
Topside	☐		
Beef Mince	☐		
Beef Tongue	☐		
Beef Hearts	☐		
Tripe Corned Beef	☐		
Beef Sausages	☐		
Lamb Forequarter	☐		
Lamb Neck Chops	☐		
Lamb Loin Chops	☐		
Leg of Lamb	☐		
Lamb's Fry	☐		
Lamb's Kidney	☐		
Hogget Forequarter	☐		
Hogget Neck Chops	☐		
Hogget Loin Chops	☐		
Leg of Hogget	☐		
Mutton Forequarter	☐		
Mutton Neck Chops	☐		
Mutton Loin Chops	☐		
Leg of Mutton	☐		
Pork Chops	☐		
Pork Pieces	☐		
Leg of Pork	☐		
Sliced Ham	☐		
Ham-on-the-Bone	☐		
Ham Steaks	☐		
Middle Bacon	☐		
Shoulder Bacon	☐		

		AMOUNT CONSUMED PER MEAL	FREQUENCY OF CONSUMPTION
Fish	☐		
Chicken	☐		
Shell Fish	☐		
Hamburgers	☐		
Pork Sausages	☐		
Luncheon	☐		
Ham-n-Chicken	☐		
Salami	☐		
Frankfurters	☐		
Saveloys	☐		
Black Pudding	☐		
Garlic Sausages	☐		

SECTION G.

In this section of the questionnaire I should like to ask you some personal details. The information will be treated with the utmost secrecy. The information is needed to see if the information obtained earlier in the questionnaire is related in any way to some of the personal details that will be asked in this part of the questionnaire.

Q.1 How many people are there in your household?_____

Q.2 How many adults live in your household?_____

Q.3 How many children are there in this household in the following age groups?

Under 2	_____
2 - 10	_____
11 - 20	_____

Q.4 How old are you?

Under 20	___
21 - 29	___
30 - 39	___
40 - 49	___
50 - 59	___
60 - 69	___
Over 70	___

Q.5 How old is your husband/wife?

Under 20	___
21 - 29	___
30 - 39	___
40 - 49	___
50 - 59	___
60 - 69	___

Q.6 How much does the principal income earner in this household earn?

Under $2,000/annum	___	Under $40/week	___
$2,000 - 3,999 "	___	$40 - 79 "	___
$4,000 - 5,999 "	___	$80 - 119 "	___
$6,000 - 7,999 "	___	$120 - 159 "	___
10,000-13,999 "	___	$160 - 199 "	___
$14,000-17,999 "	___	$280 - 360 "	___
Over $18,000 "	___	Over $360 "	___

Q.7 How many people work in your household?_____

Q.8 What do they do for a living?_____

_____

_____

Q.9 Where were you born?

Q.10 Where was your husband/wife born?

Q.11 How long have you been living in New Zealand?_____

Q.12 How long has your husband/wife been living in New Zealand?

_____

THANK YOU VERY MUCH INDEED FOR YOUR CO-OPERATION AND FOR THE TIME THAT YOU HVE GIVEN UP TO ANSWER THIS QUESTIONNAIRE. IF YOU HAVE ANY QUERIES ABOUT THE QUESTIONNAIRE PLEASE FEEL FREE TO CONTACT ME AT 69099 Ext 2446.

BRIAN WILKINSON

APPENDIX 2.2

FOOD TECHNOLOGY RESEARCH CENTRE

MASSEY UNIVERSITY

MEAT CONSUMPTION

SURVEY

INTERVIEWERS: Robert Beausire, Claudia Groenendijk, Brian Wilkinson

MEAT CONSUMPTION SURVEY

Respondent Code: 67
Area Code:
Session No.:
Time:
Date:

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Section 1: Meat Purchases

(1) From which of the shops shown below do you purchase most of the items shown? Please tick appropriate box.

	1 Fresh Meat	2 Ham & Bacon	3 Poultry	4 Fish	5 Eggs	6 Cheese
A. Dairy	☐	☐	☐	☐	☐	☐
B. Grocer	☐	☐	☐	☐	☐	☐
C. Supermarket	☐	☑	☑	☐	☐	☑
D. City Butcher	☐	☐	☐	☐	☐	☐
E. Suburban Butcher	☑	☐	☐	☐	☐	☐
F. Freezing Works	☐	☐	☐	☐	☐	☐
G. Delicatessen	☐	☐	☐	☐	☐	☐
H. Farmer	☐	☐	☐	☐	☐	☐
I. Kill own stock	☐	☐	☐	☐	☐	☐
J. Fish Shop	☐	☐	☐	☑	☐	☐
K. No Regular Shop	☐	☐	☐	☐	☑	☐
Other, please specify:						
Have own laying hens	☐	☐	☐	☐	☑	☐
_____	☐	☐	☐	☐	☐	☐
_____	☐	☐	☐	☐	☐	☐

(2) How often do you buy your fresh meat?

- Every day ☐
- Twice per week ☐
- Once per week ☑
- Once per fortnight ☐
- Once per month ☐
- In Bulk ☐
- Other (please specify) ☐

_____

_____

67 1 5 3 3 10 14 3 17 3

(3) With this question we should like to find out how much of the following meats you would use per meal and roughly how often you would serve them per month. Because there are so many meats we have decided to group them. The various groupings are shown on the opposite page.

	Meat	$Value/Meal	Number of Times Eaten per Month	For Office Use Only			
1	Frying steak	$8	twice	18	80	108	2
2	Stewing steak	$6	three		60		3
3	Roasts of beef	$8	once		80		1
4	Mince	$4	six		40		6
5	Corned beef	$12	once		120		1
6	Lamb chops	$6	six		60		6
7	Leg of lamb	$12	once		120		1
8	Mutton and hogget chops	$5	~~tw~~ three		50		3
9	Mutton and hogget legs	$10	once	42	100	124	1
10	Lamb, mutton and hogget shoulder roasts	$10	once		100		1
11	Pork steaks		nil				
12	Pork chops	$7	once		70		1
13	Roasts of Pork		nil				
14	Sliced ham	$4	twice		40		2
15	Ham steaks	$6	once		60		1
16	Bacon	$6	four		60		4
17	Whole chicken	$5	once		50		1
18	Chicken pieces	$5	twice	69	50	142	2
19	Fish	$6	four		60		4
20	Shellfish		nil				
21	Sausages	$4	four		40		4
22	Saveloys/Polonies		nil				
23	Luncheon type sausages		nil				
24	Salami		nil				
25	Eggs	$2	four		20		4
26	Cheese	$2	three		20		3
27	Beans/nuts		nil				
	Any other meat you eat regularly:			100			
						166	

BEEF

Frying and grilling and Barbecuing steaks

Fillet steak
T-Bone steak
Porterhouse Steak
Rump Steak
Schnitzel Steak
Tenderised Steak
Cross-cut Blade

Stewing and Casseroling Steaks

Blade Steak
Thick Flank Steak
Topside Steak
Skirt Steak
Chuck Steak
Gravy Beef
Shin Steak

Roasting and Braising Beef cuts

Prime rib roast
Sirloin
Wing Rib
Topside Roast
Pot Roast

PORK

Steaks	Roasts of Pork	Chicken	Pieces
Rump Steaks	Foreloin	Whole	Legs
Rib Eye Steaks	Rib Eye Roast	Half	Wings
Schnitzel Steak	Leg Roast	Quarter	Thighs
Medallion Steak	Rolled Pork		Backs
Butterfly Steak			Breast
Pork Fillets			

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(4) Looking back over the last 4 years:
Do you think you eat less meat now thanyou did 4 years ago?

Yes ☐ No ☑ Unsure ☐ 168 [2]

Do you think your husband/wife eats less meat now than 4 years ago?

Yes ☐ No ☑ Unsure ☐ [2]

(5) Which of the following statements best fits the changes that you have made in the amount of meat consumed now compared with 4 years ago?

My/our meat consumption has:

(a) Increased significantly	☐	[2]
(b) Increased moderately	☑	☐
(c) Increased slightly	☐	☐
(d) Remained the same	☑	☐
(e) Decreased slightly	☐	☐
(f) Decreased moderately	☐	☐
(g) Decreased significantly	☐	☐

(6) Have these changes been due to:

(a) Children growing older	☑	[1]
(b) Increase in family size	☐	☐
(c) Children leaving home	☐	☐
(d) Loss of spouse	☐	☐
(e) Increase in family income	☐	☐
(f) Decrease in family income	☐	☐
(g) Changed views on the nutritional value of meat	☐	☐
(h) Increases in the price of meat	☐	☐
(i) Other, please specify:		
_____	☐	☐
_____	☐	186 ☐

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(7) Please show whether you/your family eats either the same, more or less now compared to 4 years ago of each of the foods shown below:

Food	Eat the same now	Eat Less now	Eat more now	
Frying steak	☐	☑	☐	187 [2]
Stewing steak	☑	☐	☐	[1]
Roasts of beef	☑	☐	☐	[1]
Mince	☑	☐	☐	[1]
Corned beef	☐	☑	☐	[2]
Lamb chops	☑	☐	☐	[1]
Leg of lamb	☑	☐	☐	[1]
Mutton & hogget chops	☑	☐	☐	[1]
Lamb, hogget & mutton shoulder roasts	☑	☑	☐	[1]
Pork steaks	☐	☑	☐	[2]
Pork chops	☐	☑	☐	[2]
Roasts of pork	☐	☑	☐	[2]
Whole chicken	☐	☑	☐	[2]
Chicken pieces	☑	☐	☐	200 [1]
Fish	☑	☐	☐	[1]
Sliced ham	☐	☑	☐	[2]
Ham steaks	☐	☑	☐	[2]
Bacon	☑	☐	☐	[1]
Shellfish	☐	☑	☐	[2]
Sausages	☑	☐	☐	[1]
Saveloys/Polonies	☐	☑	☐	[2]
Luncheon type sausages	☐	☑	☐	[2]
Salami	☐	☑	☐	[2]
Eggs	☐	☐	☑	[3]
Cheese	☐	☐	☑	[3]
Bread	☑	☐	☐	[1]
Pasta e.g. Noodles	☐	☐	☑	[3]
Bean/nuts	☑	☐	☐	[1]
Vegetables	☐	☐	☑	[3]
Fruit	☐	☐	☑	216 [3]

(8) If you or anyone in your family/household eat less meat, are any of the reasons below responsible for the changes?

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Health Reasons

- Doctor's advice ☐ — 217 ☐
- Concern for health of family ☐ — ☐
- Advice from magazines, papers, radio etc. ☐ — ☐
- Advice from friend and acquaintances ☐ — ☐

Changes in Family Lifestyle

- Family don't eat as many meals together ☐ — ☐
- Family members have different meat preferences ☐ — ☐
- Family becoming more involved in outside activities, e.g. sport, societies, dancing, art etc. ☐ — ☐
- Eating less to stay in shape ☐ — ☐
- Eating more vegetarian type foods ☐ — ☐
- Religious requirements ☐ — ☐
- Moral reasons ☐ — ☐
- Eating more meals outside of home ☐ — ☐

Financial Reasons

- Price of meat ☐ — 229 ☐
- Price of other foods ☐ — ☐
- Reduction in overall family income, e.g. 2 income earners to 1 etc. ☐ — ☐
- Increased hire purchase and mortgage payments ☐ — ☐
- Cost of other items leaving less for food ☐ — ☐
- No increase in family food budget ☐ — ☐

Meal Patterns

- Eat more chicken ☐ — ☐
- Eat more fish ☐ — ☐
- Eat more of other protein foods e.g. nuts, cheese ☐ — ☐
- Eat less meat for lunches ☐ — ☐
- Eat less meat for dinner ☐ — ☐
- Eat out more often ☐ — ☐
- Cook fewer roasts ☐ — ☐

Others, please specify

- _____ ☐ — ☐
- _____ ☐ — 243 ☐

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Could you pick out the 3 most important reasons for the change in your family's meat consumption and list them in order of importance:

Most important reason: Children growing and eat more. — 144 [2][9]

Second important reason: Try to give a good basic diet. — [3][0]

Third important reason: _____ — [ ][ ]

(9) If you had more money left in your housekeeping after paying all the other bills, would you buy more meat for your family?

Yes ☐ No ☑ Maybe ☐ — [2]

(10) If YES list a few of the meats that you would buy if you had more money left over in your housekeeping?

251 [ ][ ]

[ ][ ]

[ ][ ]

(11) If NO what type of foods would you buy more if you hadmore money left in your housekeeping? Please list a few of the foods.

Fruit
Vegetables
Yogurt

[ ][6]

[ ][7]

261 [1][2]

484

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(12) We are interested in your views on a range of foods and how they compare with each other.

It is important that you think about your answers and it is VITAL that you answer each question for each food on the page.

We are asking you to compare each food in the list with the other foods and then tick the answer that shows best how you feel.

Example: (non-food)

'Cost of a Radio'

I think the following radios are:

	Very Cheap	Cheap	Slightly Expensive	Quite Expensive	Very Expensive
HiFi AM/FM Stereo receiver	—	—	—	—	✓
Portable Stereo radio cassette	—	—	✓	—	—
AM Portable Radio	✓	—	—	—	—

Therefore I think the 'Stereo Receiver' is very expensive, the 'Portable Radio Cassette' is quite expensive, while the 'portable radio' is very cheap - in comparison to the other two.

(12a) COST OF THE FOOD

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I think that the food is:

	Very Cheap	Cheap	Neither Cheap nor Expensive	Expensive	Very Expensive		
FRYING STEAK	—	—	—	✓	—	263	4
STEWING STEAK	—	—	—	✓	—		4
ROAST OF BEEF	—	—	—	✓	—		4
MINCE	—	—	✓	—	—		3
CORNED BEEF	—	—	—	—	✓		5
LAMB CHOPS	—	—	✓	—	—		3
LEG OF LAMB	—	—	—	✓	—		4
HOGGET CHOPS	—	—	✓	—	—		3
HOGGET ROASTS	—	—	✓	—	—		3
OFFAL	✓	—	—	—	—		1
PORK STEAKS	—	—	—	—	✓		5
PORK CHOPS	—	—	—	—	✓		5
ROASTS OF PORK	—	—	—	—	✓		5
WHOLE CHICKEN	—	—	✓	—	—		3
CHICKEN PIECES	—	—	✓	—	—	277	3
FISH	—	—	✓	—	—		3
SHELLFISH	—	—	✓	—	—		3
SLICED HAM	—	—	—	✓	—		4
HAM STEAKS	—	—	—	✓	—		4
BACON	—	—	—	✓	—		4
SAUSAGES	—	✓	—	—	—		2
LUNCHEON	—	✓	—	—	—		2
SAVELOYS	—	✓	—	—	—		2
SALAMI	—	—	—	✓	—		4
EGGS	—	—	✓	—	—		3
CHEESE	—	✓	—	—	—		2
BEANS	—	—	✓	—	—		3
BREAD	—	—	✓	—	—		3
PASTA	—	—	✓	—	—		3
FRUIT	—	—	—	✓	—		5
VEGETABLES	—	—	—	✓	—	293	5

485

(12b) WASTAGE ASSOCIATED WITH FOOD

(Wastage means fat, gristle and bone leftovers)

I think that the food has:

	No Wastage	Very little wastage	Some wastage	Moderate wastage	Excessive wastage	for office use only.
FRYING STEAK	✓					294 1
STEWING STEAK		✓				2
ROAST OF BEEF		✓				2
MINCE	✓					1
CORNED BEEF	✓					1
LAMB CHOPS			✓			3
LEG OF LAMB			✓			300 3
HOGGET CHOPS			✓			3
HOGGET ROASTS		✓				2
OFFAL	✓					1
PORK STEAKS	✓					1
PORK CHOPS		✓				2
ROASTS OF PORK			✓			3
WHOLE CHICKEN			✓			3
CHICKEN PIECES			✓			308 3
FISH	✓					1
SHELLFISH	✓					1
SLICED HAM			✓			3
HAM STEAKS			✓			3
BACON			✓			3
SAUSAGES			✓			3
LUNCHEON			✓			3
SAVELOYS			✓			3
SALAMI	✓					1
EGGS	✓					1
CHEESE	✓					1
BEANS	✓					1
BREAD	✓					1
PASTA	✓					1
FRUIT	✓					1
VEGETABLES	✓					324 1

(12c) NUTRITIONAL VALUE OF THE FOOD

I think that the food is:

	Very good for you	Good for you	Neither good nor bad for you	Bad for you	Very bad for you	for office use only.
FRYING STEAK		✓				325 2
STEWING STEAK		✓				2
ROAST OF BEEF		✓				2
MINCE			✓			3
CORNED BEEF			✓			3
LAMB CHOPS		✓				2
LEG OF LAMB		✓				2
HOGGET CHOPS		✓				2
HOGGET ROASTS						
OFFAL				✓		4
PORK STEAKS				✓		4
PORK CHOPS				✓		4
ROASTS OF PORK						
WHOLE CHICKEN		✓				2
CHICKEN PIECES		✓				339 2
FISH	✓					1
SHELLFISH	✓					1
SLICED HAM			✓			3
HAM STEAKS			✓			3
BACON			✓			3
SAUSAGES			✓			3
LUNCHEON			✓			3
SAVELOYS					✓	5
SALAMI			✓			3
EGGS	✓					1
CHEESE	✓					1
BEANS	✓					1
BREAD			✓			3
PASTA		✓				2
FRUIT	✓					1
VEGETABLES	✓					355 1

(12d) CONVENIENCE OF THE FOOD

I usually use the food when I have:

	No real rush	Up to 1 hour	Up to 1½ hours	Up to 3 hours	Over 3 hours	for office use only.
FRYING STEAK	—	✓	—	—	—	356 2
STEWING STEAK	✓	—	—	—	—	1
ROAST OF BEEF	✓	—	—	—	—	1
MINCE	—	✓	—	—	—	2
CORNED BEEF	✓	—	—	—	—	1
LAMB CHOPS	—	✓	—	—	—	2
LEG OF LAMB	✓	—	—	—	—	1
HOGGET CHOPS	—	✓	—	—	—	2
HOGGET ROASTS	—	—	—	—	—	
OFFAL	nil	—	—	—	—	
PORK STEAKS	—	—	✓	—	—	
PORK CHOPS	—	—	✓	—	—	3
ROASTS OF PORK	—	—	✓	—	—	3
WHOLE CHICKEN	—	—	✓	—	—	3
CHICKEN PIECES	—	—	✓	—	—	370 3
FISH	✓	—	—	—	—	1
SHELLFISH	nil	—	—	—	—	
SLICED HAM	✓	—	—	—	—	1
HAM STEAKS	✓	—	—	—	—	1
BACON	✓	—	—	—	—	1
SAUSAGES	✓	—	—	—	—	1
LUNCHEON	✓	—	—	—	—	1
SAVELOYS	—	—	—	—	—	
SALAMI	—	—	—	—	—	
EGGS	✓	—	—	—	—	1
CHEESE	✓	—	—	—	—	1
BEANS	✓	—	—	—	—	1
BREAD	✓	—	—	—	—	1
PASTA	✓	—	—	—	—	1
FRUIT	✓	—	—	—	—	1
VEGETABLES	✓					386 1

(12e) RANGE OF DISHES

From the food I think that I can create:

	1 Dish only	Up to 3 dishes	Up to 5 dishes	Up to 7 dishes	Over 7 dishes	for office use only.
FRYING STEAK	✓	—	—	—	—	387 1
STEWING STEAK	—	✓	—	—	—	2
ROAST OF BEEF	—	✓	—	—	—	2
MINCE	—	—	✓	—	—	3
CORNED BEEF	✓	—	—	—	—	1
LAMB CHOPS	✓	—	—	—	—	1
LEG OF LAMB	—	✓	—	—	—	2
HOGGET CHOPS	✓	—	—	—	—	1
HOGGET ROASTS	—	✓	—	—	—	2
OFFAL	—	—	—	—	—	
PORK STEAKS	—	✓	—	—	—	2
PORK CHOPS	✓	—	—	—	—	1
ROASTS OF PORK	—	✓	—	—	—	2
WHOLE CHICKEN	✓	—	✓	—	—	400 1
CHICKEN PIECES	—	—	✓	—	—	3
FISH	—	✓	—	—	—	2
SHELLFISH	—	—	—	—	—	
SLICED HAM	✓	—	—	—	—	1
HAM STEAKS	✓	—	—	—	—	1
BACON	—	✓	—	—	—	2
SAUSAGES	—	✓	—	—	—	2
LUNCHEON	✓	—	—	—	—	1
SAVELOYS	✓	—	—	—	—	1
SALAMI	✓	—	—	—	—	1
EGGS	—	—	—	✓	—	4
CHEESE	—	—	—	—	✓	5
BEANS	✓	—	—	—	—	1
BREAD	✓	—	—	—	—	1
PASTA	—	—	—	✓	—	4
FRUIT	—	✓	—	—	—	2
VEGETABLES			✓	—	—	417 3

487

(13) PREFERENCE FOR FOOD

We like to eat this food?

	Like very much	Like	Neither like nor dislike	Don't like	Don't like at all	for office use only.
FRYING STEAK		✓				418 2
STEWING STEAK		✓				2
ROAST OF BEEF		✓				2
MINCE		✓				2
CORNED BEEF			✓			3
LAMB CHOPS		✓				2
LEG OF LAMB	✓					1
HOGGET CHOPS		✓				2
HOGGET ROASTS	✓					1
OFFAL					✓	5
PORK STEAKS	✓					1
PORK CHOPS	✓					1
ROASTS OF PORK	✓					1
WHOLE CHICKEN	✓					1
CHICKEN PIECES	✓					432 1
FISH	✓					1
SHELLFISH					✓	5
SLICED HAM		✓				2
HAM STEAKS		✓				2
BACON		✓				2
SAUSAGES			✓			3
LUNCHEON			✓			3
SAVELOYS					✓	5
SALAMI					✓	5
EGGS	✓					1
CHEESE	✓					1
BEANS		✓				2
BREAD		✓				2
PASTA		✓				2
FRUIT	✓					1
VEGETABLES	✓					448 1

(14) What are some of the good things about eating meat?

Can always have a meal when running late with some varieties of meat. Is mostly pure with no colours or preservatives added.

(15) What are some of the bad things about eating meat?

Too much fat on some meat, even after grilling

(16) What are some of the good things about eating sausages?

Quick + easy.

(17) What are some of the bad things about eating sausages?

Full of fat and goodness. Know what! 460 5

(18) Do you think the shops stock a large enough range of meats?

Yes ☑ No ☐ Undecided ☐ 1

(19) Would you like to know more about the way the various meats could be cooked?

Yes ☑ No ☐ Undecided ☐ 1

(20) Would you buy high quality prepared meat dishes such as beef stroganoff, chicken kiev, veal parmesan etc.?

Yes ☐ No ☐ Undecided ☑ 3

(21) Would you like to be able to buy pre-cooked roasts from a Supermarket, butcher shop or other retail outlet?

Yes ☐ No ☑ Undecided ☐ 2

(22) Would you like to see leaner meat being sold?

Yes ☑ No ☐ Not sure ☐ 1

If yes, even if it was more expensive?

For Office Use Only

449 6

488

		For Office Use Only
(23)	Who buys meat in your household?	
	Yourself ☑ Wife/Husband ☐ Both ☐	470 [1]
(24)	Who decides what meat will be eaten for that night's meal?	
	Yourself ☑ Wife/Husband ☐ Children ☐	[1]
(25)	Here are a number of statements which you may either agree with or disagree with. Could you please tick one of the boxes alongside each statement that best describes how you feel about the particular statement.	

		Agree	Disagree	
(a)	Although certain food products are available in a number of different flavours, I always tend to buy the same flavour.	☑	☐	[1]
(b)	When I eat out, I like to try the most unusual items the restaurant serves, even if I am not sure I would like them.	☐	☑	[2]
(c)	When I see a new food on the supermarket shelf, I often pick up to see what it is like.	☐	☑	[2]
(d)	I often read the information on food packs just out of curiosity.	☑	☐	[1]
(e)	I am the kind of person who would try any new food product once.	☐	☑	[2]
(f)	When I go to a restaurant, I feel it is safer to order dishes I am familiar with.	☑	☐	[1]
(g)	I would rather stick with the food I usually buy than try something new.	☑	☐	[1]
(h)	If I like a food I rarely switch from it to try something different.	☑	☐	[1]
(i)	A lot of the time I feel the urge to buy something really different from the foods I usually buy.	☑	☐	[1]
(j)	I enjoy taking chances in buying unfamiliar foods just to get some variety in my purchases.	☐	☑	[2]
(k)	I enjoy exploring several different alternative foods while shopping.	☑	☐	[1]
(l)	I stick to a strict budget when I do my	☑	☐	483 [1]

		Agree	Disagree	For Office Use Only
(m)	I love to cook different meat dishes.	☑	☐	484 [1]
(n)	I rarely ever use recipe books when I am cooking.	☐	☑	[2]
(o)	I love to try new recipes.	☑	☐	[1]
(p)	I take a great deal of pride in my home.	☑	☐	[1]
(q)	I exercise regularly.	☑	☐	[1]
(r)	I study the grocers advertisements in the newspaper every week.	☐	☑	[2]
(s)	I often eat too much.	☑	☐	[1]
(t)	I like to work outdoors.	☑	☐	[1]
(u)	Advertisements picture a woman's place to be in the home.	☑	☐	[1]
(v)	Advertisements depict women as sexual objects.	☐	☑	[2]
(w)	I would like to see more and more young girls play with mechanical toys.	☐	☐	[ ]
(x)	I don't like watching television and so I rarely do.	☐	☑	[2]
(y)	Television has added a great deal of enjoyment to my life.	☐	☑	[2]
(z)	I usually read the newspaper every day.	☑	☐	[1]
(za)	I like to read the Women's Weekly.	☑	☐	[1]
(zb)	I stick to a strict budget when I buy meat.	☑	☐	499 [1]

IF they want to fine.

489

SECTION B:

In this section of the questionnaire I should like to ask you some personal details. The information will be treated with the utmost secrecy. The information is needed to see if the information obtained earlier in the questionnaire is related in any way to some of the personal details that will be asked in this part of the questionnaire.

For Office Use Only

(1) How many people are there is your household? 4 — 500 [4]

(2) How many adults live in your household? 2 — [2]

(3) How many children are there in this household in the following age groups?

Under 2 ____ [ ]

2 - 10 2 [2]

11 -18 ____ [ ]

(4) How old are you?

Under 20 ____
21-29 ____
30-39 ✓
40-49 ____
50-59 ____
60-69 ____
Over 70 ____

[3]

(5) How old is your husband/wife?

Under 20 ____
21-29 ____
30-39 ____
40-49 ✓
50-59 ____
60-69 ____
Over 70 ____

511 [4]

For Office Use Only

(6) How much does the principal income earner in this household earn before tax?

Under $2,000/annum	___	Under $40/week	___
2,000-$3,999/annum	___	$40-79/week	___
$4,000-$5,999/annum	___	$80-119/week	___
$6,000-$7,999/annum	___	$120-150/week	___
$8,000-$9,999/annum	___	$160-199/week	___
$10,000-$13,999/annum	___	$200-279/week	✓
$14,000-$17,999/annum	___	$280-359/week	___
$18,000-$21,999/annum	___	$360-424/week	___
$22,000-$25,999/annum	___	$425-499/week	___
$26,000-$29,999/annum	___	$500-579/week	___
Over $30,000/annum	___	Over $580/week	___

512 [6]

(7) How many people in your household work:

Full time: 1 — [1]

Part time: 1 — [1]

(8) What does the principle income earner do for a living?

CARPENTER'S LABOURER — [6]

And any others that work: CLEANER — [6]

[ ]

(9) What is the highest qualification you have achieved?

	Yourself	Wife/Husband
School certificate	[ ]	[ ]
University Entrance	[ ]	[ ]
Bursary	[ ]	[ ]
Trade Certificate (e.g. builder, butcher)	[ ]	[ ]
Technical Institute Qualification (e.g NZCS, NZCE)	[ ]	[ ]
Diploma	[ ]	[ ]
Degree	[ ]	[ ]
Post graduate qualification	[ ]	[ ]

[ ]

523 [ ]

For office use only

(10) What is your ethnic background and that of your wife/husband?

	Yourself	Wife/Husband	
Caucasian/Pakeha	☑	☑	524 [1]
Maori	☐	☐	
Polynesian	☐	☐	
Negro	☐	☐	[1]
Asian	☐	☐	
Arabic	☐	☐	
Hispanic	☐	☐	
Other: _____	☐	☐	

(11) Which of the following best describes your living situation?

Married, no children	☐	[2]
Married with children at home	☑	
One adult with children	☐	
One adult alone	☐	
Single people flatting (not students)	☐	
Student flat	☐	
Other _____	☐	

MALES ONLY

Would you describe yourself as:

Radical	☐	☐
Liberal	☐	
Moderate	☐	
Conservative	☐	
Unsure	☐	

FEMALES ONLY

Would you describe yourself as:

Feminist	☐	528 [3]
Moderate	☐	
Traditional	☑	
Unsure	☐	

THANK YOU VERY MUCH INDEED FOR YOUR COOPERATION AND FOR THE TIME THAT YOU HAVE GIVEN UP TO ANSWER THIS QUESTIONNAIRE. IF YOU HAVE ANY QUERIES ABOUT THE QUESTIONNAIRE PLEASE FEEL FREE TO CONTACT ME COLLECT AT PALMERSTON NORTH, 69099 EXTENSION 7497.

APPENDIX 3.1

CONSUMPTION OF MEAT IN NEW ZEALAND

(Kg/Capita/Annum)

Year	Beef	Veal	Mutton	Lamb	Pigmeat	Offal	Total Red Meat	Total Red Chicken
1950	49.06	2.61	28.95	4.10	14.77	4.43	103.94	
51	52.02	2.56	28.96	5.02	14.38	4.44	107.38	
52	49.58	2.60	29.89	4.74	12.39	4.34	103.54	
53	46.22	2.28	29.82	4.37	10.08	4.08	102.32	
54	47.17	2.67	30.67	3.90	12.55	4.48	101.70	
55	47.72	2.73	32.50	3.95	15.41	4.23	106.09	
56	48.64	2.91	31.09	3.64	13.54	4.04	104.22	
57	48.36	3.09	30.22	4.45	13.77	3.68	103.59	
58	42.09	2.68	34.68	5.41	15.00	4.27	104.14	
59	41.54	2.82	37.00	6.50	15.18	4.77	107.86	
1960	40.91	3.00	35.77	6.54	15.41	4.23	105.40	
61	44.50	3.73	35.59	8.14	15.95	4.27	111.18	
62	47.14	3.41	35.45	8.00	15.14	4.54	113.72	
63	44.36	3.77	34.86	8.23	15.27	4.27	11.68	
64	46.00	3.59	33.00	7.41	14.68	4.18	108.82	
65	45.99	3.27	29.04	8.36	13.32	4.41	105.22	
66	46.18	3.68	28.95	10.04	12.95	4.27	106.04	0.42
67	44.86	3.82	30.04	9.77	13.82	4.54	106.91	0.69
68	45.09	3.50	30.77	9.22	13.50	4.86	106.91	1.46
69	43.82	3.32	31.00	9.54	13.72	5.23	106.64	2.51
1970								3.49
71	45.09	3.66	32.56	10.55	14.87	6.19	112.92	4.29
72	43.92	3.27	33.18	11.65	14.75	5.81	112.57	5.41
73	45.60	4.00	30.57	12.67	12.02	5.74	110.60	5.97
74	44.64	3.82	28.19	10.78	11.05	4.79	103.20	6.64
75	50.31	3.64	25.83	12.21	11.75	5.15	108.89	6.95
76	52.73	3.62	21.47	12.14	11.33	5.59	106.88	7.38
77	56.53	3.14	19.29	11.22	12.63	5.51	108.34	8.22
78	57.15	2.97	20.23	10.74	12.94	5.53	109.56	9.60
79	50.82	1.93	20.21	10.91	12.02	4.90	100.82	10.42
1980	47.61	1.17	21.00	10.84	11.72	5.11	97.45	10.91
81	46.04	1.21	20.13	9.36	10.22	5.08	92.04	
82	47.28	1.54	22.49	8.58	11.04	5.93	96.86	
83								
84								

APPENDIX 4.1

SURVEY SAMPLE

4.1.1 TOTAL PEOPLE IN HOUSEHOLD

A comparison of the survey sample and the 1976 Census of Population is shown in the Table below.

TABLE 4.1 : PROPORTION OF VARIOUS SIZED HOUSEHOLDS

No of people in each household	Nov 1979 survey	1976 Census of Population
	% of households	
1	2.2	15.6
2	13.0	27.9
3	21.7	16.9
4	46.7	18.5
5	13.0	11.8
6	2.2	5.7
7	1.1	4.3

The sample clearly did not mirror the New Zealand population as far as the distribution of household sizes were concerned. There were 1, 2, 6 and 7 person households in the sample and far too many 3 and 4 person households.

4.1.2 NUMBER OF ADULTS IN THE HOUSEHOLD

In the context of the survey an adult was defined as anybody who was 20 or over unless the respondents were married or living in a flatting situation.

TABLE 4.2 : PROPORTION OF HOUSEHOLDS WITH DIFFERING ADULT NUMBERS

Number of Adults in Household	Nov 1979 Survey % of households
1	2.2
2	83.5
3	8.8
4	3.3
5 or more	1.1

As can be seen from the above Table the sample was clearly biased towards the traditional 2 adult household.

4.1.3 NUMBER OF CHILDREN OF VARIOUS AGES IN HOUSEHOLDS

The age groupings of the children were taken as those under 2, 2-10 and over 10. The rationale behind the choice was the fact that children over 10 tend to consume as much food as an adult, those between 2 and 10 consume something less than an adult and those under 2 substantially less than an adult. Had the sample been greater than more age groupings would have been selected so that a clearer understanding could have been obtained for the effect of age of children on the meat consumption of the household. A breakdown of the sample by age of children is supplied in the Table over.

TABLE 4.3 : PROPORTION OF HOUSEHOLDS WITH CHILDREN OF DIFFERENT AGES.

Number of People/ Children in Household	Whole Sample	Adults	Children under 2	Children 2-10	Children over 10
0	-		60.4	41.8	85.7
1	2.2 (2)	2.2 (2)	38.5	25.3	6.6
2	13.0 (12)	83.5 (76)	1.1	27.5	5.5
3	21.7 (20	8.8 (8)		4.4	1.1
4	46.7 (43)	3.3 (3)		1.1	1.1
5	13.0 (12)	1.1 (3)			
6	2.2 (2)				
7	1.1 (1)				
Total	(92)	(90)			

Note: Numbers in brackets denotes actual numbers of households

The sample was clearly biased toward young families with children under the age of 10 and only 14.3% of the households had chldren over the age of 10. Nearly forty per cent of the households had children under the age of 2, and 58.2% between 2 and 10 years. Nearly 50% of the hosueholds were 4 member households, i.e. two adults and two young children.

4.4 AGE OF RESPONDENT

The table 4.4 clearly shows the bias of the sample towards people in the 20-40 age brackets. An examination of the Census of Population (1976) shows that the sample did not have enough people in the 40-50, 50-60 and over 60 age groups. The very low percentage of over 60's was caused by the fact that of the 20 people in this age group who were approached to answer the three questionnaires only one managed to answer all three questionnaires.

TABLE 4.4 : PROPORTION OF HOUSEHOLDS WITH RESPONDENTS OF DIFFERING AGES.

Age of Respondents	Nov 1979 Survey	1976 Census of Population
	% of households	
Under 20	4.4	5.6
20-29	52.7	24.6
30-39	28.6	18.2
40-49	6.6	15.3
50-59	5.5	14.4
Over 60	1.1	21.9
	98.9	

4.1.6 OCCUPATION OF THE WIFE

As can be seen from the Table below 58.2% of the wives were not working.

TABLE 4.7 : WIFE'S OCCUPATIONS OF THE SURVEY SAMPLE

Occupation of Wife	1979 Survey Sample % of households
Not actively engaged in work force i.e. at home	58.2
Labourer	8.8
Tradesperson	17.6
Clerical	11.0
Professional	3.3
Self Employed	1.1

An examination of the 1980 Yearbook (N.Z. Department of Statistics) shows that some 77% of married women were not actively engaged in the workforce. The survey sample seemed to be a reasonable reflection of the population of people actively engaged in the workforce.

4.1.7 INCOME OF THE PRINCIPAL INCOME EARNER

As was pointed out in section 3.2.6 the sample was biased towards the self employed, managerial and professional and as a result of this bias the survey sample had a relatively high proportion of high income households. A comparison with income data obtained from the N.Z. Yearbook (N.Z. Department of Statistics) shows that the survey sample had a disproportionate number of households earning 10,000 - 14,000 per annum.

TABLE 4.8 : SAMPLE BROKEN DOWN BY INCOME OF PRINCIPAL INCOME EARNER

Income of Principal Income Earner $ per annum	1979 Survey Sample % of households
Less than 6,000	4.4
6,000 - 7,999	4.4
8,000 - 9,999	17.6
10,000 - 13,999	37.4
14,000 - 17,999	22.0
Over 18,000	7.7
Did not answer	6.6

4.8 NUMBER EMPLOYED IN HOUSEHOLD

The data shown in the Table below does not match the information shown in Table 4.7 . This is because this section deals with the whole s ple and not just the wives and includes all types of households. The survey sample failed to pick up the relatively high proportion of people not working and tended to be biased toward the one and two person working households.

TABLE 4.9 : NUMBER OF PEOPLE EMPLOYED IN EACH HOUSEHOLD

Number of People	Nov 1979 Survey
None	3.3
1	50.5
2	34.1
3	6.6
4	4.4
5	1.1

4.1.9 PLACE OF BIRTH OF RESPONDENT

The survey sample consisted of 81.3% of respondents who had been born in New Zealand. 8.8% born in the Pacific Islands, 5.5% in the United Kingdom and 1.1% in South Africa. The sample failed to pick up any of the other ethnic groups who have migrated to New Zealand. A comparison of the 1979 Census of distribution shows that the sample had a disproportionate number of Pacific Islanders and an insufficient proportion of people born in the United Kingdom and elsewhere.

TABLE 4.10 : PLACE OF BIRTH OF RESPONDENT.

Place of Birth	1979 Survey %	1976 Census of Population
New Zealand	81.3	83.4
Pacific Islands	8.8	1.1
United Kingdom	5.5	9.3
South Africa	1.1	-
Continent	1.1	0.7
No reply	1.2	-

On the 15.4% of the sample who were born outside of New Zealand only 9 people, i.e. 9.9%, had been in the country less than 8 years with 3 less than 3 years. Clearly there was little point in examining the effect of time in the country on per capita meat consumption given firstly the relatively small sample size and secondly the small proportion of the sample who had been in the country for less than 5 years.

4.1.10 TYPE OF ACCOMMODATION

Only three categories of housing were looked at in this section - rental and own home for married couples and flats for unmarried respondents. The results of the survey are presented in the Table below.

TABLE 4.11 : TYPE OF HOUSING OCCUPIED BY THE SAMPLE

Type of Housing	1979 Survey Sample %	1976 Census of Distribution %
Own home	67.0	
Rental home	22.0	
Flat	9.9	
Did not answer	1.1	

67.0% of the sample had their own home, whilst 22.0% of occupied rental accommodation. In comparison with the Census of distribution shows that??

Appendix 4.2.1 PROPORTION OF VARIOUS SIZED HOUSEHOLDS

No of people in each household	Jan 1985 Survey
	% of households
1	7.9
2	28.6
3	20.6
4	23.8
5	12.7
6	3.2
7	1.6
Did not answer	1.6
Total	100.0
Valid responses	126

Appendix 4.2.2 PROPORTION OF HOUSEHOLDS WITH DIFFERENT NUMBERS OF ADULTS

Number of adults in household	Jan 1985 Survey
	% of households
1	12.7
2	65.1
3	15.9
4	4.8
Did not answer	1.6
Total	100.0
Valid responses	126

Appendix 4.2.3 PROPORTION OF HOUSEHOLDS WITH CHILDREN OF DIFFERING AGES.

Number of children in household	Children under 2	Children 2-10	Children over 10
		% of households	
None	82.5	65.1	71.4
1	17.5	17.5	19.0
2	n.a.	12.7	7.9
3	n.a.	4.8	1.6
Total	100.0	100.0	100.0
Valid responses	126	126	126

Appendix 4.2.4 PROPORTION OF HOUSEHOLDS WITH RESPONDENTS OF DIFFERING AGES

Age of respondent	Jan 1985 survey
	% of households
Under 20	n.a.
20-29	22.2
30-39	27.0
40-49	19.0
50-59	17.5
60-69	6.3
over 70	6.3
Did not answer	1.6
Total	100.0
Valid responses	126

Appendix 4.2.5 PROPORTION OF SAMPLE BROKEN DOWN BY OCCUPATION

Occupation of the principal income earner	Jan 1985 Survey
	Proportion of households
Labourers	12.7
Clerical	20.6
Technical and trades	22.2
Managerial	12.7
Professional	3.2
Self-employed	3.2
Pensioner	14.3
Solo-parent	1.6
Other benefit	1.6
Did not answer	7.9
Total	100.0
Valid responses	126

Appendix 4.2.6 SAMPLE BROKEN DOWN BY INCOME OF PRINCIPAL INCOME EARNER

Income of Principal income earner	Jan 1985 Survey
	% of households
$2,000 - $3,999	1.6
$4,000 - $5,999	3.2
$6,000 - $7,999	9.5
$8,000 - $9,999	7.9
$10,000- $13,999	11.1
$14,000- $17,999	17.5
$18,000- $21,999	9.5
$22,000- $25,999	9.5
$26,000- $29,999	6.3
Over $30,000	17.5

Appendix 4.2.7 PROPORTION OF HOUSEHOLDS WITH DIFFERING QUALIFICATIONS.

Qualification	1985 Survey	
	Spouse %	Respondent %
No qualification	42.9	34.9
School certificate	7.9	27.0
University entrance	6.3	6.3
Trade certificate	19.0	6.3
Technical Institute	4.8	4.8
Diploma	4.8	9.5
Degree	4.8	6.3
Post graduate	9.5	4.8
Total	100.0	100.0
Valid responses	126	126

Appendix PROPORTION OF HOUSEHOLDS WITH DIFFERING ETHNIC BACKGROUND

Ethnicity	Spouse %	Respondent %
Caucasian	81.0	96.8
Maori	4.8	1.6
Did not answer	14.3	1.6
Total	100.0	100.0
Valid responses	126	126

APPENDIX 4.3

MEAT CONSUMPTION PER ANNUM BY HOUSEHOLD SIZE

MEAT	TOTAL PEOPLE IN HOUSEHOLD: WHOLE SAMPLE Mean	S.D.	2 Mean	S.D.	3 Mean	S.D.	4 Mean	S.D.	5 Mean	S.D.	6 Mean	S.D.	7 Mean	S.D.	F. D.F.6	Signif-icance	Linearity
	Kg / Annum																
Wienersnitzel	0.3527	0.3573	0.2583	0.2065	0.2350	0.2390	0.4140	0.4496	0.3833	0.1586	0.3000	0.4243	1.0000	0.00	1.311	0.2611	0.0578
Rump Steak	0.5418	0.4756	0.3750	0.2701	0.4600	0.4333	0.5116	0.4568	0.7667	0.5333	1.4500	1.0607	1.0000	0.00	2.396	0.0347	0.0046
Porterhouse St	0.3879	0.3483	0.2667	0.2535	0.3150	0.2834	0.3814	0.3480	0.4500	0.2680	1.2500	0.7778	1.0000	0.00	3.542	0.0036	0.0032
Stewing Steak	0.5495	0.4483	0.5750	0.5691	0.5250	0.4339	0.5023	0.3764	0.5083	0.3630	1.500	1.1314	1.000	0.00	2.008	0.0736	0.4830
Topside Steak	0.5176	0.6319	0.4330	0.6228	0.5250	0.5524	0.4651	0.6491	0.4750	0.4025	1.600	1.2728	2.000	0.0	2.142	0.0569	0.1036
*Total Steak	2.3495	1.4008	1.9083	0.9520	2.0600	1.1166	2.2744	1.1727	2.5883	1.2401	6.100	4.6669	6.000	0.0	5.002	0.0002	0.0009
Beef Mince	0.5374	0.3285	0.4833	0.2209	0.4500	0.4640	0.5767	0.2827	0.5167	0.2368	0.900	0.5657	1.000	0.0	1.244	0.2922	0.0506
Corned Beef	0.7319	0.8456	0.8917	0.195	0.380	0.4572	0.800	0.9092	0.800	0.5377	1.65	1.2021	1.00	0.0	1.265	0.2826	0.1845
*Total Beef	4.2670	2.5806	3.8833	2.7544	3.2800	1.6564	4.3302	2.4206	4.600	1.2083	11.200	7.7782	8.900	0.0	4.311	0.0008	0.0015
Lamb F'qtr	0.3429	0.4259	0.1667	0.3172	0.280	0.3847	0.3651	0.4364	0.3333	0.3822	1.25	0.6364	0.80	0	2.407	0.0339	0.0269
Lamb Neck Chops	0.2275	0.3432	0.1500	0.1931	0.1150	0.2996	0.2047	0.3015	0.3500	0.4034	1.05	0.6364	0.90	0	4.257	0.0009	0.0039
Lamb Loin Chops	0.3758	0.3793	0.125	0.1913	0.3000	0.3309	0.3628	0.3237	0.5750	0.3864	1.300	0.9899	0.9	0	5.069	0.0002	0.0001
Leg of Lamb	0.6198	1.1161	0.3333	0.4924	0.3850	0.4534	0.5186	0.4646	0.6917	0.4481	0.7500	1.067	10.00	0.00	68.728	0.0000	0.0000
*Total Lamb	1.5659	1.7277	0.7750	0.7852	1.0800	1.0986	1.4512	1.1038	1.9500	0.9950	5.3500	3.3234	12.600	0.0	22.580	0.0000	0.0000
Hogget F'qtr	0.4835	0.8249	0.5000	0.8676	0.3900	0.7601	0.5047	0.8646	0.4083	0.5648	1.500	2.1213	0.00	0.00	0.615	0.7173	0.7499
Hogget Neck Chps	0.2385	0.4406	0.0917	0.173	0.150	0.3154	0.2674	0.4476	0.2667	0.4147	1.1500	1.623	0.00	0.00	2.153	0.0579	0.1039
Hogget Loin Chps	0.3495	0.4799	0.1833	0.2980	0.2100	0.3144	0.3628	0.3799	0.6167	0.8548	0.8500	1.2021	0	0.0	1.774	0.1143	0.0487
Leg of Hogget	0.9143	1.2018	0.8500	1.2443	0.5300	1.0916	1.1814	1.344	0.7417	0.7342	0.900	1.2728	0.3000	0.00	0.785	0.5838	0.5987
Total Hogget	1.9857	2.2961	1.6250	1.9027	1.2800	1.9210	2.3163	2.4331	2.0333	2.0491	4.400	6.2225	6.300	0.0	0.979	0.4447	0.2719
Mutton F'qtr	0.1978	0.3657	0.2833	0.6952	0.030	0.1129	0.2326	0.6308	0.1417	0.3370	1.150	1.6263	0.0	0.0	1.408	0.2210	0.4170
Mutton Neck Chp	0.1440	0.3655	0.0833	0.2125	0.110	0.2789	0.1372	0.3094	0.1417	0.3370	1.150	1.6263	0.0	0.0	3.022	0.010	0.0762
Mutton Loin Chp	0.1934	0.4419	0.0750	0.2593	0.125	0.2613	0.1605	0.3245	0.4417	0.8795	0.6500	0.9192	0.0	0.0	1.557	0.1699	0.1508
Leg of Mutton	0.4813	0.9755	0.4000	0.8571	0.3250	0.9216	0.5465	1.0543	0.5583	0.9491	1.150	1.6263	0.0	0.0	0.366	0.8987	0.3696
Total Mutton	1.0165	1.7162	0.8417	1.2788	0.5900	1.1854	1.0767	1.6951	1.2833	1.9291	4.100	5.7983	0.0	0.0	1.468	0.1989	0.1278
Total Sheepmeat	4.9835	4.3778	3.5167	2.9285	3.3550	4.2243	5.2698	3.3176	5.7500	4.5432	14.7000	15.8392	13.500	0.0	3.5881	0.0033	0.0012
Pork Chops	0.5527	0.4945	0.4000	0.3668	0.4150	0.3602	0.6512	0.5431	0.5500	0.5179	0.8500	1.202	0.500	0.0	0.864	0.5251	0.1163
Pork Pieces	0.3231	0.6037	0.7667	1.3647	0.1250	0.2593	0.2535	0.3195	0.3833	0.3326	0.8500	1.202	0.500	0.0	1.994	0.0756	0.7340
Leg of Pork	1.2659	1.7625	1.7833	2.1813	0.8300	1.5058	1.4535	1.878	0.5750	0.7783	1.4000	1.979	4.500	0.0	1.395	0.2261	0.9412
Total Pork	2.1418	2.14	2.9500	2.6473	1.3700	1.7517	2.3581	2.1702	1.5083	1.2979	3.1000	4.3841	5.500	0.0	1.556	0.1701	0.7335
Sliced Ham	0.1912	0.3234	0.1167	0.1030	0.0950	0.2235	0.2093	0.3221	0.2750	0.2927	0.9000	1.2728	0	0	2.504	0.0281	0.0151
Ham-on-the-bone	1.8222	2.7080	2.1083	2.3940	1.0550	2.3603	1.9791	2.8167	2.4833	2.7359	1.400	1.9799	6.00	0.0	9.903	0.4969	0.1980
Ham Steak	0.2824	0.4062	0.2083	0.2193	0.1300	0.2494	0.2930	0.2823	0.2667	0.2774	1.500	1.8385	2.00	0.0	8.392	0.0000	0.0001
Total Ham	2.3429	2.9156	2.4333	2.9259	1.2800	2.4200	2.4814	3.0092	3.0250	2.7720	3.600	5.0912	8.00	0.0	1.385	0.2303	0.0518
Middle Bacon	0.1769	0.2985	0.1917	0.2065	0.1750	0.2447	0.1395	0.3310	0.2417	0.3029	0.1000	0.0000	1.00	0.0	1.551	0.1699	0.3991
Shoulder Bacon	0.1626	0.4481	0.0667	0.1497	0.1000	0.1777	0.2163	0.6122	0.2167	0.3099	0.0500	0.0707	0	0.0	0.338	0.9149	0.4039
Total Bacon	0.3396	0.5306	0.2583	0.1090	0.2750	0.2826	0.3558	0.6752	0.4583	0.5485	0.1500	0.0707	1.00	0.0	0.498	0.8080	0.2442
Total Pigmeat	4.8242	4.1515	5.6417	4.1179	2.9250	2.8438	5.1953	4.2820	4.9917	3.6813	6.8500	9.349	14.500	0.0	2.080	0.0640	0.0832
Chicken	1.0253	0.6021	1.0085	0.5664	0.7350	0.7043	1.1395	0.4919	0.9083	0.5838	2.000	1.1314	1.400	0.0	2.231	0.0479	0.1252
Shellfish	0.1132	0.1899	0.0417	0.0900	0.0550	0.1317	0.1279	0.2131	0.200	0.2089	0.1500	0.2121	0.500	0.0	1.935	0.0844	0.0033
Fish	0.5835	0.3828	0.5167	0.4648	0.4650	0.3376	0.6279	0.3731	0.5583	0.2678	1.1500	0.9192	0.800	0.0	1.354	0.2430	0.1413
Total Fish	0.6967	0.4478	0.5583	0.5213	0.5200	0.3847	0.7558	0.4239	0.7583	0.3397	1.300	1.1314	1.300	0.0	1.896	0.091	0.0118
*Beef Tongue	0.1275	0.3215	0.2083	0.3965	0.0150	0.0671	0.1395	0.3332	0.0417	0.1443	1.1500	0.2121	0.0	0.0	5.287	0.0001	0.2294
*Beef Hearts	0.0187	0.1273	0.0833	0.2887	0.0	0.0	0.0	0.0	0.0	0.0	0.3500	0.4950	0.0	0.0	3.574	0.0033	0.9633
*Beef Tripe	0.0505	0.1669	0.0833	0.2887	0.0	0.0	0.0302	0.1036	0.1333	0.2229	0.3500	0.4950	0.0	0.0	2.259	0.0453	0.1348
Lamb's Fry	0.3077	0.4773	0.2333	0.2587	0.3650	0.8839	0.2977	0.3059	0.2917	0.2539	0.5000	0.00	0.60	0.0	0.274	0.9477	0.5068
Lamb's Kidney	0.1077	0.1968	0.0417	0.0900	0.0400	0.0883	0.1279	0.1830	0.1917	0.3315	0.3500	0.4950	0.0	0.0	1.348	0.7499	0.0120
*Total Offal	0.6121	0.7737	0.6500	0.6640	0.4200	0.9277	0.5953	0.6290	0.6583	0.5486	2.700	1.6971	0.600	0.0	3.446	0.0078	0.0566
Hamburger	0.1286	2.2505	0.1167	0.1642	0.0250	0.0910	0.0953	0.2160	0.3667	0.3892	0.4000	0.5657	0.5000	0.0	3.964	0.0015	0.0010
Luncheon	0.2286	0.2172	0.1833	0.2038	0.1750	0.2425	0.2233	0.1986	0.3833	0.2406	0.2500	0.0707	0.200	0.0	1.349	0.2449	0.0625
Ham'n'Chicken	0.1615	0.4437	0.0667	0.1231	0.0600	0.1536	0.2488	0.6158	0.0833	0.1642	0.1500	0.2121	0.5000	0.0	0.69	0.6586	0.36
Salami	0.0484	0.1417	0.025	0.0866	0.0800	0.2308	0.0372	0.1134	0.0583	0.0996	0.1000	0.1414	0.0	0.0	0.342	0.9125	0. 8383
*Frankfurter	0.0418	0.1326	0.025	0.0866	0.045	0.1146	0.0186	0.0699	0.0833	0.1946	0.400	0.5657	0.0	0.0	3.380	0.0049	0.0689
*Saveloys	0.3407	0.3091	0.2083	0.2353	0.2250	0.2221	0.4140	0.3385	0.2750	0.2598	0.6500	0.2121	1.00	0.0	2.848	0.0142	0.0230
*Black Pudding	0.0615	0.1496	0.0250	0.0866	0.0800	0.1908	0.0605	0.1417	0.0167	0.0577	0.200	0.2828	0.50	0.0	2.272	0.0442	0.1582
Garlic Sausage	0.0791	0.2927	0.0	0.0	0.045	0.105	0.1140	0.3980	0.050	0.1168	0.40	0.3657	0.0	0.0	0.724	0.6313	0.2356
Total Cooked Sausages	0.9615	0.8915	0.5333	0.5399	0.7100	0.6750	1.1163	1.0251	0.9500	0.4739	2.1500	2.0506	2.200	0.0	1.978	0.0778	0.0091
Total Continental	0.1692	0.4040	0.0500	0.1168	0.1700	0.3404	0.1698	0.4438	0.1917	0.3423	0.9000	1.2728	0.0	0.0	1.347	0.2457	0.1327
Fresh Beef Saus	0.4516	0.5460	0.2250	0.2261	0.3750	0.2936	0.5093	0.7409	0.5250	0.1603	0.7000	0.1414	0.9000	0.0	0.695	0.6544	0.0678
Fresh Pork Saus	0.2791	0.2640	0.1833	0.1946	0.1600	0.1984	0.3349	0.2751	0.3333	0.2462	0.400	0.5657	0.800	0.0	2.473	0.0298	0.0014
Total Fresh	0.7308	0.5842	0.4083	0.3118	0.5350	0.2852	0.8442	0.7395	0.8583	0.2234	1.100	0.7071	1.700	0.0	2.147	0.0563	0.0014
Total Sausages	1.2407	1. 0125	0.7167	0.6548	0.8700	0.8131	1.4512	1.0894	1.2833	0.5828	2.5500	2.6163	3.000	0.0	2.622	0.0223	0.0016
Total Meat	17.1659	10.5072	15.4417	9.6072	11.7100	6.9449	18.2372	9.2959	18.6583	6.9877	39.00	38.608	43.0	0.0	4.330	0.0007	0.0005
*Convenience Meats	4.7659	2.8358	3.2917	1.6014	3.6350	1.9991	4.9349	2.3112	5.8750	2.5818	11.9500	11.5258	9.300	0.00	5.059	0.0002	0.000
Roast Meats	4.8231	4.5640	4.7500	5.1387	3.2950	4.6572	5.2674	4.0258	3.9254	2.2899	10.700	11.5969	17.600	0.0	2.660	0.0206	0.0476
Valid Responses	91		12		20		43		12		2		1				
Types of Household			(2)		(3)		(4)		(5)		(6)		(7)				

* Means that consumption is non linear with household size

APPENDIX 4.4

MEAT CONSUMPTION OF FAMILIES WITH CHILDREN UNDER 2 KGS/CAPITA/ANNUM

	WHOLE SAMPLE		NO CHILDREN		1 OR MORE CHILDREN		Fo	SIGNIFICANCE
MEAN	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.		
Weinersnitzel	0.35	0.36	0.40	0.43	0.26	0.18	1.64	0.20
Rump Steak	0.54	0.48	0.54	0.46	0.54	0.51	0.004	0.99
Porterhouse	0.38	0.34	0.42	0.38	0.34	0.29	0.62	0.54
Stewing Steak	0.24	0.44	0.60	0.48	0.46	0.10	0.02	0.36
Topside Steak	0.52	0.63	0.47	0.66	0.98	0.60	0.34	0.70
Total Steak	2.35	1.40	2.44	1.46	2.20	1.33	0.32	0.73
Beef Mince	0.54	0.32	0.57	0.34	0.48	0.31	0.72	0.48
Corned Beef	0.73	0.84	0.80	0.89	0.62	0.78	0.53	0.59
Total Beef	4.27	2.58	4.54	2.89	3.86	2.01	0.76	0.47
Lamb F'qtr	0.34	0.42	0.34	0.45	0.36	0.38	0.36	0.69
L. Neck Chops	0.22	0.34	0.25	0.36	0.19	0.31	0.58	0.56
L. Loin Chops	0.38	0.38	0.34	0.41	0.41	0.31	0.32	0.27
Leg of Lamb	0.62	1.12	0.64	1.39	0.58	0.44	0.073	0.93
Total Lamb	1.56	1.73	1.58	2.08	1.56	1.03	0.025	0.97
Hogget F'qtr	0.48	0.82	0.43	0.80	0.58	0.88	0.50	0.61
H. Neck Chops	0.24	0.44	0.31	0.51	0.14	0.28	1.77	0.18
H. Loin Chops	0.35	0.48	0.35	0.41	0.34	0.57	0.66	0.52
Leg of Hogget	0.91	1.20	0.69	1.00	1.27	1.41	2.65	0.08
Total Hogget	1.99	2.30	1.77	2.26	2.33	2.38	0.62	0.54
Mutton F'qtr	0.20	0.57	0.27	0.64	0.09	0.42	1.12	0.33
Mutton Neck Chops	0.14	0.36	0.17	0.43	0.10	0.23	0.46	0.63
Mutton Loin Chops	0.19	0.44	0.20	0.37	0.18	0.55	0.12	0.89
Leg of Mutton	0.48	0.98	0.56	0.98	0.37	0.97	0.54	0.58
Total Mutton	1.02	1.72	1.21	1.86	0.75	1.47	0.95	0.39
Total Sheepmeat	4.98	4.34	4.92	4.46	5.13	4.35	0.14	0.87
Pork Chops	0.55	0.49	0.55	0.49	0.56	0.52	0.05	0.95
Pork Pieces	0.32	0.60	0.43	0.72	0.16	0.30	2.32	0.10
Leg of Pork	1.26	1.76	1.27	1.26	1.26	0.81	0.12	0.98
Total Pork	2.14	2.14	2.25	2.16	1.98	2.16	0.19	0.83
Sliced ham	0.19	0.32	0.21	0.37	0.17	0.25	0.38	0.68
Ham-on-the-Bone	1.87	2.71	1.58	2.54	2.33	2.97	0.83	0.44
Ham Steaks	0.28	0.41	0.34	0.47	0.19	0.27	1.62	0.20
Total Ham	2.34	2.92	2.13	2.84	2.69	3.08	0.39	0.68
Middle Bacon	0.18	0.29	0.21	0.34	0.13	0.22	0.81	0.45
Shoulder Bacon	0.16	0.45	0.17	0.55	0.14	0.22	0.33	0.72
Total Bacon	0.34	0.53	0.38	0.61	0.27	0.39	0.45	0.64
Total Pigmeat	4.82	4.15	4.76	4.30	4.94	4.03	0.028	0.97
Chicken	1.03	0.60	1.14	0.62	0.83	0.53	2.93	0.098
Shellfish	0.11	0.19	0.13	0.21	0.07	0.14	3.20	0.84
Fish	0.58	0.38	0.65	0.42	0.48	0.30	2.22	0.12
Total Fish	0.69	0.45	0.78	0.49	0.55	0.35	3.13	0.05
Beef Tongue	0.12	0.32	0.15	0.36	0.09	0.26	0.41	0.66
Beef hearts	0.02	0.12	0.03	0.16	0.0	0.0	0.64	0.53
Beef Tripe	0.05	0.16	0.06	0.20	0.02	0.10	0.75	0.50
Lamb's fry	0.31	0.48	0.27	0.28	0.37	0.68	0.66	0.52
Lambs kidney	0.11	0.20	0.09	0.17	0.14	0.23	0.86	0.42
Total offal	0.61	0.77	0.61	0.76	0.63	0.81	0.32	0.73
Beef Sausages	0.45	0.54	0.47	0.67	0.42	0.26	0.086	0.92
Pork Sausages	0.28	0.26	0.31	0.26	0.23	0.27	1.17	0.32
Total Fresh Saus.	0.73	0.58	0.78	0.69	0.65	0.37	0.57	0.59
Hamburger	0.13	0.25	0.15	0.29	0.09	0.18	0.81	0.45
Luncheon	0.23	0.22	0.21	0.18	0.25	0.27	1.04	0.32
Ham-n-Chicken	0.16	0.44	0.21	0.55	0.08	0.17	1.01	0.37
Salami	0.05	0.14	0.05	0.15	0.03	0.10	5.81	0.004
Frankfurters	0.04	0.13	0.04	0.14	0.05	0.13	0.11	0.89
Saveloys	0.34	0.31	0.40	0.34	0.25	0.23	2.67	0.07
Black Pudding	0.06	0.15	0.05	0.14	0.08	0.17	0.36	0.69
Garlic Sausage	0.08	0.29	0.09	0.36	0.05	0.12	1.18	0.31
Total Cooked Saus.	0.96	0.89	1.05	1.04	0.79	0.57	1.39	0.25
Total Continental	0.17	0.41	0.17	0.47	0.14	0.26	2.27	0.11
Total Sausages	1.24	1.01	1.37	1.15	1.01	0.71	1.67	0.19
Total Meat	17.17	10.51	17.67	11.46	16.43	9.08	0.16	0.85
Convenience Meats	4.76	2.84	5.00	3.09	4.36	2.42	0.59	0.56
Roast Meats	4.82	4.56	4.68	4.55	5.11	4.68	0.20	0.82
Valid Responses		91		55		35		

MEAT CONSUMPTION OF FAMILIES WITH CHILDREN
BETWEEN 2 - 10 YEARS OF AGE. KG/CAPITA/ANNUM

MEAT	WHOLE SAMPLE		0 CHILD		1 CHILD		2 CHILDREN		3 CHILDREN OR MORE		Fo	SIGN-IFICANCE
	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.		
Wienersnitzel	0.35	0.36	0.27	0.24	0.39	0.21	0.47	0.55	0.32	0.24	1.57	0.19
Rump Steak	0.54	0.48	0.43	0.44	0.59	0.55	0.62	0.45	0.78	0.55	1.01	0.41
Porterhouse	0.39	0.35	0.39	0.38	0.32	.031	.041	0.37	0.50	0.0	0.56	0.69
Stewing Steak	0.55	0.45	0.62	0.55	0.50	0.41	0.48	0.31	0.48	0.33	0.50	0.74
Topside Steak	0.52	0.63	0.55	0.76	0.52	0.67	0.46	0.43	0.50	0.41	0.08	0.98
Total Steak	2.34	1.40	2.26	1.57	2.33	1.51	2.45	1.16	2.58	0.71	0.12	0.98
Beef Mince	0.54	0.33	0.54	0.43	0.58	0.22	0.50	0.27	0.50	0.0	0.22	0.93
Corned Beef	0.73	0.85	0.70	0.91	0.63	0.84	0.83	0.83	1.00	0.41	0.27	0.90
Total Beef	4.27	2.58	4.16	3.37	4.10	2.25	4.48	1.61	4.57	0.38	0.17	0.95
Lamb F'qtr	0.34	0.43	0.25	0.42	0.29	0.36	0.49	0.44	0.50	0.58	1.73	0.15
L. Neck Chops	0.23	0.34	0.16	0.34	0.17	0.29	0.32	0.33	0.50	0.58	1.89	0.12
L. Loin Chops	0.38	0.38	0.32	0.43	0.30	0.32	0.43	0.30	0.93	0.15	2.99	0.02
Leg of Lamb	0.62	1.12	0.42	0.57	0.99	2.04	0.58	0.36	0.63	0.48	0.98	0.42
Total Lamb	1.56	1.73	1.15	1.46	1.75	2.54	1.81	1.02	2.56	1.68	1.26	0.29
Hogget F'qtr	0.48	0.82	0.52	0.94	0.50	0.84	0.47	0.69	0.25	0.50	0.18	0.95
H. Neck Chops	0.24	0.44	0.24	0.53	0.10	0.24	0.33	0.41	0.50	0.58	1.25	0.29
H. Loin Chops	0.35	0.48	0.31	0.43	0.28	0.32	0.48	0.65	0.43	0.51	0.78	0.54
Leg of Hogget	0.91	1.20	0.76	1.16	1.37	1.49	0.82	0.99	0.63	0.48	1.27	0.29
Total Hogget	1.99	2.30	1.83	2.46	2.25	2.67	2.09	2.56	1.80	1.68	0.32	0.87
Mutton F'qtr	0.20	0.57	0.21	0.61	0.23	0.69	0.16	0.38	0.25	0.50	0.09	0.99
M. Neck Chops	0.14	0.37	0.17	0.45	0.07	0.20	0.16	0.34	0.25	0.50	0.38	0.82
M. Loin Chops	0.19	0.44	0.17	0.36	0.15	0.30	0.26	0.64	0.25	0.50	0.29	0.88
Leg of Mutton	0.48	0.96	0.42	0.97	0.46	1.00	0.58	1.03	0.75	0.95	0.23	0.92
Total Mutton	1.02	1.72	0.97	1.79	0.91	1.52	1.15	1.85	1.50	1.91	0.23	0.92
Total Sheepmeat	4.98	4.38	4.30	5.16	5.30	3.72	5.53	3.68	6.55	4.85	0.50	0.73
Pork Chops	0.55	0.49	0.50	0.54	0.60	0.48	0.58	0.46	0.75	0.29	0.62	0.65
Pork Pieces	0.32	0.60	0.36	0.86	0.16	0.27	0.41	0.34	0.50	0.0	0.74	0.57
Leg of Pork	1.27	1.76	1.22	1.79	1.66	2.00	1.05	1.65	1.13	0.63	0.52	0.72
Total Pork	2.14	2.14	2.08	2.35	2.41	2.24	2.04	1.93	2.38	0.63	0.37	0.83
Sliced Ham	0.19	0.32	0.21	0.45	0.14	0.17	0.20	0.22	0.33	0.13	0.43	0.78
Ham-on-the-Bone	1.87	2.71	1.71	2.76	2.62	3.04	1.62	2.48	1.13	1.31	0.72	0.58
Ham Steaks	0.28	0.41	0.29	0.48	0.27	0.45	0.25	0.26	0.55	0.10	0.61	0.66
Total Ham	2.34	2.92	2.21	3.08	3.03	3.28	2.06	2.52	2.00	1.39	0.56	0.69
Middle Bacon	0.18	0.30	0.16	0.22	0.13	0.23	0.25	0.44	0.18	0.24	0.58	0.68
Shoulder Bacon	0.16	0.45	0.21	0.68	0.11	0.13	0.15	0.25	0.18	0.13	0.20	0.94
Total Bacon	0.34	0.53	0.36	0.65	0.24	0.30	0.40	0.54	0.35	0.13	0.36	0.84
Total Pigmeat	4.82	4.15	4.65	4.65	5.68	4.36	4.50	3.42	4.73	1.90	0.61	0.66
Chicken	1.02	0.60	1.02	0.77	1.02	0.49	1.01	0.43	1.20	0.50	0.11	0.98
Shellfish	0.11	0.19	0.10	0.21	0.13	0.18	0.12	0.18	0.18	0.13	0.30	0.88
Fish	0.58	0.38	0.58	0.48	0.57	0.25	0.59	0.36	0.63	0.15	0.03	0.99
Total Fish	0.70	0.45	0.68	0.57	0.10	0.33	0.71	0.37	0.80	0.08	0.11	0.98
Beef Tongue	0.13	0.32	0.11	0.31	0.11	0.30	0.16	0.35	0.0	0.0	2.23	0.07
Beef Hearts	0.02	0.13	0.05	0.19	0	0	0	0	0	0	0.67	0.61
Beef Tripe	0.05	0.17	0.04	0.20	0.04	0.12	0.08	0.18	0.03	0.05	0.22	0.93
Lamb's Fry	0.31	0.48	0.30	0.66	0.27	0.25	0.33	0.31	0.43	0.39	0.15	0.96
Lamb's Kidney	0.11	0.20	0.06	0.14	0.13	0.18	0.15	0.27	0.28	0.21	1.85	0.13
Total Offal	0.61	0.77	0.55	0.96	0.54	0.53	0.71	0.69	0.73	0.56	0.55	0.70
Beef Sausages	0.45	0.55	0.46	0.80	0.41	0.26	0.47	0.23	0.48	0.05	0.06	0.99
Pork Sausages	0.28	0.26	0.22	0.26	0.28	0.30	0.34	0.23	0.50	0.0	1.94	0.11
Total Fresh Sausages	0.73	0.58	0.68	0.80	0.69	0.44	0.81	0.30	0.98	0.05	0.40	0.81
Hamburger	0.13	0.25	0.13	0.29	0.08	0.17	0.10	0.20	0.58	0.15	3.96	0.005
Luncheon	0.23	0.22	0.20	0.23	0.20	0.21	0.28	0.21	0.35	0.17	0.93	0.45
Ham-n-Chicken	0.16	0.44	0.19	0.65	0.14	0.19	0.14	0.19	0.18	0.24	0.09	0.98
Salami	0.05	0.14	0.07	0.19	0.05	0.12	0.02	0.06	0.03	0.05	0.42	0.79
Frankfurter	0.04	0.13	0.05	0.16	0.07	0.14	0.02	0.10	0.0	0.0	0.48	0.75
Saveloys	0.34	0.31	0.33	0.38	0.31	0.27	0.38	0.23	0.38	0.25	0.22	0.93
Black Pudding	0.06	0.15	0.07	0.17	0.07	0.15	0.05	0.12	0.0	0.0	0.33	0.86
Garlic Sausage	0.08	0.29	0.06	0.16	0.06	0.13	0.14	0.51	0.0	0.0	0.46	0.77
Total Cooked Sausage	0.96	0.89	0.96	1.15	0.90	0.70	1.04	0.69	0.93	0.25	0.09	0.98
Total Continental Saus.	0.10	0.41	0.17	0.40	0.17	0.35	0.19	0.5	0.03	0.05	0.18	0.95
Total Sausages	1.24	1.012	1.18	1.25	1.18	0.89	1.38	0.80	1.42	0.25	0.26	0.90
Total Meat	17.17	10.51	16.12	13.34	18.07	10.07	17.71	6.23	19.85	4.67	0.27	0.89
Convenience Meats	4.77	2.84	4.53	3.70	4.52	2.02	5.14	2.09	6.28	1.34	0.52	0.72
Roast Meats	4.82	4.56	4.34	3.35	6.01	4.91	4.59	3.05	4.63	2.06	0.57	0.68
			38		23			25		5		

MEAT CONSUMPTION OF HOUSEHOLDS
WITH CHILDREN OVER 10
KG/CAPITA/ANNUM

MEAT	WHOLE SAMPLE MEAN	WHOLE SAMPLE S.D.	0 CHILDREN MEAN	0 CHILDREN S.D.	1 CHILD MEAN	1 CHILD S.D.	2 CHILDREN MEAN	2 CHILDREN S.D.	Fo	S SIGN-FICANCE	LINEARITY DEVIATION DEVIATION FROM LINEARITY	
Wienersnitzel	0.35	0.36	0.34	0.36	0.27	0.16	0.42	0.37	1.09	0.37		
Rump Steak	0.54	0.48	0.52	0.44	0.30	0.33	0.68	0.59	4.36	0.003	0.026	0.009
Porterhouse	0.39	0.35	0.37	0.31	0.22	0.34	0.50	0.35	6.85	0.001	0.0016	0.0015
Stewing Steak	0.55	0.45	0.55	0.41	0.28	0.32	0.48	0.40	5.56	0.0005	0.086	0.0006
Topside Steak	0.52	0.63	0.52	0.60	0.08	0.20	0.24	0.25	5.81	0.0003	0.096	0.0004
Total Steak	2.35	1.40	2.31	1.12	1.15	0.63	2.32	1.18	14.735	0.0000	0.0003	0.0000
Beef Mince	0.54	0.33	0.54	0.31	0.28	0.32	0.50	0.35	3.01	0.022	0.29	0.0159
Corned Beef	0.73	0.85	0.76	0.87	0.33	0.21	0.42	0.40	1.688	0.1602	0.8073	0.089
Total Beef	4.26	2.68	4.26	2.19	2.05	1.40	3.62	1.81	4.396	0.0000	0.058	0.0000
Lamb F'qtr	0.34	0.43	0.35	0.41	0.18	0.32	0.0	0.0	4.45	0.003	0.57	0.0011
L. Neck Chops	0.23	0.34	0.22	0.32	0.0	0.0	0.16	0.23	6.31	0.0002	0.034	0.0003
L. Loin Chops	0.36	0.38	0.37	0.33	0.0	0.0	0.44	0.44	8.87	0.0000	0.0167	0.0000
Leg of Lamb	0.62	1.12	0.52	0.45	0.43	0.78	0.20	0.27	107.65	0.0000	0.0000	0.0000
Total Lamb	1.57	1.73	1.47	1.12	0.62	0.75	0.80	0.63	36.156	0.0000	0.0000	0.0000
Hogget F'qtr	0.48	0.82	0.51	0.82	0.0	0.0	0.28	0.41	3.33	0.014	0.89	0.0060
H. Neck Chops	0.24	0.44	0.23	0.40	0.0	0.0	0.28	0.41	7.821	0.000	0.1079	0.0000
H. Loin Chops	0.35	0.48	0.35	0.48	0.28	0.37	0.24	0.34	2.337	0.0617	0.7116	0.0321
Leg of Hogget	0.91	1.24	1.02	1.25	0.08	0.20	0.20	0.27	1.549	0.1953	0.1387	0.2729
Total Hogget	1.99	2.30	2.11	2.28	0.37	0.34	1.00	0.96	3.785	0.0070	0.6878	0.0031
Mutton F'qtr	0.20	0.57	0.18	0.52	0.0	0.0	0.40	0.89	4.447	0.0026	0.076	0.003
M. Neck Chops	0.14	0.37	0.13	0.29	0.0	0.0	0.20	0.48	14.46	0.0000	0.0051	0.000
M. Loin Chops	0.19	0.44	0.18.	0.44	0.18	0.28	0.20	0.45	1.679	0.1623	0.3851	0.1223
Leg of Mutton	0.48	0.98	0.50	0.99	0.42	1.02	0.0	0.0	1.263	0.2910	0.7984	0.1813
Total Mutton	1.02	1.72	0.98	1.58	0.60	1.20	0.80	1.79	5.50	0.0005	0.2268	0.0003
Total Sheepmeat	4.98	4.38	4.99	3.77	1.70	2.03	2.88	1.60	11.376	0.000	0.0237	0.0000
Pork Chops	0.55	0.49	0.57.	0.50	0.28	0.32	0.40	0.42	2.023	0.0984	0.9788	0.0509
Pork Pieces	0.32	0.60	0.32	0.63	0.22	0.25	0.16	0.23	1.492	0.2118	2.5239	0.1437
Leg of Pork	1.27	1.76	1.34	1.82	0.35	0.42	0.20	0.27	2.019	0.0989	0.9052	0.0515
Total Pork	2.14	2.14	2.23	2.16	0.85	0.77	0.76	0.72	2.832	0.0293	0.7710	0.0139
Sliced Ham	0.19	0.32	0.18	0.29	0.08	0.13	0.28	0.23	8.887	0.000	0.0239	0.000
Ham-on-the-bone	1.87	2.71	1.93	2.70	0.18	0.28	1.90	3.97	1.215	0.3105	0.6011	0.2131
Ham Steaks	0.28	0.41	0.24	0.26	0.20	0.25	0.30	0.45	29.029	0.000	0.0000	0.0000
Total Ham	2.34	2.92	2.34	2.81	0.47	0.45	2.48	4.41	2.399	0.0562	0.1545	0.0639
Middle Bacon	0.18	0.30	0.18	0.30	0.07	0.10	0.16	0.15	2.243	0.0710	0.2567	0.0605
Shoulder Bacon	0.16	0.45	0.17	0.48	0.0	0.0	0.32	0.24	0.381	0.8213	0.9374	0.6788
Total Bacon	0.34	0.53	0.34	0.56	0.07	0.10	0.48	0.33	0.886	0.4757	0.5793	0.3625
Total Pigmeat	4.82	4.15	4.92	3.96	1.38	1.28	3.72	4.70	4.102	0.0043	0.2059	0.0033
Chicken	1.02	0.60	0.98	0.49	1.23	1.02	1.04	1.18	2.75	0.0330	0.0379	0.095
Shellfish	0.11	0.19	0.09	0.16	0.10	0.20	0.34	0.42	3.70	0.0079	0.0006	0.5506
Fish	0.58	0.38	0.58	0.37	0.50	0.37	0.50	0.32	2.984	0.0234	0.2009	0.0207
Total Fish	0.69	0.45	0.67	0.40	0.60	0.43	0.84	0.73	3.539	0.0101	0.0104	0.0707
Beef Tongue	0.13	0.32	0.13	0.32	0.0	0.0	0.0	0.0	4.37	0.0029	0.63	0.0012
Beef Hearts	0.02	0.13	0.01	0.11	0.0	0.0	0.0	0.0	10.26	0.000	0.02	0.0000
Beef Tripe	0.05	0.17	0.04	0.15	0.08	0.20	0.10	0.22	4.79	0.0015	0.0212	0.0052
Lamb's Fry	0.31	0.48	0.32	0.51	0.10	0.20	0.26	0.22	0.43	0.78	0.95	0.63
Lamb's Kidney	0.11	0.20	0.11	0.20	0.02	0.04	0.02	0.04	3.22	0.0164	0.9515	0.0072
Total Offal	0.61	0.77	0.62	0.72	0.20	0.40	0.38	0.36	6.227	0.0002	0.2868	0.0001
Beef Sausages	0.45	0.55	0.47	0.57	0.20	0.24	0.28	0.26	0.73	0.57	0.92	0.41
Pork Sausages	0.28	0.26	0.26	0.24	0.25	0.27	0.42	0.40	2.609	0.041	0.0055	0.51
Total Fresh Sausages	0.73	0.58	0.73	0.59	0.45	0.34	0.70	0.42	1.637	0.1724	0.2492	0.1661
Hamburger	0.13	0.25	0.10	0.21	0.02	0.04	0.36	0.49	4.41	0.0027	0.0015	0.0827
Luncheon	0.23	0.22	0.23	0.22	0.22	0.25	0.16	0.11	0.164	0.9563	0.6599	0.9275
Ham-n-Chicken	0.16	0.44	0.15	0.47	0.13	0.21	0.26	0.25	0.240	0.9152	0.3967	0.9720
Salami	0.05	0.14	0.03	0.10	0.20	0.40	0.06	0.13	2.359	0.0597	0.1674	0.0649
Frankfurters	0.04	0.13	0.03	0.10	0.05	0.12	0.10	0.22	13.44	0.0000	0.0002	0.0000
Saveloys	0.34	0.31	0.33	0.31	0.27	0.23	0.30	0.27	1.875	0.1222	0.1242	0.1738
Black Pudding	0.06	0.15	0.05	0.14	0.03	0.08	0.10	0.22	4.167	0.0039	0.0021	0.0929
Garlic Sausage	0.08	0.29	0.07	0.30	0.05	0.12	0.06	0.13	1.602	0.1812	0.4480	0.1288
Total Cooked Sausages	0.96	0.89	0.91	0.85	0.95	0.82	1.04	0.89	2.997	0.0229	0.0203	0.1020
Total Continental	0.17	0.41	0.14	0.35	0.30	0.53	0.22	0.49	5.188	0.0009	0.0306	0.0021
Total Sausages	1.24	1.01	1.17	0.93	1.20	1.03	1.46	1.20	2.767	0.0072	0.0051	0.086
Total Meat	17.16	10.50	17.10	8.64	8.18	4.91	13.92	10.51	12.343	0.0000	0.0053	0.0000
Convenience Meats	4.77	2.84	4.68	2.23	2.58	1.80	4.72	3.06	13.951	0.0000	0.0013	0.0000
Roast Meats	4.82	4.56	4.94	4.22	1.55	1.58	1.52	0.98	7.427	0.0000	0.1363	0.0000
Valid Responses				78		6		5				

APPENDIX 4.7

MEAT CONSUMPTION PER ANNUM BY AGE OF RESPONDENT

MEAT	AGE OF RESPONDENT																
	WHOLE SAMPLE		UNDER 20(4)		20 -29 (48)		30 - 39 (26)		40 - 49 (6)		50 - 59 (5)		Over 60			SIGN. F.	LINEARITY SIGN.
	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.	F		
Weinersnitzel	0.3527	0.3573	0.1000	0.1155	0.3646	0.4295	0.3462	0.2587	0.4167	0.3430	0.4000	0.3391	0.400	0.00	0.381	0.8894	0.4540
Rump Steak	0.5418	0.4756	0.3750	0.2500	0.5354	0.4927	0.5654	0.4317	0.7667	0.8140	0.3600	0.2191	0.5000	0.00	0.425	0.8604	0.8005
*Porterhouse	0.3879	0.3483	0.0	0.0	0.3792	0.3229	0.3962	0.3039	0.8839	0.4792	0.1200	0.1643	0.400	0.0	4.055	0.0013	0.3479
Stewing Steak	0.5495	0.4483	0.1750	0.350	0.4937	0.3551	0.5231	0.4082	1.0333	0.7633	0.8800	0.6907	0.500	0.0	2.569	0.0247	0.0101
*Topside Steak	0.5176	0.6319	0.3750	0.4787	0.4646	0.6005	0.5308	0.4145	1.2833	1.3717	0.1600	0.2302	0.500	0.0	1.943	0.0832	0.4219
*Total Steak	2.3495	1.4008	1.025	0.9743	2.2375	1.1645	2.3615	1.0845	4.3833	3.0662	1.9200	0.5541	2.300	0.0	3.276	0.0061	0.0712
Beef Mince	0.5374	0.3285	0.1250	0.2500	0.4979	0.3336	0.6115	0.2026	0.8333	0.5502	0.5600	0.2608	0.500	0.0	2.524	0.027	0.0105
Corned Beef	0.7319	0.8456	0.1250	0.2500	0.8750	0.9888	0.5423	0.3568	1.2667	0.1944	0.3800	0.6301	0.500	0.0	1.523	0.1805	0.9175
*Total Beef	4.2670	2.5806	1.3250	0.9430	4.1979	2.1040	4.0962	1.4581	8.3667	6.1318	3.5200	1.3461	3.800	0.00	4.275	0.0008	0.0453
Lamb F'qtr	0.3429	0.4259	0.0	0.0	0.3479	0.4410	0.3615	0.3656	0.5500	0.6863	0.2400	0.3578	0.0	0.0	0.889	0.5069	0.8226
L. Neck Chops	0.2275	0.3432	0.075	0.150	0.1812	0.3153	0.2885	0.3398	0.400	0.6481	0.2400	0.2302	0.0	0.0	0.933	0.4760	0.5946
L.Loin Chops	0.3758	0.3793	0.10	0.20	0.3417	03420	0.4846	0.3246	0.4833	0.8256	0.2400	0.2302	0.0	0.0	1.269	0.2805	0.7133
*Leg of Lamb	0.6198	1.1161	0.250	0.50	0.5562	0.4621	0.5500	0.4735	2.1333	3.9758	0.200	0.4472	0.0	0.0	2.310	0.0410	0.3343
*Total Lamb	1.5659	1.7277	0.4255	0.6652	1.4271	1.1276	1.6846	1.0259	3.5667	5.337	0.920	0.8468	0.0	0.0	2.161	0.0548	0.3845
Hogget F'qtr	0.4835	0.8249	0.0	0.0	0.5229	0.8309	0.4231	0.7202	1.1500	1.4348	0.080	0.1781	0.0	0.0	1.199	0.3149	0.9856
*H. Neck Chops	0.2385	0.4406	0.0	0.0	0.2104	0.3592	0.2038	0.3268	0.8667	1.0577	0.1000	0.2236	0.0	0.0	2.841	0.0144	0.3345
H. Loin Chops	0.3495	0.4799	0.0750	0.150	0.3708	0.5307	0.3423	0.3635	0.6167	0.7250	0.080	0.1789	0.0	0.0	0.984	0.4415	0.6991
Leg of Hogget	0.9143	1.2018	0.0	0.0	1.1521	1.2536	0.7038	1.1577	0.9333	1.2127	0.680	1.3084	0.0	0.0	0.970	0.4509	0.4795
Total Hogget	1.9857	2.2 61	0.0750	0.150	2.2560	2.1514	1.6731	2.1653	3.5667	4.2027	0.9400	1.228	0.0	0.0	1.479	0.1954	0.7347
Mutton F'qtr	0.1978	0.3657	0.0	0.0	0.1604	0.4499	0.2000	0.6119	0.3833	0.9390	0.5600	1.0431	0.0	0.0	0.590	0.7375	0.1487
M. Neck Chops	0.1440	0.3655	0.0	0.0	0.1875	0.3356	0.0692	0.2462	0.5833	0.9390	0.0	0.0	0.0	0.0	1.008	0.4254	0.7836
M. Loin Chops	0.1934	0.4419	0.0	0.0	0.2437	0.5198	0.1269	0.3144	0.3167	0.5382	0.0	0.0	0.0	0.0	0.807	0.5670	0.5277
Leg of Mutton	0.4813	0.9755	0.0	0.0	0.6917	1.1734	0.2808	0.6735	0.3833	0.9393	0.2000	0.2000	0.0	0.0	0.807	0.5202	0.3034
Total Mutton	1.0165	1.7162	0.0	0.0	1.2833	1.7374	0.6769	1.4365	1.4667	3.3074	0.7600	0.9633	0.0	0.0	0.735	0.6226	0.6877
*Total Sheepmeat	4.9835	4.3778	0.9250	0.9878	5.400	4.2098	4.4462	2.5188	9.1167	9.5882	2.9200	3.1571	0.0	0.0	2.163	0.0546	0.9809
Pork Chops	0.5527	0.4945	0.1000	0.200	0.6000	0.4659	0.5115	0.3912	0.8333	1.045	0.420	0.2950	0.0	0.0	1.433	0.2116	0.8617
Pork Pieces	0.3231	0.6037	0.0	0.0	0.2667	0.3231	0.2692	0.3320	0.5333	0.6218	1.280	2.0921	0.0	0.0	2.943	0.0118	0.0057
Leg of Pork	1.2659	1.7625	0.0	0.0	1.3979	1.9017	1.0269	1.5180	2.2167	2.0058	1.520	1.9499	0.0	0.0	0.888	0.5078	0.5328
Total Pork	2.1418	2.140	0.100	0.2000	2.2646	2.1286	1.8077	1.8269	3.6333	2.9797	3.220	2.5342	0.0	0.0	1.741	0.1215	0.1704
*Sliced Ham	0.1912	0.3234	0.0250	0.0500	0.1437	0.1956	0.2154	0.2257	0.7167	0.9261	0.100	0.100	0.0	0.0	3.790	0.0022	0.0414
Ham-on-th-bone	1.8692	2.780	0.0	0.0	1.8146	2.7235	2.1000	2.7894	2.6333	2.9911	1.3200	2.7869	6.000	0.00	0.929	0.4786	0.1828
*Ham steaks	0.2824	0.4062	0.0	0.0	0.2312	0.2389	0.3000	0.3311	0.9667	1.0838	0.1600	0.1817	0.0	0.0	4.194	0.0010	0.0493
Total Ham	2.3429	2.9156	0.0250	0.050	2.1896	2.7654	2.6154	2.9194	4.3167	4.1983	1.5800	2.9845	6.00	0.0	1.383	0.2508	0.0863
Middle Bacon	0.1769	0.2985	0.025	0.050	0.2021	0.3617	0.1346	0.1853	0.3000	0.3578	0.1400	0.1517	0.100	0.0	0.494	0.8112	0.9388
*Shoulder Bacon	0.1626	0.4481	0.0	0.0	0.1437	0.2062	0.1000	0.1549	0.7833	1.9030	0.1200	0.2168	0.00	0.00	2.351	0.0379	0.1810
*Total Bacon	0.3396	0.5306	0.025	0.050	0.3458	0.4262	0.2346	0.2591	1.0833	1.4757	0.260	0.1673	0.100	0.0	2.712	0.0186	0.2662
Total Pigmeat	4.8242	4.1515	0.1500	0.2380	4.800	3.7344	4.6577	3.2584	9.033	8.0864	5.060	4.8573	6.100	0.0	2.177	0.0531	0.0370
Chicken	1.0235	0.6021	0.6250	0.6652	1.0846	0.5733	0.9731	0.5862	1.200	0.9529	1.000	0.6557	1.000	0.00	0.444	0.8472	0.7963
*Shellfish	0.1132	0.1899	0.0	0.0	0.0875	0.1496	0.1808	0.2482	0.2333	0.2338	0.0	0.0	0.0	0.0	1.846	0.0999	0.3282
*Fish	0.5835	0.3828	0.1250	0.0957	0.56 7	0.3530	0.4962	0.2425	1.0833	0.6706	0.7200	0.4685	0.400	0.0	3.631	0.0030	0.0581
*Total Fish	0.6967	0.4478	0.1250	0.957	0.6792	0.3952	0.6769	0.3902	1.3167	0.6735	0.7200	0.4658	0.400	0.00	3.659	0.0028	0.0405
Beef Tongue	0.1275	0.3215	0.0	0.0	0.0896	0.2991	0.1731	0.3144	0.2167	0.5307	0.2000	0.4472	0.500	0.0	0.657	0.6843	0.8738
Beef Hearts	0.0187	0.1273	0.0	0.0	0.0208	0.1443	0.0	0.0	0.1167	0.2858	0.0	0.0	0.0	0.0	0.714	0.6395	0.7153
Beef Tripe	0.0505	0.1669	0.0	0.0	0.0458	0.1701	0.0462	0.1395	0.2000	0.3162	0.0	0.0	0.0	0.0	0.978	0.4455	0.5217
Lamb's Fry	0.3077	0.4773	0.3250	0.3202	003396	0.6146	0.2692	0.2510	0.3833	0.2317	0.2200	0.249	0.0	0.0	0.244	0.9606	0.6544
Lamb's Kidney	0.1077	0.1968	0.100	0.1414	0.0937	0.1994	0.1423	0.2023	0.1333	0.2805	0.0800	0.1304	0.0	0.0	0.294	0.9382	0.7520
Total Offal	0.6121	0.7737	0.4250	0.4031	0.5896	0.8164	0.6308	0.5870	1.050	1.4391	0.500	0.5745	0.50	0.0	0.477	0.8239	0.4584
*Fresh Beef Sausages	0.4516	0.5460	0.050	0.100	0.4312	0.2252	0.3615	0.2660	1.3500	1.7986	0.4600	0.3647	0.0	0.0	3.869	0.0015	0.0779
Pork Sausages	0.2791	0.2640	0.025	0.050	0.2896	0.2503	0.3269	0.2631	0.3500	0.5987	0.1600	0.2322	0.0	0.0	1.427	0.2141	0.7561
*Total Fresh Sausages	0.7308	0.5842	0.075	0.0957	0.7208	0.3242	0.6885	0.3229	1.700	1.7041	0.6200	0.3564	0.0	0.0	5.025	0.0002	0.0648
Hamburger	0.1286	0.2505	0.0250	0.0500	0.1375	0.2489	0.1231	0.2761	0.2167	0.3488	0.1000	0.1414	0.0	0.0	0.333	0.9177	0.7925
Luncheon	0.2286	0.2172	0.0250	0.0500	0.2521	0.2297	0.2731	0.2164	0.1667	0.1366	0.0600	0.0894	0.0	0.0	0.1709	0.1286	0.2888
*Ham-n-Chicken	0.1615	0.4437	0.00	0.00	0.1000	0.1650	0.1692	0.2092	0.850	1.5553	0.040	0.0548	0.0	0.0	3.125	0.0082	0.1003
Salami	0.0484	0.1417	0.00	0.00	0.0521	0.1676	0.0577	0.1270	0.8677	0.1033	0.0	0.0	0.0	0.0	0.242	0.9614	0.9048
Frankfurters	0.0418	0.1326	0.0	0.0	0.0479	0.1220	0.0269	0.1040	0.1333	0.3266	0.0	0.0	0.0	0.0	0.717	0.6369	0.8936
*Saveloys	0.3407	0.3091	0.050	0.10	0.3375	0.2429	0.3423	0.2230	0.7167	0.7494	0.1600	0.2302	0.0	0.0	3.038	0.0097	0.6840
Black Pudding	0.0615	0.1496	0.0	0.0	0.0396	0.1233	0.100	0.1855	0.1833	0.2229	0.0	0.0	0.0	0.0	1.476	0.1962	0.2389
Garlic Sausage	0.0791	0.2927	0.0	0.0	0.0979	0.3716	0.0538	0.1449	0.1833	0.3251	0.0	0.0	0.0	0.0	0.311	0.9296	0.8790
*Total Cooked Sausages	0.9615	0.8915	0.075	0.0957	0.9271	0.6129	1.0231	0.7005	2.300	2.1790	0.260	0.3209	0.0	0.0	4.512	0.0005	0.3781
Total Continental	0.1692	0.4060	0.0	0.0	0.1979	0.4460	0.1385	0.2981	0.3833	0.7233	0.00	0.00	0.00	0.00	0.646	0.6932	0.9152
*Total Sausages	1.2407	1.0125	0.100	0.1155	1.2167	0.7493	1.3500	0.8425	2.6500	2.2341	0.4200	0.4207	0.0	0.0	4.496	0.0005	0.3873
*Total Meat	17.1659	10.5072	3.2750	2.2247	17.4958	8.1237	16.3231	6.2031	31.90	25.8197	13.7400	8.9288	11.3000	0.00	3.994	0.0014	0.1204
*Convenience Meats	4.7659	2.8358	1.125	0.8221	4.6333	2.0193	4.7846	1.9295	9.2667	7.0090	3.780	1.042	2.300	0.00	4.879	0.0003	0.0790
*Roast Meats	4.8231	4.5640	0.625	0.9465	5.2937	4.4779	4.0769	3.1460	9.033	8.5528	3.64	4.66	0.50	0.0	1.955	0.0814	0.7096
Valid Responses	91		5		48		26		6		5		1				

APPENDIX 4.8

MEAN CONSUMPTION PER ANNUM BY INCOME OF PRINCIPAL INCOME EARNER

. MEAT	ENTIRE SAMPLE MEAN	S.D.	UNDER 6000 MEAN	S.D.	6000-7999 MEAN	S.D.	8000-10000 MEAN	S.D.	10001-13999 MEAN	S.D.	14000-17999 MEAN	S.D.	Over 18000 MEAN	S.D.	F	SIGN OF F	LINEA SIGN
Wienersnitzel	0.35	0.24	0.15	0.17	0.25	0.21	0.29	0.20	0.40	0.51	0.40	0.27	0.31	0.09	0.519	0.7922	0.3631
Rump	0.54	0.48	0.62	0.25	0.18	0.35	0.51	0.43	0.48	0.37	0.56	0.61	0.70	0.66	1.379	0.2524	0.2781
Porterhouse	0.38	0.34	0.20	0.24	0.18	0.35	0.41	0.30	0.36	0.29	0.42	0.44	0.61	0.48	1.026	0.4142	0.316
Stewing	0.54	0.44	0.42	0.30	0.80	0.47	0.44	0.40	0.56	0.44	0.56	0.50	0.48	0.37	0.536	0.7788	0.545
Topside	0.52	0.63	0.32	0.47	0.18	0.35	0.43	0.44	0.59	0.76	0.52	0.57	0.38	0.39	0.670	0.6340	0.555
Total Steak	2.34	1.40	1.72	0.86	1.58	0.94	2.09	1.24	2.39	1.26	2.46	1.09	2.50	0.95	0.821	0.5567	0.7317
Beef Mince	0.54	0.32	0.38	0.25	0.75	0.50	0.54	0.35	0.54	0.34	0.52	0.32	0.56	0.32	0.453	0.8408	0.8120
Corned Beef	0.73	0.84	0.28	0.48	0.55	0.41	0.58	0.60	0.86	1.00	0.70	0.62	0.64	0.69	0.593	0.735	0.8246
Total Beef	4.26	2.58	2.62	1.54	3.50	2.05	3.74	2.02	4.57	2.70	4.29	3.16	4.41	1.84	0.666	0.6772	0.9922
Lamb F'qtr	0.34	0.42	0.35	0.47	0.20	0.40	0.18	0.33	0.42	0.46	0.34	0.46	0.20	0.30	1.190	0.3198	0.3500
L. NeckChops	0.22	0.34	0.42	0.42	0.22	0.28	0.18	0.34	0.21	0.32	0.28	0.42	0.11	0.30	0.482	0.8201	0.5685
L. Loin Chops	0.38	0.38	0.25	0.50	0.15	0.30	0.36	0.40	0.35	0.33	0.49	0.46	0.21	0.29	1.159	0.3362	0.5607
Leg of Lamb	0.62	1.12	0.25	0.50	1.00	0.82	0.39	0.49	0.82	1.68	0.46	0.60	0.32	0.24	0.643	0.6951	0.5635
Total Lamb	1.56	1.72	1.28	1.84	1.58	1.26	1.11	1.32	1.82	2.18	1.57	1.68	0.86	0.52	0.699	0.6508	0.4010
Hogget F'qtr	0.48	0.82	0.10	0.20	0.0	0.0	0.33	0.56	0.54	0.88	0.40	0.82	0.62	1.07	1.552	0.1716	0.2271
H. Neck Chops	0.24	0.44	00.25	0.50	0.0	0.0	0.15	0.32	0.28	0.45	0.24	0.56	0.28	0.49	0.392	0.8822	0.8457
H. Loin Chops	0.34	0.48	0.0	0.0	0.125	0.25	0.48	0.77	0.36	0.38	0.32	0.46	0.36	0.46	0.687	0.6607	0.7833
*Leg of Hogget	0.91	1.20	0.35	0.47	0.0	0.0	0.50	0.73	1.07	1.22	0.82	1.23	1.00	1.38	2.668	0.0203	0.1210
*Total Hogget	1.98	2.29	0.70	0.94	0.12	0.25	1.46	1.67	2.26	2.38	1.78	2.30	2.27	3.32	2.086	0.0633	0.2533
Mutton F'qtr	0.20	0.56	0.10	0.20	0.0	0.0	0.13	0.28	0.14	0.48	0.42	0.83	0.0	0.0	1.017	0.4201	0.8674
M. Neck Chops	0.14	0.36	0.0	0.0	0.25	0.50	0.14	0.29	0.10	0.27	0.23	0.55	0.16	0.42	0.406	0.8733	0.5021
M. Loin Chops	0.19	0.44	0.0	0.0	0.12	0.25	0.38	0.78	0.10	0.28	0.28	0.43	0.18	0.32	1.022	0.4166	0.5726
Leg of Mutton	0.48	0.98	0.10	0.20	0.62	1.25	0.34	0.73	0.50	1.03	0.62	1.05	0.42	1.13	0.234	0.9642	0.6815
Total Mutton	1.02	1.72	0.20	0.40	1.00	1.41	0.98	1.72	0.84	1.46	1.56	2.32	0.77	1.79	0.564	0.7581	0.6448
Total Sheepmeat	4.98	4.34	2.60	3.16	2.90	2.03	3.86	4.13	5.41	4.12	5.34	5.52	4.32	4.52	1.146	0.3429	0.5122
Pork Chops	0.55	0.49	0.35	0.47	0.30	0.36	0.41	0.42	0.60	0.52	0.54	0.50	0.68	0.58	0.971	0.4497	0.760
Pork Pieces	0.32	0.60	0.20	0.24	0.25	0.50	0.26	0.32	0.40	0.86	0.24	0.44	0.41	0.34	0.227	0.9670	0.8298
* Leg of Pork	1.26	1.76	0.38	0.48	0.0	0.0	0.55	0.83	1.91	2.08	1.52	1.83	0.14	0.24	2.492	0.0287	0.573
Total Pork	2.14	2.14	0.92	1.19	0.55	0.80	1.22	1.12	2.91	2.50	2.32	2.23	1.21	0.62	2.275	0.0440	0.6510
Sliced Ham	0.19	0.32	0.15	0.12	0.02	0.05	0.18	0.24	0.18	0.35	0.26	0.44	0.21	0.20	0.367	0.8981	0.3210
Ham-on-the-bone	1.86	2.70	0.0	0.0	0.0	0.0	0.94	1.94	2.29	2.80	2.16	3.00	2.00	3.08	1.460	0.2020	0.8825
Ham Steaks	0.28	0.40	0.20	0.24	0.05	0.10	0.32	0.32	0.27	0.38	0.40	0.58	0.12	0.22	0.711	0.6418	0.6198
Total Ham	2.34	2.92	0.35	0.36	0.08	0.10	1.44	2.03	2.75	3.00	2.82	3.38	2.34	3.05	1.432	0.2121	0.2472
Middle Bacon	0.18	0.30	0.0	0.0	0.30	0.46	0.08	0.12	0.22	0.39	0.24	0.26	0.08	0.09	1.044	0.4031	0.3092
Shoulder Bacon	0.16	0.48	0.10	0.14	0.0	0.0	0.16	0.22	0.22	0.68	0.16	0.25	0.06	0.08	0.252	0.9571	0.8567
Total Bacon	0.34	0.53	0.10	0.14	0.30	0.46	0.25	0.29	0.44	0.74	0.40	0.44	0.14	0.12	0.639	0.6983	0.4717
*Total Pigmeat	4.82	4.15	1.38	1.70	0.92	1.21	2.91	2.56	6.10	4.53	5.53	4.37	3.70	2.98	2.804	0.0155	0.5676
Chicken	1.02	0.60	0.72	0.58	0.80	0.63	0.79	0.62	1.12	0.55	1.18	0.76	0.87	0.32	1.124	0.3553	0.5650
Shellfish	0.11	0.18	0.0	0.0	0.0	0.0	0.12	0.20	0.10	0.16	0.17	0.25	0.10	0.19	0.776	0.5907	0.2927
Fish	0.58	0.38	0.32	0.36	0.70	0.24	0.46	0.34	0.62	0.42	0.64	0.80	0.60	0.34	0.784	0.5846	0.4613
Total Fish	0.70	0.44	0.32	0.36	0.70	0.24	0.58	0.40	0.72	0.46	0.82	0.54	0.70	0.36	0.908	0.4930	0.2800
Beef Tongue	0.12	0.32	0.0	0.0	0.25	0.50	0.03	0.12	0.16	0.34	0.10	0.30	0.28	0.56	0.813	0.5631	0.3466
Beef Hearts	0.018	0.12	0.0	0.0	0.0	0.0	0.06	0.25	0.00	0.00	0.035	0.16	0.0	0.0	0.551	0.7677	0.8586
Beef Tripe	0.05	0.16	0.0	0.0	0.0	0.0	0.0	0.0	0.06	0.0	0.085	0.21	0.07	0.18	0.562	0.7597	0.2593
Lamb's Fry	0.30	0.48	0.35	0.41	0.12	0.25	0.18	0.24	0.39	0.68	0.28	0.24	0.40	0.41	0.516	0.7949	0.5038
Lamb's Kidney	0.10	0.20	0.075	0.15	0.075	0.15	0.12	0.28	0.10	0.16	0.15	0.22	0.028	0.08	0.376	0.8921	0.8908
Total Offal	0.61	0.77	0.42	0.53	0.45	0.71	0.39	0.48	0.72	0.86	0.66	0.90	0.78	0.94	0.479	0.8221	0.2696
Fresh Beef Saus	0.45	0.54	0.25	0.28	0.38	0.26	0.44	0.22	0.54	0.82	0.40	0.32	0.36	0.24	0.324	0.9227	0.9510
Pork Sausages	0.28	0.26	0.28	0.26	0.12	0.25	0.24	0.22	0.30	0.26	0.34	0.30	0.27	0.22	0.757	0.6020	0.1071
Total Fresh Sausages	0.73	0.58	0.52	0.55	0.50	0.08	0.68	0.31	0.85	0.86	0.74	0.32	0.62	0.36	0.516	0.7948	0.4197
Hamburger	0.12	0.25	0.12	0.25	0.0	0.0	0.10	0.30	0.14	0.20	0.18	0.32	0.14	0.30	0.477	0.8236	0.183[illegible]
Luncheon	0.22	0.22	0.18	0.22	0.22	0.20	0.23	0.21	0.21	0.18	0.30	0.31	0.17	0.11	0.634	0.7027	0.3617
Ham-n-Chicken	0.16	0.44	0.025	0.05	0.18	0.24	0.12	0.20	0.22	0.68	0.14	0.19	0.14	0.24	0.188	0.9795	0.6461
Salami	0.048	0.14	0.0	0.0	0.0	0.0	0.034	0.12	0.08	0.20	0.03	0.06	0.028	0.07	0.505	0.803	0.864
Frankfurters	0.042	0.13	0.0	0.0	0.0	0.0	0.05	0.14	0.035	0.12	0.06	0.18	0.0	0.0	0.511	0.7985	0.5020
Saveloys	0.34	0.30	0.20	0.24	0.25	0.28	0.30	0.24	0.44	0.37	0.24	0.26	0.34	0.25	1.194	0.3175	0.9336
Black Pudding	0.06	0.14	0.0	0.0	0.0	0.0	0.044	0.13	0.68	0.16	0.11	0.208	0.028	0.0750	0.700	0.6503	0.261
*Garlic Sausage	0.08	0.29	0.0	0.0	0.0	0.0	0.03	0.12	0.068	0.14	0.06	0.18	0.40	0.93	1.667	0.1393	0.1700
Total Cooked Sausage	0.96	0.89	0.40	0.45	0.65	0.64	0.82	0.65	1.12	1.11	0.95	0.77	1.11	1.10	0.611	0.7286	0.3330
Total Continental	0.16	0.40	0.0	0.0	0.0	0.0	0.12	0.27	0.18	0.36	0.15	0.40	0.42	0.93	0.764	0.6004	0.4331
Total Sausages	1.24	1.01	0.68	0.70	0.78	0.86	1.06	0.76	1.42	1.19	1.29	0.97	1.38	1.22	0.675	0.6703	0.2031
*Total Meat	17.16	10.50	8.45	7.85	9.60	2.99	13.04	7.83	19.49	10.35	18.62	13.46	15.54	5.94	2.003	0.0742	0.8561
Convenience Meats	4.76	2.84	2.98	1.90	3.30	1.19	4.76	3.10	4.76	2.49	5.16	3.99	4.78	1.64	0.584	0.7424	0.8438
*Roast Meats	4.82	4.56	1.95	2.42	2.00	1.96	2.86	2.22	6.00	5.25	5.11	4.85	3.11	2.87	2.312	0.0409	0.5059
Valid Responses	91		10		4		16		34		20		7				

MEAT CONSUMPTION BY TYPE OF EMPLOYMENT OF PRINCIPAL INCOME EARNER

	WHOLE SAMPLE		LABOURER		MEAT TRADE		TRADESMAN		CLERICAL		SELF EMPLOYED		MANAGERIAL		PROFESSIONAL		
MEAT	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	S.F.O.
Weinerschnitzel	0.35	0.35	0.33	0.16	0.50	0.20	0.33	0.21	0.20	0.18	0.49	0.34	0.44	0.68	0.33	0.23	0.69
Rump Steak	0.54	0.47	0.28	0.31	0.23	0.40	0.57	0.48	0.44	0.33	0.82	0.75	0.72	0.49	0.48	0.44	1.362 0.05*
Porterhouse Stk	0.39	0.35	0.46	0.30	1.03	0.42	0.34	0.32	0.30	0.29	0.66	0.61	0.38	0.18	0.29	0.27	3.017 0.05*
Stewing Steak	0.55	0.45	0.40	0.28	0.23	0.40	0.51	0.38	0.69	0.58	0.56	0.80	0.62	0.40	0.60	0.42	0.683
Topside Steak	0.52	0.63	0.29	0.31	0.33	0.57	0.54	0.64	0.68	1.06	0.60	0.87	0.79	0.68	0.32	0.32	1.063
Total Steak	2.35	1.40	1.76	0.35	2.33	1.07	2.28	1.45	2.31	1.36	3.14	2.79	2.95	1.31	2.03	0.76	1.456
Beef Mince	0.54	0.33	0.53	0.28	0.33	0.29	0.52	0.36	0.84	0.44	0.51	0.50	0.53	0.19	0.52	0.28	1.386
Corned Beef	0.73	0.85	0.60	0.42	0.90	1.01	0.76	0.91	0.99	0.93	0.69	0.84	1.04	1.22	0.47	0.50	0.785
Total Beef	4.26	2.58	3.44	1.38	4.03	1.83	4.20	2.69	5.63	4.02	5.16	4.94	5.16	1.96	3.51	1.22	1.184
Lamb F'qtr	0.34	0.42	0.35	0.40	0.47	0.29	0.36	0.52	0.0	0.0	0.49	0.63	0.45	0.37	0.28	0.36	1.322
Lamb Neck Chops	0.23	0.34	0.19	0.26	0.27	0.46	0.33	0.35	0.07	0.14	0.54	0.61	0.15	0.23	0.14	0.26	1.916 0.68*
*Lamb Loin Chops	0.38	0.38	0.46	0.41	0.43	0.40	0.31	0.38	0.11	0.22	0.78	0.62	0.42	0.25	0.31	0.29	2.526* 0.01
Leg of Lamb	0.62	1.12	0.84	0.66	0.60	0.36	1.04	2.16	0.06	0.18	0.88	0.80	0.63	0.45	0.31	0.35	0.950
Total Lamb	1.57	1.73	1.84	0.65	1.77	0.76	2.02	2.81	0.25	0.41	2.68	2.41	1.64	0.83	1.05	0.88	1.812* 0.0884
Hogget F'qtr	0.48	0.82	0.34	0.64	0.73	1.27	0.30	0.68	0.51	1.08	0.74	1.03	0.88	1.00	0.32	0.63	0.965
Hog.Neck Chops	0.24	0.44	0.06	0.18	0.0	0.0	0.13	0.24	0.39	0.70	0.64	0.82	0.21	0.34	0.25	0.38	1.586
Hog.Loin Chops	0.35	0.48	0.31	0.36	0.0	0.0	0.27	0.69	0.34	0.41	0.66	0.60	0.45	0.37	0.32	0.37	0.863
Leg of Hogget	0.91	1.20	0.81	0.80	1.00	1.73	0.50	0.95	0.75	1.13	1.51	1.41	1.38	1.44	0.86	1.22	0.983
Total Hogget	1.99	2.30	1.53	1.36	1.73	3.00	1.19	1.91	1.99	3.15	3.55	2.76	2.92	2.49	1.75	2.05	1.332
Mutton F'qtr	0.20	0.57	0.0	0.0	0.0	0.0	0.15	0.33	0.0	0.0	0.76	0.95	0.14	0.58	0.28	0.70	1.495 0.0029*
Mut.Neck Chops	0.14	0.36	0.0	0.0	0.0	0.0	0.13	0.28	0.13	0.35	0.71	0.78	0.08	0.22	0.10	0.27	3.405
Mutt.Loin Chops	0.19	0.44	0.15	0.28	0.0	0.0	0.24	0.71	0.0	0.0	0.51	0.56	0.16	0.31	0.20	0.32	0.895
Leg of Mutton	0.48	0.98	0.91	1.28	0.0	0.0	0.48	0.95	0.05	0.14	0.89	1.17	0.75	1.29	0.28	0.74	1.057
Total Mutton	1.07	1.72	1.06	1.52	0.0	0.0	1.00	1.75	0.18	0.36	2.86	2.83	1.13	1.54	0.85	1.55	1.842* 0.08
Total Sheepmeat	4.98	4.38	4.52	1.69	3.80	3.69	4.50	4.32	2.68	3.16	9.67	7.65	6.39	4.40	4.05	3.11	2.182* 0.0371
Pork Chops	0.55	0.49	0.64	0.42	1.03	0.93	0.42	0.43	0.61	0.87	0.95	0.48	0.62	0.35	0.38	0.35	0.0615 1.865*
Pork Pieces	0.32	0.60	0.18	0.37	0.17	0.29	0.30	0.50	0.75	1.75	0.56	0.60	0.29	0.31	0.20	0.28	0.908
Leg of Pork	1.27	1.76	1.06	1.57	0.0	0.0	3.30	1.89	0.86	1.67	1.98	1.86	2.27	2.02	0.14	1.45	1.534
Total Pork	2.14	2.14	1.89	1.89	1.20	0.66	2.03	2.18	2.23	2.70	3.49	2.32	3.18	2.33	1.33	1.66	1.641
Sliced Ham	0.19	0.32	0.06	0.12	0.23	0.21	0.18	0.24	0.38	0.68	0.45	0.63	0.21	0.17	0.09	0.12	1.518
Ham-on-the-Bone	1.87	2.71	2.76	2.77	4.33	3.75	1.06	2.21	2.41	3.25	2.45	3.46	1.73	2.57	1.69	2.63	0.807
Ham Steaks	0.28	0.41	0.24	0.26	0.37	0.35	0.38	0.48	0.26	0.27	0.61	0.90	0.25	0.26	0.13	0.18	1.338
Total Ham	2.34	2.92	3.06	2.72	4.93	3.94	1.62	2.52	3.05	3.66	3.51	4.15	2.19	2.61	1.90	2.73	0.856
Middle Bacon	0.18	0.30	0.14	0.23	0.07	0.12	0.23	0.48	0.14	0.35	0.14	0.35	0.22	0.18	0.15	0.17	0.245
Shoulder Bacon	0.16	0.45	0.12	0.23	0.13	0.06	0.09	0.16	0.61	1.38	0.23	0.36	0.11	0.15	0.09	0.14	1.323
Total Bacon	0.34	0.53	0.26	0.26	0.20	0.17	0.32	0.49	0.75	1.36	0.36	0.68	0.33	0.23	0.24	0.21	0.830
Total Pigmeat	4.82	4.15	5.21	3.23	6.33	4.62	3.96	3.97	6.03	6.55	7.36	5.13	5.70	3.50	3.46	3.53	1.1788
Chicken	1.02	0.60	1.10	0.52	1.03	0.15	0.94	0.73	0.93	0.55	1.54	0.94	1.13	0.34	0.90	0.52	1.440
Shellfish	0.11	0.19	0.16	0.23	0.07	0.12	0.07	0.15	0.01	0.04	0.25	0.33	0.12	0.17	0.10	0.15	0.0780* 1.865
Fish	0.58	0.38	0.50	0.27	0.73	0.25	0.54	0.39	0.80	0.63	0.71	0.56	0.61	0.34	0.50	0.29	0.331
Total Fish	0.69	0.45	0.66	0.35	0.80	0.26	0.61	0.43	0.81	0.66	0.96	0.76	0.73	0.40	0.59	0.33	0.822
Beef Tongue	0.13	0.33	0.13	0.35	0.0	0.0	0.08	0.24	0.19	0.37	0.16	0.46	0.18	0.35	0.12	0.33	0.263
Beef Hearts	0.02	0.13	0.0	0.0	0.0	0.0	0.05	0.22	0.0	0.0	0.09	0.25	0.0	0.0	0.0	0.0	0.591
Beef Tripe	0.05	0.17	0.0	0.0	0.0	0.0	1.90	0.095	0.0	0.0	0.16	0.28	0.05	0.13	0.02	0.12	0.072
Lamb's Fry	0.31	0.48	0.06	0.18	0.23	0.25	0.18	0.21	0.25	0.28	0.40	0.32	0.52	0.93	0.33	0.29	0.946
Lamb's Kidney	0.11	0.20	0.04	0.11	0.07	0.12	0.12	0.26	0.03	0.05	0.18	0.27	0.18	0.20	0.07	0.14	0.489
Total Offal	0.62	0.77	0.23	0.53	0.30	0.36	0.52	0.63	0.46	0.47	0.98	1.28	0.93	1.07	0.53	0.57	1.088
Beef Sausages	0.45	0.55	0.42	0.20	0.47	0.06	0.42	0.26	0.96	1.86	0.41	0.36	0.41	0.26	0.35	0.26	1.06
Pork Sausages	0.28	0.26	0.35	0.27	0.17	0.29	0.27	0.27	0.06	0.14	0.46	0.34	0.38	0.27	0.20	0.21	0.0209 2.43*
Total Fresh Sausages	0.73	0.58	0.78	0.29	0.63	0.32	0.69	0.41	1.04	1.64	0.88	0.41	0.78	0.40	0.55	0.30	0.745
Hamburger	0.13	0.25	0.21	0.44	0.10	0.10	0.13	0.22	0.03	0.07	0.30	0.41	0.08	0.16	0.11	0.23	0.935
Luncheon	0.23	0.22	0.36	0.20	0.13	0.15	0.21	0.18	0.11	0.17	0.26	0.33	0.19	0.16	0.23	0.24	1.495
Ham-n-Chicken	0.16	0.44	0.06	0.18	0.07	0.12	0.16	0.18	0.51	1.41	0.16	0.19	0.15	0.18	0.08	0.16	0.870
Salami	0.05	0.14	0.08	0.18	0.07	0.12	0.07	0.23	0.0	0.0	0.03	0.07	0.04	0.13	0.05	0.10	0.279
Frankfurter	0.04	0.13	0.0	0.0	0.10	0.17	0.08	0.17	0.0	0.0	0.14	0.29	0.02	0.10	0.02	0.06	1.207
Saveloys	0.34	0.31	0.43	0.19	0.50	0.10	0.34	0.28	0.49	0.70	0.35	0.28	0.34	0.23	0.23	0.24	0.914
Black Pudding	0.06	0.15	0.0	0.0	0.07	0.12	0.07	0.16	0.0	0.0	0.20	0.29	0.05	0.13	0.04	0.09	0.956* 1.767
Garlic Sausage	0.08	0.29	0.06	0.18	0.07	0.12	0.03	0.09	0.0	0.0	0.13	0.28	0.06	0.15	0.14	0.51	0.369
Total Cooked Sausages	0.96	0.89	0.99	0.46	1.00	0.45	0.95	0.77	1.11	2.03	1.26	1.02	0.86	0.58	0.79	0.74	0.497
Total Continental	0.17	0.41	0.14	0.35	0.23	0.40	0.18	0.37	0.0	0.0	0.29	0.64	0.13	0.31	0.21	0.51	0.335
Total Sausages	1.24	1.01	1.34	0.57	1.17	0.31	1.21	0.96	1.18	2.02	1.72	1.26	1.24	0.73	0.99	0.86	0.755
Convenience Meats	4.77	2.84	4.29	1.13	4.87	1.12	4.47	2.88	5.14	4.22	7.42	5.97	5.21	1.54	4.01	1.46	1.507
Roast Meats	4.82	4.56	4.60	1.81	3.13	3.37	4.66	4.95	2.93	4.68	7.84	5.89	7.29	5.19	3.40	3.26	1.859* 0.0778
Total Meat	17.17	10.51	16.48	3.89	17.27	6.75	15.54	10.51	16.95	15.72	26.71	18.45	20.43	8.06	13.62	6.77	1.727 0.1044*
Valid Responses	1			8		3		20	8		8			17	24		

APPENDIX 5.1

Socio-Economic Characteristics and Mean Consumption Pattern of low, medium and high Beef Consumers.

Socio Economic Characteristic	Whole Sampe	Low Beef Consumers < 12.0 kg/capita/annum	Medium Beef consumers 12.0 to 16.5 kg/capita/annum	High Beef consumers > 16.5 kg/capita/annum	Significance
Total people in Household		3	4	4	
No. of children		1	2	2	
Age of rspondent		20-29	20-29	20-29	
Income of principal Income earners		10,000 - 13,999	8,000 - 9,999	10,000 - 13,999	
Meat					
Wienersnitzel	2.0	1.3	1.8	2.2	66.96
Rump Steak	3.2	1.5	2.5	3.7	98.96
Porterhouse Steak	2.2	0.8	1.5	2.6	99.74
Stewing Steak	3.2	1.2	1.5	3.8	99.97
Topside Steak	3.1	0.3	2.2	3.8	99.71
Total Steaks	13.7	5.1	9.4	16.1	100.00
Beef Mince	3.2	1.0	2.9	3.7	100.00
Corned Beef	4.4	1.1	0.5	5.6	99.91
Total Beef	22.1	7.3	12.9	26.4	

Meat	Whole Sample	Low	Medium	High	Significance
Lamb forequarter	2.0	1.7	0.9	2.2	63.18
Lamb Neck Chops	1.3	0.9	1.0	1.5	48.85
Lamb Loin Chops	2.3	0.7	0.9	2.8	99.96
Leg of Lam	3.6	1.8	3.6	4.0	43.94
Total Lamb	9.2	5.1	6.5	10.4	85.82
Hogget foreq'ter	2.9	0.1	2.1	3.6	95.81
Hogget Neck Chops	1.4	0.3	0.8	1.7	89.45
Hogget Loin chops	2.0	0.5	0.7	2.4	97.45
Leg of Hogget	5.4	3.5	6.0	5.7	42.47
Total Hoggel	11.6	4.3	9.6	13.4	93.55
Mutton Foreq'ter	1.0	1.1	0.0	1.1	33.19
Mutton Neck Chops	0.7	0.3	0.5	0.9	53.15
Mutton loin chops	1.0	0.7	0.0	1.2	52.67
Leg of Mutton	2.5	2.0	2.6	2.6	5.31
Total Mutton	5.2	4.0	3.1	5.7	33.51
Total Sheepmeat	28.5	14.7	21.2	32.3	97.79
Pork CHops	3.3	2.2	4.4	3.4	77.87
Pork Pieces	1.9	0.4	0.4	2.4	90.61
Leg of Pork	7.8	8.7	4.3	8.0	34.60
Sliced ham	1.1	0.3	0.5	1.3	93.66
Ham-on-the-bone	10.3	3.3	16,3	11.2	85.55
Ham steaks	1.6	0.6	0.0	2.0	99.41
Middle Bacon	1.1	0.3	0.4	1.3	88.94
Shoulder Bacon	1.0	0.4	0.6	1.2	45.46
Total Pigmeat	28.0	16.2	26.9	30.8	86.69

Meat	Whole Sample	Low	Medium	High	Significance
Fish	3.5	2.4	3.5	3.7	86.55
Shellfish	0.6	0.3	0.0	0.8	91.37
Chicken	5.9	4.7	4.0	6.4	92.53
Total non red meat	10.0	7.4	7.5	10.9	
Beef Tongue	0.7	0.1	0.0	0.9	79.53
Beef Meats	0.1	0.0	0.0	0.1	15.04
Tripe	0.2	0.0	0.0	0.3	63.58
Lamb's Fry	1.9	0.2	1.4	2.1	71.45
Lamb's Kidney	0.6	0.6	0.6	0.6	1.69
	3.5	0.9	2.0	4.0	
Beef Sausage	2.8	1.2	2.1	3.2	88.96
Hamburger	0.7	0.04	0.0	0.9	96.68
Pork Sausage	1.6	1.2	0.9	1.8	74.01
Luncheon	1.3	1.4	0.9	1.3	28.05
Ham n Chicken	1.0	0.3	0.0	1.2	66.65
Salami	0.3	0.5	0.0	0.2	52.53
Frankfurters	0.2	0.2	0.3	0.2	1.61
Saveloys	2.0	0.9	1.5	2.3	96.83
Black Pudding	0.3	0.5	8.0	0.3	48.26
Garlic Sausage	0.4	0.1	0.2	0.5	37.25
Total Sausage	7.2	5.1	3.8	8.0	92.92
Total Meat	96.0	50.2	74.2	111.4	99.94

APPENDIX 5.2

Socio-Economic Characteristics and Meat Consumption Pattern of low, medium and high sheep meat consumers

Socio Economic Characteristics	Whole Sample	Low Sheepmeat consumers <15/kg/ capita	Medium sheepmeat consumers 15 to 24 kg/capita	High sheepmeat consumers >24 kg/ capita	Significance
Total People in household		3	4	4	
No. of children		1	2	2	
Age of Respondent		20-29	20-29	20-29	
Income of Principal Income earner		8,000 - 9,999	8,000 - 14,000	10,000 - 13,999	
Meat					
Wienersnitzel		1.6	2.8	1.9	82.54
Rump Steak		2.5	3.5	3.5	74.82
Porterhouse Steak		1.6	2.6	2.4	79.65
Stewing Steak		3.2	2.4	3.7	86.33
Topside Steak		2.3	2.8	3.8	78.87
Total Steaks		10.4	14.8	15.4	98.01
Beef Mince		2.7	3.1	3.5	72.51
Corned Beef		2.6	4.2	5.7	94.98
Total Beef		18.1	26.0	29.3	99.60

Meat	Whole Sample	Low	Medium	High	Significance
Lame Foreq'ter		0.7	1.9	3.0	99.95
Lamb Neck Chops		0.6	1.0	2.0	98.64
Lamb Loin CHops		0.9	2.6	3.0	99.99
Leg of Lamb		1.4	2.4	5.6	96.88
Total lamb		3.6	7.9	13.6	99.99
Hoggel foreq'ter		0.3	1.2	5.4	100.00
Hogget Neck Chops		0.3	0.8	2.3	99.83
Hogget Loin Chops		0.4	2.0	3.0	99.94
Leg of Hogget		0.4	2.2	10.2	100.00
Total Hogget		1.4	6.2	20.9	100.00
Mutton Foreq'ter		0.1	0.3	2.0	96.90
Mutton Neck Chops		0.2	0.3	1.3	96.73
Mutton Loin Chops		0.0	0.6	1.8	98.55
Leg of Mutton		0.2	1.0	4.6	99.78
Total Mutton		0.6	2.4	9.8	100.00
Total Sheep Meat		5.6	16.5	25.4	
Pork Chops		1.7	2.8	4.6	99.98
Pork pieces		2.0	1.3	2.1	28.15
Leg of Pork		1.4	2.1	14.8	100.00
Sliced ham		0.6	1.1	1.4	86.73
Ham-on-the-Bone		3.5	14.0	13.0	96.83
Ham Steaks		0.7	1.5	2.2	98.37
Middle Bacon		0.9	0.9	1.3	48.67
Shoulder Bacon		0.5	1.1	1.4	51.05
Total Pigmeat		11.3	24.9	40.7	100.00

Meat	Whole Sample	Low	Medium	High	Significance
Fish		3.2	3.0	3.8	66.05
Shellfish		0.2	0.5	0.7	
Chicken		5.3	6.1	6.3	48.90
Total non red meat		8.7	8.6	10.8	
Beef Tongue		0.2	0.8	1.0	72.54
Beef Hearts		0.0	0.3	0.0	81.82
Tripe		0.0	0.9	1.1	75.02
Lamb's fry		1.1	1.5	2.5	84.88
Lamb's kidney		0.4	0.7	0.7	42.15
Total Offal		1.7	4.2	5.3	
Beef Sausage		2.1	2.5	3.4	68.51
Hamburger		0.2	1.2	0.6	98.69
Pork Sausage		0.8	1.7	2.1	99.52
Luncheon		0.9	1.5	1.5	86.14
Ham n Chicken		0.3	0.9	1.4	75.47
Salami		0.3	0.5	0.1	68.87
Frankfurters		0.1	0.3	0.3	61.38
Saveloys		1.2	2.2	2.5	97.67
Black Pudding		0.0	0.5	0.5	93.54
Garlic Sausage		0.0	0.6	0.6	60.26
Total Sausage		3.6	8.1	9.0	99.95
Total Meat		49.0	88.3	120.5	

APPENDIX 5.3

Socio-Economic Characteristics and Meat Consumption Pattern of low, medium and high pig meat consumers

Socio-Economic Characteristics	Whole Sample	Low Pig meat consumers Kg/capita/ annum	Medium Pig meat consumers kg/capita annum	High PIg meat consumers kg/capita annum	Significance
Total People in Household		3	4	4	
No of children		1	2	2	
Age of Respondent		20.29	30-39	20-29	
Income of Principal income earner		8,000 - 9,999	10,000 - 13,999	10,000 - 13,999	
Meat					
Wienersnitzel		2.1	1.8	2.1	10.93
Rump steak		2.0	4.5	3.3	97.92
Porterhouse Steak		1.3	2.4	2.5	93.29
Stewing Steak		2.6	4.2	3.1	79.55
Topside Steak		1.9	3.6	3.4	72.40
Total Steaks		9.9	16.4	14.4	97.70
Beef Mince		2.2	3.7	3.4	94.26
Corned Beef		2.9	3.4	5.3	85.26
Total Beef		17.7	27.4	27.2	97.25

Meat	Whole Sample	Low	Medium	High	Significance
Lamb Foreq'ter		0.9	1.8	2.5	96.69
Lamb Neck Chops		0.8	1.0	1.6	77.84
Lamb Loin Chops		1.2	1.9	2.6	98.75
Leg of Lamb		1.3	2.4	4.8	87.90
Total Lamb		4.2	7.0	11.7	98.96
Hoggett foreq'ter		0.3	3.6	3.7	96.91
Hogget Neck Chops		1.1	1.8	1.3	29.57
Hogget Loin CHops		0.9	3.6	1.9	98.52
Leg of Hogget		0.8	4.5	7.4	99.76
Total Hogget		3.1	13.4	14.2	99.41
Mutton Foreq'ter		0.03	0.4	1.6	86.51
Mutton Neck Chops		0.3	0.7	0.9	54.00
Mutton Loin Chops		0.2	2.0	1.0	87.01
Leg of Mutton		0.0	1.9	3.6	94.99
Total Mutton		0.5	5.1	7.1	97.31
Total Sheep Meat		9.8	27.6	35.8	99.99
Pork CHops		0.3	2.5	4.7	100.00
Pork Pieces		0.2	1.9	2.5	95.00
Leg of Pork		0.0	2.1	12.4	100.00
Sliced ham		0.3	1.2	1.3	90.93
Ham-on-the-bone		0.3	0.4	17.0	100.00
Ham Steaks		0.3	1.2	2.2	99.86
Middle Bacon		0.5	0.8	1.4	80.83
Shoulder Bacon		0.6	0.9	1.3	35.82
Total Pig meat		2.5	11.0	42.5	

Meat	Whole Sample	Low	Medium	High	Significance
Fish		2.8	3.3	3.7	70.75
CHicken		4.6	5.7	6.5	88.31
Shellfish		0.3	0.3	0.9	93.28
Total non-red meat		7.7	6.3	11.1	
Beef Tongue		0.4	1.0	0.7	35.29
Beef Hearts		0.0	0.0	0.1	28.34
Tripe		0.0	0.2	0.3	64.68
Lamb's fry		1.6	1.4	2.1	33.53
Lamb's kidney		0.4	0.7	0.7	39.96
Total Offal		2.4	3.3	3.9	
Beef Sausage		2.3	2.7	3.0	25.63
Hamburger		0.4	0.1	0.9	93.02
Pork Sausage		0.9	1.5	1.9	95.94
Luncheon		1.0	1.2	1.5	60.77
Ham n Chicken		0.3	0.7	1.3	62.94
Salami		0.2	0.2	0.3	20.22
Frankfurters		0.0	0.4	0.2	80.70
Saveloys		0.6	2.5	2.4	99.94
Black Pudding		0.1	0.1	0.5	92.44
Garlic Sausage		0.2	1.1	0.3	76.50
Total Sausage		3.2	7.7	8.5	99.79
Total Meat		43.3	83.3	129.0	

Appendix 7.1 Kendall's Coefficient of Concordance (W).

Kendall's coefficient of concordance (W) is used to test the agreement among subjects' rank ordering of proximities.

$$W = \frac{12\ S}{m^2(n^3-n)}$$

Where:

W = the coefficient of concordance,
m = the number of subjects,
n = the number of ranks or objects.
S = the sum of squares of the deviation of rank totals across all subjects, for each object, from the mean sum of ranks.

The mean sum of ranks must always be m(n+1)/2.

Large numbers of tied rankings can be accomodated by the following equation:

$$W = \frac{S}{\frac{1}{12} m^2(n^3-n) - m\ T'}$$

Where $T' = \frac{1}{12} \sum_t (t^3-t)$ and t is the number of ranks in each tied set.

The significance of the value of W can be tested using the chi square value.

$$X_w^2 = \frac{S}{\frac{1}{12} mn(n+1) - \frac{1}{n-1} T'}$$

with n-1 degrees of freedom.

APPENDIX 7.2

METHOD OF ANALYSING PREFERENCE DATA

A. 7.2 .1. Determination of Triads and Coefficient of consistence

In Table A.4.2.1, the number of people who preferred one of the meats in each pair is presented. The row totals A_i ad $(a_n\ i)^2$ are also included so as to estimate the number of triads in the data and hence Kendall's coefficient of consistence. The number of triads in the aggregated Thurstone's matrix and not in each respondent's response were calculated as follows:

If the row totals are $A_i \ldots\ldots A_n$ then the number of triads ^{d} is given by:

$$d = \frac{1}{6}\, n\,(n-1)(n-2) - \tfrac{1}{2}\sum_{1=1}^{n} a_i\,(a_i - 1) \qquad \text{A 4.1}$$

$$\text{or} \quad d = \frac{1}{12}\, n\,(n-1)(2n-2) - \tfrac{1}{2}\sum_{1=1}^{n} a_i^{\,2} \qquad \text{A 4.2}$$

For the 15 meats the maximum number of triads is given by the formula $\frac{1}{24}\ (n^3 - n)$ when n is odd. In this case n = 15 and $d = \frac{1}{24}\ (15^3 - 15) = 140$

The number of triads in the data was obtained by using Kendall's second formula (b) and for 15 meats:

$$\begin{aligned} d &= \frac{1}{12}\ 15 \times 14 \times .28 - \tfrac{1}{2} \times 822 \\ &= 490. - 411 \\ &= 79 \text{ triads} \end{aligned}$$

Kendall's coefficient of consistence φ was obtained by using the formula:

$$\varphi = 1 - \frac{24\ d}{n^3 - n} \quad \text{when n is odd.}$$

For the data:

$$\varphi = 1 - \frac{24 \times 79}{15^3 - 15} = 1 - \frac{1896}{3360}$$

$$= 0.436$$

The significance of the value of φ was determined by using the formula:

$$\nu = \frac{n\,(n-1)(n-2)}{(n-4)^2}$$

to calculate the degrees of freedom. i.e. 22.56 for n = 15 and since the distribution of d tends to a χ^2 distribution for n greater than 7 then $\cdot\chi$ was determined by using the formula

$$\chi^2 = \frac{8}{n-4} \left\{\tfrac{1}{4} \binom{n}{3} - d + \tfrac{1}{2}\right\} + \nu$$

$$= \frac{8}{15-4} \quad \frac{1}{24} \times 15 \times 14 \times 13 - 79 = \tfrac{1}{2}\} = 22.56$$

i.e. $\chi^2 = 48.14$

The χ^2 value corresponds to a significance of about 0.001. Now the distribution of d is measured from hgher to lower values of d, i.e. it is the complement of the probability of χ^2 and so the appropriate significance level for d is thus 1 - 0.001=0.989. If the number of triads (d) had been the maximum, i.e. 140, the χ^2 value would have been 3.83 and the χ^2 value would have corresponded to a significance of 0.999 and the significance of d would have been 0.001. In this case the conclusion would have been drawn that the repondents were incompetent. A significance level for d of 0.999 suggests that the 80 respondents were reasonably consistent in their judgements.

A.7.2.2. Transformation of Paired Comparisons

The data in Table A.4.1.1, i.e. the number of respondents in each χ_{ij} cell were transformed using the following operations $Y_{ij} = (\gamma_{ij}) \times (\gamma_{ij} - 1)$ where γ_{ij} = the number of respondents in the χ_{ij} cell and these values can be found in Table (i). The transformations were required for the calculation of Kendall's coefficient of agreements which is defined by the formula

$$u = \frac{2\,\Sigma}{\binom{m}{2}\binom{n}{2}} - 1$$

where m = the total number of respondents
n = the number of stimuli

and $\Sigma = \Sigma \binom{\gamma}{2}$ the summation extending over the n (n-1) cells.

For the data in Table A.4.1.3

$$\Sigma = 208.948$$

$$u = \frac{8 \times 208,948}{70 \times 79 \times 15 \times 14} - 1$$

$$= 1.25948 - 1 = 0.26$$

If there is complete agreement u = 1. The further that this is the case so u becomes smaller. A value of 0.26 suggests that there was a reasonable amount of disagreement amongst the respondents regarding the ranking within each meat pair.

For high values of m and n the distribution of u tends to follow a χ^2 distribution where the χ^2 and degrees of freedom can be calculated as follows:

$$\chi^2 = \frac{4}{m-2} \left\{ \Sigma - \tfrac{1}{2} \binom{n}{2}\binom{m}{2} \frac{m-3}{m-2} \right\}$$

and

$$\nu = \left(\frac{n}{2}\right) \frac{m\ (m-1)}{(m-2)^2}$$

$$\chi^2 = \frac{4}{78} \left\{ 208{,}948 - \frac{1}{8}\ 15 \times 14 \times 80 \times 79 \times \frac{77}{78} \right\}$$

$$= 2316.66$$

and $\nu = \frac{1}{2}\ 15 \times 14 \times \dfrac{80 \times 79}{(78)^2} = 109$

These values of χ^2 and ν are not to be found in most χ^2 tables. However for values of ν greater than 30 the quantity $\sqrt{2\chi^2}$ may be taken to be distributed normally about mean $\sqrt{2\nu - 1}$ with unit variance. For the data obtained in the preference paired comparison the equation

$$\sqrt{2\ \chi^2} - \sqrt{2\nu - 1} = 68.06 - 14.73$$
$$= 53.32$$

gives an expected χ^2 value if the data were first significant. The χ^2 value obtained for ν is far beyond any significance point and so we must conclude that the observed value of ν could not have arisen by chance from a population in which all the respondents alloted their preferences at random.

APPENDIX 7.3a

TABLE 7. .a. Thurstone Case V Data (Modal Values)

	Salami	Beef	Veal	Mutton	Hogget	Lamb	Pork	Bacon	Ham	Smallgoods	Offal	Fish	Chicken	Turkey	Shellfish
Salami	0.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	0.00	3.00	3.00	3.00	3.00
Beef	-3.00	0.00	-3.00	-3.00	3.00	-1.00	3.00	-1.00	3.00	-3.00	-3.00	3.00	3.00	-3.00	-3.00
Veal	-3.00	3.00	0.00	3.00	3.00	3.00	3.00	3.00	3.00	-1.00	-3.00	3.00	3.00	3.00	3.00
Mutton	-3.00	3.00	-3.00	0.00	-2.00	3.00	3.00	3.00	3.00	1.00	-3.00	3.00	3.00	3.00	3.00
Hogget	-3.00	-3.00	-3.00	2.00	0.00	3.00	3.00	3.00	3.00	-2.00	-3.00	3.00	3.00	3.00	3.00
Lamb	-3.00	1.00	-3.00	-3.00	-3.00	0.00	3.00	-2.00	3.00	-3.00	-3.00	3.00	3.00	-3.00	-3.00
Pork	-3.00	-3.00	-3.00	-3.00	-3.00	-3.00	0.00	-3.00	1.00	-3.00	-3.00	3.00	3.00	-3.00	-3.00
Bacon	-3.00	1.00	-3.00	-3.00	-3.00	2.00	3.00	0.00	1.00	-3.00	-3.00	3.00	3.00	-3.00	-3.00
Ham	-3.00	-3.00	-3.00	-3.00	-3.00	-3.00	-1.00	-1.00	0.00	-3.00	-3.00	3.00	3.00	-3.00	-3.00
Smallgoods	-3.00	3.00	1.00	-1.00	2.00	3.00	3.00	3.00	3.00	0.00	-3.00	3.00	3.00	3.00	3.00
Offal	0.00	3.00	3.00	3.00	3.00	3.00	3.00	+3.00	3.00	3.00	0.00	3.00	3.00	3.00	3.00
Fish	-3.00	-3.00	-3.00	-3.00	-3.00	-3.00	-3.00	-3.00	-3.00	-3.00	-3.00	0.00	3.00	-3.00	-3.00
Chicken	-3.00	-3.00	-3.00	-3.00	-3.00	-3.00	-3.00	-3.00	-3.00	-3.00	-3.00	-3.00	0.0	-3.00	-3.00
Turkey	-3.00	3.00	-3.00	-3.00	-3.00	3.00	3.00	3.00	3.00	-3.00	-3.00	3.00	3.00	0.00	0.00
Shellfish	-3.00	3.00	-3.00	-3.00	-3.00	3.00	3.00	3.00	3.00	-3.00	-3.00	3.00	3.00	0.00	0.00
	-39	8	-26	-20 36	-12 46	13 55	26 63	70	26 76	-23 81	-39 85	36 88	42 90	-3	-3
	-13	2.67	-9.33	-7.33	-4	4.33	8.67	2.67	8.67	-7.67	-13	12	14	-1	-1
	14	6	13	11	10	5	3	6	3	12	14	2	1	8	

SAME DATA USING MEANS

Appendix Table 7.3b. Thurstone Case V data (mean values).

	Salami	Beef	Veal	Mutton	Hogget	Lamb	Pork	Bacon	Ham	Smallgoods	Offal	Fish	Chicken	Turkey	Shellfish
Salami	0.00	4.2	3.1	1.9	3.5	4.1	4.8	3.9	4.8	0.7	-1.1	5.2	5.0	3.3	3.5
Beef	-4.2	0.00	-2.4	-3.9	-0.6	0.6	2.6	0.4	3.0	-4.5	-6.4	1.7	3.1	-0.3	-0.4
Veal	3.1	2.4	0.00	1.1	1.6	2.6	4.8	2.5	4.8	-2,3	-4.8	4.5	4.9	2.2	1.2
Mutton	-1.9	3.9	1.1	0.00	3.2	4.4	5.7	3.2	5.1	-0.2	-3.3	4.8	6.2	2.7	1.4
Hogget	-3.5	0.6	-1.6	-3.2	0.00	1.8	4.5	2.0	4.7	-3.4	-5.7	3.2	4.4	1.3	0.7
Lamb	-4.1	-0.6	-2.6	-4.4	-1.8	0.0	2.4	-0.5	2.7	-4.8	-6.3	1.1	2.8	-0.5	-1.2
Pork	-4.8	-2.6	-4.8	-5.7	-4.5	-2.4	0.0	-2.4	0.2	-5.7	-6.5	0.1	0.9	-2.0	-1.8
Bacon	-3.9	0.4	-2.5	-3.2	-2.0	0.5	2.4	0.0	2.6	-3.8	-5.5	2.4	3.3	0.5	-0.6
Ham	-4.8	-3.0	-4.8	-5.1	-4.7	2.7	-0.2	-2.6	0.0	-5.9	-6.7	-0.5	0.5	-2.2	-1.9
Smallgoods	-0.7	4.5	2.3	0.2	3.4	4.8	5.7	3.8	5.9	0.0	-2.5	5.6	6.7	3.6	2.8
Offal	1.1	6.4	4.8	3.3	5.7	6.3	6.5	5.5	6.7	2.5	0.0	6.8	7.3	5.4	4.9
Fish	-5.2	-1.7	-4.5	-4.8	-3.2	-1.1	-0.1	-2.4	0.5	-5.6	-6.8	0.0	1.7	-1.0	-2.2
Chicken	-5.0	-3.1	-4.9	-6.2	-4.4	-2.8	-0.9	-3.3	-0.5	-6.7	-7.3	-1.7	0.0	-2.8	-2.2
Turkey	-3.3	0.3	-2.2	-2.7	-1.3	0.5	2.0	-0.5	2.2	-3.6	-5.4	1.0	2.8	0.0	0.0
Shellfish	-3.5	0.4	-1.2	-1.4	-0.7	1.2	1.8	0.6	1.9	-2.8	-4.9	2.2	2.2	0.0	0.00
	-46.9	+12.1	-20.2	-30.5	-5.5	17.8	42	9.4	44.6	-40.1	-73.2	36.4	51.5	10.2	4.2
	-3.1	0.81	-1.3	-2.0	-0.4	1.2	2.8	0.6	3.0	-2.7	-4.9	2.4	3.4	0.7	0.3
	14	6	11	12	10	5	3	8	2	13	15	4	1	7	9

Appendix 7.4 Thurstone Case V Lower Half Dominance Matrix.

Beef	0.00													
Veal	0.40	0.00												
Mutton	0.90	0.25	0.00											
Hogget	0.28	-0.25	-0.69	0.00										
Lamb	-0.01	-0.44	-1.01	-0.37	0.00									
Pork	-0.48	-1.01	-1.28	-1.11	-0.58	0.00								
Bacon	0.15	-0.34	-0.55	-0.37	0.17	0.54	0.00							
Ham	-0.74	-1.13	-1.08	-1.08	-0.58	0.02	-0.64	0.00						
Sausages	1.08	0.57	0.09	0.51	1.28	1.64	0.97	1.37	0.00					
Offal	1.48	0.90	0.79	1.28	1.55	1.44	1.28	1.40	0.49	0.00				
Fish	-0.36	-0.92	-1.18	-0.64	-0.16	0.12	-0.41	-0.17	-1.12	-1.55	0.00			
Chicken	-0.74	-1.06	-1.64	-1.03	-0.58	-0.09	-0.67	0.06	-1.48	-1.81	-0.35	0.00		
Turkey	0.05	-0.33	-0.41	-0.16	0.09	0.48	0.07	0.57	-0.58	-1.08	0.26	0.67	0.00	
Shellfish	0.10	-0.08	-0.09	-0.15	0.28	0.33	0.12	0.48	-0.43	-0.97	0.37	0.41	0.00	0.00
Salami	0.79	0.49	0.33	0.62	0.66	0.84	0.76	0.80	0.34	-0.16	0.97	0.88	0.52	0.55	0.00

Appendix 7.5 Thurstone General Lower Half Dominance Matrix.

Beef	0.0												
Veal	-2.4	0.00											
Mutton	-3.9	-1.1	0.0										
Hogget	-0.6	1.6	3.2	0.0									
Lamb	0.6	2.6	4.4	1.8	0.0								
Pork	2.6	4.8	5.7	4.5	2.4	0.0							
Bacon	-0.4	2.5	3.2	2.0	-0.5	-2.4	0.0						
Ham	3.0	4.8	5.2	4.7	2.7	0.2	2.6	0.0					
Sausages	-4.5	-2.3	-0.2	-3.4	-4.8	-5.7	-3.8	-5.9	0.0				
Offal	-6.4	-4.8	-3.3	-5.7	-6.3	-6.5	-5.5	-6.7	-2.5	0.0			
Fish	1.7	4.5	4.8	3.2	1.2	0.1	2.4	-0.5	5.6	6.8	0.0		
Chicken	3.1	4.9	6.2	4.4	2.8	0.9	3.3	0.5	6.7	7.3	1.7	0.0	
Turkey	-0.3	2.2	2.7	1.3	-0.5	-2.0	0.5	-2.2	3.6	5.4	-1.0	-2.8	0.0
Shellfish	-0.4	1.2	1.4	0.7	-1.2	-1.8	-0.6	-1.9	2.8	4.9	-2.2	-2.2	-0.1	0.0
Salami	-4.2	-3.1	-1.9	-3.5	-4.1	-4.8	-3.9	-4.8	-0.7	1.1	-5.2	-5.0	-3.3	-3.5	0.0

Appendix 7.6 Semi-structured Linear Scale Lower Half Dominance Matrix.

Beef	0.0														
Veal	3.2	0.0													
Mutton	4.6	1.4	0.0												
Hogget	2.2	-1.0	-2.4	0.0											
Lamb	0.9	-2.3	-3.7	-1.3	0.0										
Pork	-0.8	-4.0	-5.4	-3.0	-1.7	0.0									
Bacon	3.1	-0.1	-1.5	0.9	2.2	3.9	0.0								
Ham	0.2	-3.0	-4.4	-2.0	-0.7	1.0	-2.9	0.0							
Sausages	6.6	3.4	2.0	4.4	5.7	7.4	3.5	6.4	0.0						
Offal	9.1	5.9	4.5	6.9	8.2	9.9	6.0	8.9	2.5	0.0					
Fish	1.0	-2.2	-3.6	-1.2	0.1	1.8	-2.1	0.8	-5.6	-8.1	0.0				
Chicken	-0.5	-3.7	-5.5	-2.7	-1.4	0.3	-3.6	-0.7	-7.1	-9.6	-1.5	0.0			
Turkey	3.0	-0.2	-1.6	0.8	2.1	3.8	-0.1	2.8	-3.6	-6.1	2.0	3.5	0.0		
Shellfish	3.6	0.4	-1.0	1.4	2.7	4.4	0.5	3.4	-3.0	-5.5	2.6	4.1	0.6	0.0	
Salami	7.2	4.0	2.6	5.0	6.3	8.0	4.1	7.0	0.6	-1.9	6.2	7.7	4.2	3.6	0.0

Appendix 7.7. : NUMBER OF PEOPLE IN EACH CELL AS A PERCENTAGE OF TOTAL NUMBER OF RESPONDENTS

	Salami	Beef	Veal	Mutton	Hogget	Lamb	Pork	Bacon	Ham	Smallgoods	Offal	Fish	Chicken	Turkey	Shellfish
Salami	0.0	21.5	31	37	27	25.5	20	22.5	21	36.5	56.5	16.5	19	30	29
Beef	78.5	0.0	64	81.5	61	49.5	21.5	66	23	86	93	36	23	52	54
Veal	69	36	0.0	60	40	33	15.5	36.5	13	71.5	81.5	18	14.5	37	47
Mutton	63	18.5	40	0.0	25	15.5	10	29	14	53.5	78.5	12	5	34	46.5
Hogget	73	39	60	75	0.0	35.5	13	36	14	79	90	26	15	43.5	44
Lamb	74.5	50.5	67	84.5	64.5	0.0	28	57	28	90	94	43.5	28	53.5	61
Pork	80	68.5	84.5	90	87	72	0.0	70.5	51	95	92.5	55	46.5	63.5	63
Bacon	77.5	44	63.5	71	64	43	29.5	0.0	26	83.5	90	94	25	53	55
Ham	79	77	87	86	86	72	49	74	0.0	69	13	57	52.5	71.5	68.5
Smallgoods	63.5	14	28.5	46.5	21	10	5	16.5	8.5	0.0	69	13	7	28	33.5
Offal	43.5	7	18.5	21.5	10	6	7.5	10	8.0	31	0.0	6	3.5	14	16.5
Fish	83.5	64	82	88	74	56.5	45	6	43	87	94	0.0	26	60.5	64.5
Chicken	81	77	85.5	95	85	72	53.5	75	47.5	93	96.5	64	0.0	74	66
Turkey	70	48	63	66	56.5	46.5	31.5	47	28.5	72	86	39.5	25	0.0	50
Shellfish	71	46	53	53.5	56	39	37	45	31.5	66.5	83.5	35.5	34	50	0.0

Appendix 7.8 Percentage Difference Lower Half Matrix $(X_{ij}-X_{ji})$

Chicken	0.0														
Ham	5.0	0.0													
Pork	7.0	2.0	0.0												
Fish	28.0	14.0	10.0	0.0											
Lamb	44.0	44.0	44.0	13.0	0.0										
Beef	54.0	54.0	37.0	28.0	1.0	0.0									
Bacon	50.0	48.0	41.0	32.0	14.0	12.0	0.0								
Turkey	50.0	43.0	37.0	21.0	13.0	4.0	6.0	0.0							
Shellfish	32.0	37.0	26.0	25.0	22.0	8.0	10.0	0.0	0.0						
Hogget	70.0	72.0	73.0	48.0	29.0	22.0	29.0	13.0	12.0	0.0					
Veal	71.0	74.0	69.0	64.0	34.0	31.0	27.0	26.0	6.0	20.0	0.0				
Mutton	90.0	72.0	80.0	76.0	69.0	63.0	42.0	32.0	7.0	51.0	20.0	0.0			
Salami	62.0	54.0	60.0	67.0	49.0	57.0	55.0	40.0	42.0	46.0	38.0	26.0	0.0		
Sausages	86.0	83.0	90.0	74.0	80.0	72.0	67.0	44.0	33.0	39.0	43.0	7.0	27.0	0.0	
Offal	93.0	84.0	85.5	88.0	88.0	86.0	80.0	72.0	67.0	80.0	63.0	57.0	13.0	38.0	0.0

APPENDIX 7 : 41 x 41 MATRIX OF Z VALUES FOR THE 41 MEAT CUTS

	Weinersnitzel	Rump Steak	Porterhouse Steak	Stewing Steak	Topside Steak	Beef Mince	Beef Tongue	Beef Hearts	Corned Beef	Beef Sausages	Lamb Forq'ter	Leg of Hogget	Lamb Loin Chops	Leg of Lamb	Mutton Forq'ter	Hogget Loin Chops	Mutton Loin C ops	Leg of Mutton	Pork Chops	Pork Pieces	Leg of Pork	Sliced Ham	Leg of Ham	Ham Steaks	Middle Bacon	Shoulder Bacon	Fish	Chicken	Shellfish	Hamburger	Tripe	Lamb's Fry	Kidney	Pork Sausages	Luncheon	Ham n Chicken	Salami	Frankfurters	Saveloys	Black Pudding	Garlic Sausage
Weinersnitzel		0.12	0.59	0.75	0.32	0.73	1.36	3.49	0.23	0.86	0.27	0.09	0.17	0.45	0.72	0.30	0.65	0.33	0.50	0.23	0.80	0.51	0.89	0.00	0.06	0.16	0.54	0.91	0.01	1.43	1.44	0.76	1.13	1.36	1.43	1.43	1.63	2.23	1.77	2.23	3.49
Rump Steak	0.12	0.00	0.45	1.09	0.48	0.73	0.00	0.00	0.16	0.91	0.44	0.31	0.36	0.05	1.08	0.56	1.27	0.63	0.22	0.05	0.48	0.20	0.58	0.16	0.56	0.47	0.15	0.44	0.25	1.37	1.95	0.87	1.15	1.21	1.65	1.77	1.77	2.23	1.95	3.49	3.49
Porterhouse Steak	0.59	0.45	0.00	1.52	0.72	1.63	1.43	1.77	0.31	1.43	0.84	0.41	0.66	0.19	1.29	0.76	1.08	1.00	0.24	0.53	0.31	0.06	0.13	0.06	0.86	0.89	0.08	0.18	0.42	1.53	1.76	1.34	1.52	1.42	1.76	1.62	1.62	1.94	1.76	1.94	1.94
Stewing Steak	0.75	1.09	1.52	0.00	0.67	0.20	0.63	1.63	1.03	0.48	0.39	0.66	0.69	1.18	0.20	0.40	0.00	0.27	1.07	0.69	1.42	0.98	1.43	0.93	0.31	0.26	1.00	1.76	0.23	0.58	1.34	0.16	0.45	0.43	0.79	0.85	0.69	0.88	1.13	1.52	1.52
Topside	0.32	0.48	0.72	0.67	0.00	0.47	1.08	1.95	0.14	0.72	0.21	0.06	0.09	0.44	0.61	0.23	0.60	0.41	0.41	0.16	0.87	0.51	0.97	0.33	0.13	0.15	0.45	0.81	0.11	0.00	1.94	0.60	0.89	0.98	1.56	1.28	1.02	1.42	1.26	1.43	1.38
Beef Mince	0.73	0.73	1.63	0.20	0.47	0.00	0.89	1.64	0.66	0.44	0.33	0.75	0.66	0.99	0.10	0.47	0.08	0.13	1.15	0.74	1.20	1.08	1.63	0.82	0.30	0.29	1.08	1.63	0.00	1.10	1.34	0.18	0.48	0.52	0.89	0.88	0.88	1.52	1.20	1.43	1.21
Beef Tongue	1.36	0.00	1.43	0.63	1.08	0.89	0.00	0.80	1.19	0.61	1.07	1.02	1.20	1.33	0.66	1.02	0.75	0.79	1.51	1.41	1.76	1.62	2.22	1.61	0.89	1.03	1.52	1.77	0.82	0.61	0.45	0.43	0.21	0.84	0.51	0.55	0.32	0.33	0.44	0.03	0.18
Beef Hearts	3.49	0.00	1.77	1.63	1.95	1.64	0.80	0.00	1.76	1.34	1.62	1.94	2.22	2.22	1.51	1.93	1.61	1.51	2.22	2.22	2.22	2.22	2.22	1.94	2.22	1.94	2.22	2.22	1.36	1.35	0.01	0.97	1.00	1.27	1.33	1.25	0.98	0.99	1.20	0.52	0.77
Corned Beef	0.23	0.16	0.31	1.03	0.14	0.66	1.19	1.76	0.00	0.80	0.40	0.14	0.27	0.08	0.78	0.44	0.70	0.59	0.41	0.61	0.80	0.59	0.86	0.24	0.14	0.16	0.25	0.64	0.11	1.19	1.94	0.98	1.18	1.07	1.19	1.19	1.13	1.33	1.33	1.33	1.51
Beef Sausages	0.86	0.91	1.43	0.48	0.72	0.44	0.61	1.34	0.80	0.00	0.66	1.06	1.07	1.42	0.08	0.87	0.32	0.47	1.21	1.09	1.56	1.61	2.21	1.32	0.90	0.87	1.26	1.76	0.21	0.61	1.19	0.03	0.49	0.00	0.26	0.27	0.26	0.66	0.93	0.75	0.48
Lamb F'quarter	0.27	0.44	0.84	0.39	0.21	0.33	1.07	1.62	0.40	0.66	0.00	0.20	0.47	1.14	0.98	0.02	0.81	0.47	0.82	0.64	1.19	0.91	1.32	0.74	1.12	0.05	0.58	0.98	0.03	0.98	0.43	0.61	0.91	0.73	1.34	1.26	1.12	1.75	1.74	1.62	1.50
Leg of Hogget	0.09	0.31	0.41	0.66	0.06	0.75	1.02	1.94	0.14	1.06	0.20	0.00	0.30	0.27	1.21	0.81	1.25	0.87	0.34	0.07	0.83	0.50	0.73	0.38	0.17	0.16	0.03	0.85	0.11	1.53	1.52	0.74	0.97	1.18	1.27	1.34	1.26	1.62	1.42	1.94	1.62
Lamb Loin Chops	0.17	0.36	0.66	0.69	0.09	0.66	1.20	2.22	0.27	1.07	0.47	0.30	0.00	0.70	0.98	0.25	0.87	0.26	0.62	0.32	1.00	0.77	1.13	0.61	0.08	0.09	0.66	1.34	0.05	1.28	1.76	0.50	1.11	1.06	1.91	1.51	1.11	1.93	1.75	1.74	1.61
Leg of Lamb	0.45	0.05	0.19	1.18	0.44	0.99	1.33	2.22	0.08	1.42	1.14	0.27	0.70	0.00	1.52	0.97	1.43	1.08	0.05	0.19	0.31	0.16	0.63	0.07	0.48	0.44	0.06	0.41	0.29	0.00	2.22	1.14	1.42	1.93	1.93	2.22	1.40	1.94	3.49	1.94	1.50
Mutton F'quarter	0.72	1.08	1.29	0.20	0.61	0.10	0.66	1.51	0.78	0.08	0.98	1.21	0.98	1.52	0.00	0.72	0.49	1.27	1.12	1.02	1.34	1.11	1.50	1.01	0.49	0.43	1.11	1.41	0.29	0.00	0.98	0.05	0.25	0.24	0.56	0.44	0.44	0.91	0.77	0.78	0.74
Hogget Loin Chops	0.30	0.56	0.76	0.40	0.23	0.47	1.02	1.93	0.44	0.87	0.02	0.81	0.25	0.97	0.72	0.00	1.07	0.30	0.66	0.44	1.03	0.67	1.03	0.59	0.08	0.11	0.69	0.98	0.11	1.20	1.52	0.43	0.68	1.06	1.40	1.41	0.92	1.61	1.93	1.41	1.50
Mutton Loin Chop	0.65	1.27	1.08	0.00	0.60	0.08	0.75	1.61	0.70	0.32	0.81	1.25	0.87	1.43	0.49	1.07	0.00	0.58	1.18	0.96	1.41	0.89	1.32	0.94	0.50	0.23	1.03	1.58	0.24	0.59	1.24	0.11	0.43	0.10	0.50	0.52	0.46	0.79	0.44	0.67	0.79
Leg of Mutton	0.33	0.63	1.00	0.27	0.41	0.13	0.79	1.51	0.59	0.47	0.47	0.87	0.26	1.08	1.27	0.30	0.58	0.00	0.63	0.41	0.98	0.77	1.03	0.73	0.25	0.25	0.73	1.03	0.14	0.00	1.11	0.25	0.70	0.50	0.93	0.89	0.72	1.11	0.81	1.18	0.90
Pork chops	0.50	0.22	0.24	1.07	0.41	1.15	1.51	2.22	0.41	1.21	0.82	0.34	0.62	0.03	1.12	0.66	1.18	0.63	0.00	0.67	0.70	0.18	0.59	0.11	0.48	0.55	0.06	0.25	0.29	1.52	1.94	1.19	1.52	1.63	1.52	1.42	1.26	1.76	1.63	2.23	1.63
Pork Pieces	0.23	0.05	0.53	0.69	0.16	0.74	1.41	2.22	0.16	1.09	0.64	0.07	0.32	0.19	1.02	0.44	0.96	0.41	0.67	0.00	1.03	0.69	1.04	0.40	0.14	0.08	0.41	0.77	0.11	1.23	1.77	0.64	0.90	1.07	1.42	1.34	0.98	1.52	0.00	1.52	1.43
Leg of Pork	0.80	0.48	0.31	1.42	0.87	1.20	1.76	2.22	0.80	1.36	1.19	0.83	1.00	0.31	1.34	1.03	1.41	0.98	0.70	1.03	0.00	0.14	0.15	0.29	1.12	1.06	0.39	0.11	0.41	1.64	3.49	1.14	1.53	1.65	1.63	1.76	1.43	1.94	1.63	2.23	1.76
Sliced Ham	0.57	0.20	0.06	0.98	0.51	1.08	1.62	2.22	0.59	1.61	0.91	0.50	0.77	0.16	1.11	0.67	0.89	0.77	0.18	0.69	0.14	0.00	0.66	0.09	0.76	0.87	0.02	0.18	0.44	1.76	1.94	0.97	1.52	0.63	1.94	1.94	1.50	1.94	1.94	1.94	1.76
Leg of Ham	0.89	0.58	0.13	1.43	0.97	1.63	2.22	2.22	0.86	2.21	1.32	0.73	1.13	0.63	1.50	1.03	1.32	1.03	0.59	1.04	0.15	0.66	0.00	0.73	1.19	1.34	0.49	0.26	0.73	3.49	1.94	1.34	1.63	1.76	2.22	2.22	1.75	2.22	0.00	2.22	1.94
Ham Steaks	0.00	0.16	0.06	0.93	0.33	0.82	1.61	1.94	0.24	1.32	0.74	0.38	0.61	0.07	1.01	0.59	0.94	0.73	0.11	0.40	0.29	0.09	0.73	0.00	0.76	0.76	0.08	0.12	0.28	1.43	1.52	0.82	1.26	0.95	1.13	1.03	1.18	1.61	1.25	1.62	1.52
Middle Bacon	0.06	0.56	0.86	0.31	0.13	0.30	0.89	2.22	0.14	0.90	0.12	0.17	0.08	0.48	0.49	0.08	0.30	0.25	0.48	0.14	1.12	0.76	1.19	0.76	0.00	0.31	0.59	0.87	0.00	1.18	1.41	0.40	0.68	0.77	0.91	1.07	0.87	1.12	1.06	1.25	1.12
Shoulder Bacon	0.16	0.47	0.85	0.26	0.13	0.29	1.03	1.94	0.16	0.87	0.05	0.16	0.09	0.44	0.43	0.11	0.23	0.25	0.55	0.08	1.06	0.87	1.34	0.76	0.31	0.00	0.50	0.88	0.01	0.95	1.43	0.49	0.94	0.67	0.76	0.81	0.88	1.03	0.83	0.95	1.14
Fish	0.54	0.15	0.08	1.00	0.45	1.08	1.52	2.22	0.25	1.26	0.58	0.30	0.66	0.06	1.11	0.69	1.03	0.73	0.06	0.41	0.39	0.02	0.49	0.08	0.59	0.50	0.00	0.53	-.35	1.62	1.92	1.18	1.61	1.32	1.32	1.32	1.03	1.61	1.74	1.49	1.24
Chicken	0.91	0.44	0.18	1.76	0.81	1.63	1.77	2.22	0.64	1.76	0.98	0.85	1.34	0.41	1.41	0.98	1.58	1.03	0.25	0.77	0.11	0.18	0.26	0.12	0.87	0.88	0.53	0.00	0.49	2.21	1.93	1.51	1.93	2.21	3.49	2.21	1.93	3.49	3.49	3.49	3.49
Shellfish	0.01	0.25	0.42	0.23	0.11	0.00	0.82	1.36	0.11	0.21	0.03	0.11	0.05	0.25	0.29	0.11	0.24	0.14	0.29	0.11	0.41	0.44	0.73	0.28	0.00	0.01	0.55	0.49	0.00	0.31	0.98	0.37	0.62	0.20	0.33	0.34	0.58	0.61	0.56	0.93	0.62
Hamburger	1.43	1.37	1.53	0.58	0.00	1.10	0.61	1.35	1.19	0.61	0.98	1.53	1.28	0.00	0.00	1.20	0.39	0.00	1.52	1.23	1.64	1.76	3.49	1.43	1.18	0.95	1.62	2.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tripe	1.44	1.95	1.76	1.34	1.94	1.34	0.45	0.01	1.94	1.19	1.43	1.52	1.76	2.22	0.98	1.52	1.24	1.11	1.94	1.77	3.49	1.94	1.94	1.52	1.41	1.43	1.92	1.93	0.98	0.00	0.00	1.18	0.92	1.02	0.97	1.08	0.98	0.88	1.02	0.42	0.61
Lambs Fry	0.76	0.87	1.34	0.16	0.60	0.18	0.43	0.97	0.98	0.03	0.61	0.74	0.50	1.14	0.05	0.43	0.11	0.25	1.19	0.64	1.14	0.97	1.34	0.82	0.40	0.49	1.18	1.51	0.37	0.00	1.18	0.00	0.30	0.14	0.24	0.20	0.34	0.51	0.33	0.70	0.42
Kidney	1.15	1.15	1.52	0.45	0.89	0.48	0.21	1.00	1.18	0.49	0.91	0.97	1.11	1.52	0.25	0.68	0.43	0.70	1.52	0.90	1.53	1.52	1.63	1.26	0.68	0.94	1.61	1.93	0.62	0.00	0.92	0.30	0.00	0.21	0.08	0.10	0.03	0.05	0.13	0.45	0.30
Pork Sausage	1.36	1.21	1.42	0.43	0.98	0.52	0.84	1.27	1.07	0.00	0.73	1.18	1.06	1.93	0.24	1.06	0.10	0.50	1.63	1.07	1.65	1.63	1.76	0.95	0.77	0.67	1.32	2.21	0.20	0.00	1.02	0.14	0.21	0.00	0.57	0.57	0.49	0.76	0.88	1.25	0.68
Luncheon	1.43	1.65	1.76	0.79	1.36	0.89	0.31	1.33	1.19	0.26	1.34	1.27	1.91	1.93	0.56	1.40	0.50	0.93	1.52	1.42	1.63	1.94	2.22	1.13	0.91	0.76	1.32	3.49	0.33	0.00	0.97	0.24	0.08	0.57	0.00	0.08	0.26	0.56	0.32	1.08	0.39
Ham n Chicken	1.43	1.77	1.62	0.85	1.28	0.88	0.55	1.25	1.19	0.27	1.26	1.34	1.51	2.22	0.44	1.41	0.52	0.85	1.42	1.34	1.76	1.94	2.22	1.03	1.07	0.81	1.32	2.21	0.34	0.00	1.08	0.20	0.10	0.57	0.08	0.00	0.19	0.66	0.38	1.01	0.44
Salami	1.63	1.77	1.62	0.69	1.02	0.88	0.32	0.98	1.13	0.26	1.12	1.26	1.11	1.40	0.44	0.92	0.46	0.72	1.26	0.98	1.43	1.50	1.75	1.18	0.87	0.88	1.03	1.93	0.58	0.00	0.98	0.34	0.03	0.49	0.26	0.19	0.00	0.30	0.09	0.69	0.83
Frankfurters	2.23	2.23	1.94	0.88	1.42	1.52	0.33	0.99	1.33	0.66	1.75	1.62	1.93	1.94	0.91	1.61	0.79	1.11	1.76	1.52	1.94	1.94	2.22	1.61	1.12	1.03	1.61	3.49	0.61	0.00	0.88	0.51	0.05	0.76	0.36	0.66	0.30	0.00	0.25	0.24	0.66
Saveloys	1.77	1.95	1.76	1.13	1.26	1.20	0.44	1.20	1.33	0.93	1.74	1.42	1.75	3.49	0.77	1.93	0.44	0.81	1.63	0.00	1.63	1.94	0.00	1.25	1.06	0.83	1.74	3.49	0.56	0.00	1.02	0.33	0.13	0.88	0.32	0.38	0.09	0.35	0.00	0.77	0.25
Black Pudding	2.23	3.49	1.94	1.52	1.43	1.43	0.03	0.52	0.33	0.75	1.62	1.94	1.74	1.94	0.78	1.41	0.67	1.18	2.23	1.52	2.23	1.94	2.22	1.62	1.25	0.95	1.49	3.49	0.93	0.00	0.42	0.70	0.45	1.25	1.08	1.01	0.69	0.04	0.77	0.00	0.36
Garlic Sausage	3.49	3.49	1.94	1.52	1.38	1.21	0.18	0.77	1.51	0.48	1.50	1.62	1.61	1.50	0.74	1.50	0.79	0.90	1.63	1.43	1.76	1.76	1.94	1.52	1.12	1.14	1.24	3.49	0.62	0.00	0.61	0.42	0.30	0.68	0.39	0.44	0.83	0.66	0.25	0.36	0.00
Column Totals	25.26	29.64	38.71	5.85	2.85	3.77	34.33	63.38	20.41	16.63	9.87	21.40	16.98	35.84	13.91	11.14	10.70	1.19	33.18	18.40	46.06	37.77	51.14	28.88	9.66	7.30	30.35	56.02	5.44	28.24	53.15	14.40	25.92	18.98	31.43	29.33	27.28	42.09	35.57	50.43	44.14
Mean	0.63	0.76	0.99	0.14	0.07	0.09	0.84	1.55	0.50	0.41	0.24	0.52	0.41	0.87	0.34	0.27	0.26	0.03	0.81	0.46	1.12	0.92	1.29	0.72	0.24	0.18	0.74	1.37	0.13	1.09	1.33	0.36	0.65	0.47	0.79	0.73	0.68	1.07	0.89	1.26	1.10
RANK	11	8	4	25	22	24	34	41	13	28	18	12	15	6	26	16	17	23	7	14	3	5	2	10	18	20	9	1	21	37	40	27	30	29	33	32	31	36	35	39	38

Appendix 7.9 Matrix of Z Values for the 41 Meat Cuts

Appendix 7.10 Lower Half Matrix of Preference Measurements For the 41 Meat Cuts.

Wienersnitzel	
Rump steak	4.6
Porterhouse steak	4.4 4.9
Stewing steak	5.6 5.7 5.8
Topside	5.4 5.3 5.1 5.4
Beef mince	3.3 5.0 5.4 5.0 5.3
Beef tongue	5.3 5.4 3.4 5.7 4.2 5.1
Beef hearts	5.0 5.2 5.5 4.2 4.9 4.6 4.9
Beef tripe	5.0 5.9 5.8 5.1 5.0 5.1 5.0 4.9
Corned beef	6.1 4.7 5.1 4.7 4.8 5.2 3.4 4.6 2.8
Beef sausage	4.9 5.1 4.0 4.6 4.5 4.8 4.1 3.4 4.1 4.0
Lamb forequarter	4.7 5.9 5.4 4.5 4.8 5.2 5.1 4.9 4.0 4.1 5.0
Lamb loin chops	6.0 5.7 5.1 4.3 4.4 5.2 4.0 5.0 2.8 4.4 4.8 5.0
Leg of lamb	4.9 3.5 3.9 4.4 4.6 4.8 4.6 3.4 4.6 4.7 4.2 5.4 4.8
Lamb's fry	3.5 4.9 4.3 4.7 5.3 4.8 5.4 4.6 4.5 4.0 4.8 5.1 4.8 4.7
Lamb's kidney	4.9 5.9 4.9 5.1 4.4 5.4 4.9 5.3 4.4 4.1 5.2 3.8 4.9 4.1 4.5
Hogget loin chops	5.0 3.3 3.8 4.6 4.2 5.1 5.0 4.4 5.3 4.8 4.5 5.6 4.9 5.2 5.2 4.5
Leg of hogget	3.6 4.6 4.6 3.9 5.2 4.5 4.2 5.3 5.1 4.6 4.1 5.8 5.3 5.2 5.4 5.3 5.7
Mutton forequarter	5.0 4.8 5.0 5.2 4.6 5.2 4.6 5.9 4.6 4.4 5.7 4.9 4.3 4.8 5.5 5.6 5.5 5.4
Mutton loin chops	5.0 5.0 4.2 4.1 5.3 4.9 4.6 5.0 4.4 5.3 5.8 4.9 4.6 4.1 5.5 5.8 5.4 5.5 5.0
Leg of mutton	4.9 4.1 5.2 5.6 5.0 5.4 4.8 4.5 5.5 4.6 4.7 5.0 4.5 4.6 5.5 5.4 4.5 5.4 4.5 4.2
Pork chops	4.9 4.4 4.6 4.9 5.2 4.9 5.1 4.8 5.4 5.9 4.8 5.6 5.3 5.2 6.0 5.2 4.7 5.5 5.2 4.1 4.9
Pork pieces	4.5 5.2 5.2 5.0 5.2 5.0 5.6 5.1 6.0 5.1 4.5 5.5 5.5 5.2 5.7 5.6 5.0 4.0 4.4 4.5 4.8 4.6
Leg of pork	3.0 4.0 4.7 5.6 5.2 5.0 4.6 5.5 5.6 4.0 5.0 5.7 5.9 5.3 5.7 5.6 4.8 3.8 5.2 4.5 5.6 5.7 4.8
Sliced ham	4.6 4.7 4.9 5.5 5.2 5.0 5.8 5.1 5.6 4.9 5.1 5.7 5.5 5.0 5.8 4.7 4.4 4.4 4.5 5.1 4.7 5.0 5.3 5.6
Leg of ham	4.6 3.6 5.3 5.1 5.4 5.3 4.7 5.7 4.8 4.4 5.6 5.1 5.1 5.7 4.3 5.2 5.0 4.5 5.6 4.3 5.7 5.5 5.1 5.8 4.8
Ham steaks	4.3 4.7 5.0 4.6 5.4 4.7 5.5 5.4 5.3 5.5 5.6 6.0 5.5 5.1 4.7 5.2 5.1 4.8 5.0 5.8 4.8 4.4 5.4 5.3 5.0 4.4
Middle bacon	4.3 4.5 5.0 5.5 4.7 5.2 5.3 5.3 5.5 5.6 5.6 3.7 4.1 3.9 4.0 5.4 4.4 5.5 6.1 5.1 5.7 5.6 5.4 6.0 5.1 5.4 5.0
Shoulder bacon	5.7 4.7 5.8 5.7 5.3 5.4 5.5 4.4 5.7 5.8 4.1 5.2 4.8 4.7 4.7 4.6 5.1 5.5 5.6 5.4 5.4 4.8 5.0 4.9 4.4 4.8 5.4 4.2
Fish	4.3 3.7 4.8 4.9 4.8 4.4 4.2 3.9 5.7 5.5 4.6 3.6 5.1 5.0 5.0 4.6 5.4 5.5 6.0 4.7 5.3 5.2 5.6 5.7 5.0 4.4 5.1 4.6 4.2
Chicken	4.9 5.6 5.4 5.6 5.4 4.8 4.2 5.0 5.4 4.1 3.6 5.0 5.3 5.1 4.9 4.8 5.9 5.5 5.8 4.8 5.1 5.2 5.8 5.2 4.8 5.1 4.8 4.6 2.4 5.4
Shellfish	4.0 4.9 4.4 5.8 5.1 5.1 3.8 4.5 4.9 4.9 4.5 5.3 5.4 5.6 4.6 5.5 5.6 5.9 5.3 4.4 5.4 5.3 4.7 5.1 4.9 5.0 5.2 4.3 2.3 4.6 4.8
Hamburger	5.0 5.1 5.4 5.7 5.0 5.2 4.5 4.0 4.7 4.8 5.2 5.4 4.5 5.4 5.0 5.7 5.8 4.3 5.3 4.6 5.5 4.8 4.7 4.7 5.0 4.5 4.9 4.8 2.5 4.3 5.1 3.7
Pork sausages	4.5 4.1 5.1 5.4 5.6 5.1 3.3 3.0 3.7 3.6 3.6 5.1 5.3 5.2 4.9 5.9 5.6 5.7 5.6 5.1 4.8 5.1 5.4 4.9 4.7 4.1 4.6 4.8 2.5 5.2 4.1 5.2 4.3
Luncheon	5.0 4.8 5.7 5.7 5.4 5.0 4.1 3.5 4.0 4.9 5.0 4.7 5.3 4.5 6.0 5.8 6.2 4.5 6.0 3.7 5.0 4.8 5.9 5.2 5.3 4.4 5.0 4.0 2.5 5.3 4.9 4.0 4.8 4.3
Ham'n'chicken	5.2 5.1 5.2 5.4 4.5 5.5 3.9 4.0 5.3 5.5 4.9 5.7 5.0 5.2 5.2 5.8 5.6 4.6 5.8 4.6 5.1 5.0 5.2 5.0 5.1 4.3 5.1 4.6 3.9 5.7 5.9 4.4 4.6 4.3 4.1
Salami	4.8 5.3 5.5 5.8 6.0 5.0 3.3 3.9 3.8 4.0 4.9 5.4 4.5 5.8 5.1 4.5 5.9 5.3 4.8 4.8 4.9 5.2 5.4 4.8 4.6 4.2 4.4 4.7 3.8 4.4 4.5 5.1 3.7 5.5 4.8 4.4
Frankfurters	5.7 6.0 6.0 5.5 6.0 4.7 4.9 5.2 5.3 5.4 5.2 5.3 5.4 5.4 5.0 5.2 5.2 5.1 5.5 4.9 5.1 5.2 5.4 5.8 5.3 5.5 6.0 5.4 5.7 5.4 5.5 5.2 5.2 5.7 5.4 5.4 4.9
Saveloys	5.8 5.9 5.8 6.2 5.5 5.3 4.7 5.0 5.1 5.1 5.2 5.7 5.1 5.4 5.1 5.1 4.9 4.8 5.3 5.5 5.1 5.2 4.9 5.7 4.9 5.3 5.5 5.3 5.0 5.2 4.9 4.9 5.0 5.0 5.2 5.2 3.7 5.1
Black pudding	5.5 4.8 5.6 6.0 6.0 5.9 5.4 5.6 5.9 5.5 6.0 6.0 5.5 4.5 5.0 4.7 5.3 5.1 5.7 5.8 5.4 5.2 5.6 5.7 4.5 4.9 4.5 4.3 4.9 4.9 5.2 4.4 3.9 5.1 4.5 4.7 5.0 5.9 5.1
Garlic sausage	4.1 4.1 4.3 5.5 5.0 4.7 3.9 5.5 5.5 6.0 5.1 5.4 5.8 5.2 5.3 5.5 5.7 5.3 5.8 5.6 5.6 5.8 6.0 6.1 5.1 5.5 4.2 5.0 4.8 5.2 4.9 5.2 4.9 4.6 4.8 4.7 5.4 5.3 4.5 5.0

Appendix 7.10 Lower Half Matrix Proximity Values for the 41 Meat Cut Preference Space.

MASSEY UNIVERSITY

FOOD TECHNOLOGY RESEARCH CENTRE

USE OF MEATS

Name: _____

ADDRESS: _____

Phone: _____

In the next few pages you can see that the meats have been arranged in pairs and beside each pair is a line. On one end of the line are the words "Is a Complete Substitute". At the other end of the line are the words "Cannot be a substitute".

I would like you to look at each meat pair in turn and think of the first meat as being the one you went to the refigerator to get out for the next meal, but instead found the second. I would like you to tell me whether you thought the second meat could be a substitute for the first or not. For instance if you had decided to make a casserole using blade steak and went to the refrigerator and found that the meat was actually chuck steak then the chuch steak could be used just as easily as the blade steak for the casserole and so you would say that chuck steak was a very good substitute for blade steak. Please indicate how good a substitute the second meat in each pair is for the first by placing a mark on the line at a point which reflects the degree that the second can be substituted for the first.

In the example above, i.e. chuck steak and blade steak my answer is shown below.

		COMPLETE SUBSTITUTE	CANNOT BE A SUBSTITUTE
___CHUCK STEAK	___BLADE STEAK	——×——	

Please could you do the same for the following pairs of meats

		A COMPLETE SUBSTITUE	CANNOT BE SUBSTITUTED
__BEEF	__VEAL		
__BEEF	__MUTTON		
__BEEF	__HOGGET		
__BEEF	__LAMB		
__BEEF	__PORK		
__BEEF	__BACON		
__BEEF	__HAM		
__BEEF	__SMALLGOODS		
__BEEF	__OFFAL		
__BEEF	__FISH		
__BEEF	__CHICKEN		
__BEEF	__TURKEY		
__BEEF	__SHELLFISH		
__VEAL	__ MUTTON		
__VEAL	__HOGGET		
__VEA:L	__LAMB		
__VEAL	__PORK		
__VEAL	__BACON		
__VEAL	__HAM		
__VEAL	__SMALLGOODS		
__VEAL	__OFFAL		
__VEAL	_FISH		
__VEAL	__CHICKEN		
__VEAL	__TURKEY		
__VEAL	__SHELLFISH		
__MUTTON	__LAMB		

__MUTTON __PORK _____
__MUTTON __BACON _____
__MUTTON __HAM _____
__MUTTON __SMALLGOODS _____
__MUTTON __OFFAL _____
__MUTTON __FISH _____
__MUTTON __CHICKEN _____
__MUTTON __TURKEY _____
__MUTTON __SHELLFISH _____

__HOGGET __MUTTON _____
__HOGGET __LAMB _____
__HOGGET __PORK _____
__HOGGET __BACON _____
__HOGGET __HAM _____
__HOGGET __SMALLGOODS _____
__HOGGET __OFFAL _____
__HOGGET __FISH _____
__HOGGET __CHICKEN _____
__HOGGET __TURKEY _____
__HOGGET __SHELLFISH _____

LAMB __PORK _____
__LAMB __BACON _____
--lamb --HAM _____
__LAMB __SMALLGOOD _____
__LAMB __OFFAL _____
__LAMB __FISH _____
__LAMB __CHICKEN _____
__LAMB __TURKEY _____
__LAMB __SHELLFISH _____

__PORK __BACON
__PORK __HAM _____
__PORK __SMALLGOODS _____
__PORK __OFFAL _____
_PORK __FISH _____
__PORK __CHICKEN _____
__PORK __TURKEY _____
__PORK __SHELLFISH _____

__BACON __HAM _____
__BACON __SMALLGOODS _____
__BACON __OFFAL _____
__BACON __FISH _____
__BACON __CHICKEN _____
__BACON __TURKEY _____
__BACON __SHELLFISH _____
__

__HAM __SMALLGOODS _____
__HAM __OFFAL _____
__HAM __FISDH _____
__HAM __CHICKEN _____
__HAM __TURKEY _____
__HAM __SHELLFISH _____

__SMALLGOODS __OFFAL _____
__SMALLGOODS __FISH _____
__SMALLGOODS __CHICKEN _____
__SMALLGOODS __TURKEY_ _____
__SMALLGOODS __SHELLFISH _____

__OFFAL __FISH _____

__OFFAL	__CHICKEN	_____
__OFFAL	__TURKEY	_____
__OFFAL	__SHELLFISH	_____
__		
__FISH	__CHICKEN	_____
__FISH	__TURKEY	_____
__FISH	__SHELLFISH	_____
__CHICKEN	__TURKEY	_____
__CHICKEN	__SHELLFISH	_____
__SALAMI	__BEEF	_____
__SALAMI	__VEAL	_____
__SALAMI	__MUTTON	_____
__SALAMI	__HOGGET	_____
__SALAMI	__LAMB	_____
__SALAMI	__PORK	_____
__SALAMI	__BACON	_____
__SALAMI	__HAM	_____
__SALAMI	__SMALLGOODS_	_____
__SALAMI	__OFFAL	_____
__SALAMI	__FISH	_____
__SALAMI	__TURKEY	_____
__SALAMI	__SHELLFISH	_____

Q.2.

In the next few pages you will see that the meat cuts and processed meats have been arranged in pairs. Please tell me whether you think the second meat could be used in place of the first if you went to the refrigerator to get the first but found only the second. If you think that the second meat could be used in place of the first without any change to recipes or cooking methods then give it a score of 1, but if you think that it could not possibly replace the first meat then give it a score of 9. Scores in between 1 and 9 will indicate degrees in the substitutability of the meats one for the other. Please show how good a substitute you think the second meat is for the first by placing a mark on the line alongside each pair as you did for the previous question that reflects your judgement on the substitutability of the second meat for the first.

		A COMPLETE SUBSTITUTE	CANNOT BE SUBSTITUTED
__WIENERSCHNITZEL	__RUMP STEAK		
__WIENERSCHNITZEL	__PORTERHOUSE		
__WEINERSCHNITZEL	__STEWING STEAK		
	__TOPSIDE		
__WEINERSCHNITZEL	__BEEF MINCE		
__WIENERSCHNITZEL	__BEEF TONGUE		
__WIENERSCHNITZEL	_BEEF HEARTS		
__WIENERSCHNITZEL	__CORNED BEEF		
__WIENERSCHNITZEL	__BEEF SAUSAGES		
__WEINERSCHNITZEL	__LAMB FOREQ'TER		
__WIENERSCHNITZEL	__LEG OF HOGGET		
__WEINERSCHNITZEL	__LAMB LOIN CHOP		
__WIENTERSCHNITZEL	__LEG OF LAMB		
__WIENERSCHNITZEL	__MUTTON FOREQ'TER		
__WIENERSCHNITZEL	__HOGGET LOIN CHOP		
__WIENERSCHNITZEL	__MUTTON LOIN CHOPE		
__WIENERSCHNITZEL	__LEG OF MUTTON		
__WIENERSCHNITZEL	__PORK CHOPS		
	__PORK PIECES		
__WINERSCHNITZEL	_LEG OF PORK		
__WIENERSCHNITZEL	__SLICED HAM		
__WIENERSCHNITZEL	__LEG OF HAM		
__WIENERSCHNITZEL	__MIDDLE BACON		
_WIENERSCHNITZEL	_SHOULDER BACON		
__WIENERSCHNITZEL	__FISH		
__WIENERSCHNITZEL	__CHICKEN		
__WIENERSCHNITZEL	__SHELLFISH		
__WIENERSCHNITZEL	_HAMBURGER		

		A COMPLETE SUBSTITUTE	CANNOT BE SUBSTITUTED
__WIENERSCHNITZEL	__LAMBS FRY		
__WINERSCHNITZEL	__KIDNEY		
__WIENERSCHNITZEL	__PORK SAUSAGE		
__WIENERSCHNITZEL	__LUNCHEON		
__WIENERSCHNITZEL	_HAM N CHICKEN		
__WIENERSCHNITZEL	__SALAMI		
__WIENERSCHNITZEL	__FRANKFURTERS		
	__SAVELOYS		
__WIENERSCHNITZEL	__BLACK PUDDING		
__WIENERSCHNITZEL	__GARLIC SAUSAGE		
__RUMP STEAK	__PORTERHOUSE		
__RUMP STEAK	__STEWING STEAK		
__RUMP STEAK	__TOPSIDE		
__RUMP STEAK	__BEEF MINCE		
__RUMP STEAK	__CORNED BEEF		
__RUMP STEAK	__BEEF SAUSAGES		
__RUMP STEAK	__LAMB FOREQ'TER		
__RUMP STEAK	__LEG OF HOGGET		
__RUMP STEAK	__LAMB LOIN CHOP		
__RUMP STEAK	__LEG OF LAMB		
__RUMP STEAK	__MUTTON FOREQ'TER		
__RUMP STEAK	__HOGGET LOIN CHOP		
__RUMP STEAK	__MUTTON LOIN CHOP		
__RUMP STEAK	__LEG OF MUTTON		
__RUMP STEAK	__PORK CHOP		
__RUMP STEAK	__PORK PIECES		
__RUMP STEAK	__LEG OF PORK		
RUMP STEAK	SLICED HAM		

		A COMPLETE SUBSTITUTE	CANNOT BE SUBSTITUTED
__RUMP STEAK	__LEG OF HAM		
__RUMP STEAK	__HAM STEAKS		
__RUMP STEAK	__MIDDLE BACON		
__RUMP STEAK	__SHOULDER BACON		
__RUMP STEAK	__FISH		
__RUMP STEAK	__CHICKEN		
__RUMP STEAK	__SHELLFISH		
__RUMP STEAK	__HAMBURGER		
__RUMP STEAK	__TRIPE		
_RUMP STEAK	__LAMBS FRY		
__RUMP STEAK	__KIDNEY		
__RUMPE STEAK	__PORK SAUSAGE		
__RUMP STEAK	__LUNCHEON		
__RUMP STEAK	__HAM N CHICKEN		
__RUMP STEAK	__SALAMI		
__RUMP STEAK	__FRANKFURTER		
__RUMP STEAK	__SAVELOYS		
_RUMP STEAK	__BLACK PUDDING		
__RUMP STEAK	__GARLIC SAUSAGE		
__PORTERHOUSE	__STEWING STEAK		
__PORTERHOUSE	__TOPSIDE		
__PORTERHOUSE	__BEEF MINCE		
__PORTERHOUSE	__BEEF TONGUE		
__PORTERHOUSE	__BEEF HEARTS		
__PORTERHOUSE	__BEEF SAUSAGE		
__PORTERHOUSE	__CORNED BEEF		
__PORTERHOUSE	__LAMB FOREQ'TER		
__PORTER HOUSE	__LEG OF HOGGET		

		A COMPLETE SUBSTITUTE	CANNOT BE SUBSTITUTED
__PORTERHOUSE	__LAMB LOIN CHOPS		
__PORTERHOUSE	__LEG OF LAMB		
__PORTERHOUSE	__MUTTON FOREQ'TER		
__PORTERHOUSE	__HOGGET LOIN CHOPS		
__PORTERHOUSE	__MUTTON NECK CHOPS		
__PORTERHOUSE	__MUTTON LOIN CHOPS		
__PORTERHOUSE	__LEG OF MUTTON		
__PORTERHOUSE	__PORK CHOPS		
__PORTERHOUSE	__PORK PIECES		
__PORTERHOUSE	__LEG OF PORK		
__PORTERHOUSE	__SLICED HAM		
__PORTERHOUSE	__LEG OF HAM		
__PORTERHOUSE	__HAM STEAKS		
__PORTERHOUSE	__MIDDLE BACON		
__PORTERHOUSE	__SHOULDER BACON		
__PORTERHOUSE	__FISH		
__PORTERHOUSE	__CHICKEN		
__PORTERHOUSE	__SHELL FISH		
__PORTERHOUSE	__HAMBURGERS		
_PORTERHOUSE	__TRIPE		
__PORTERHOUSE	__LAMBS FRY		
__PORTERHOUSE	__KIDNEY		
__PORTERHOUSE	__PORK SAUSAGE		
__PORTERHOUSE	__LUNCHEON		
__PORTERHOUSE	__HAM N CHICKEN		
__PORTERHOUSE	__SALAMI		
__PORTERHOUSE	__FRANKFURTHER		
_PORTERHOUSE	__SAVELOYS		
__PORTERHOUSE	__BLACK KPUDDING		

__STEWING STEAK __TOPSIDE
__STEWING STEAK __BEEF MINCE
__STEWING STEAK __BEEF TONGUE
__STEWING STEAK __CORNED BEEF
__STEWING STEAK __BEEF SAUSAGE
__STEWING STEAK __LAMB FOREQ'TER
__STEWING STEAK __LEG OF HOGGET
__STEWING STEAK __LAMB LOIN CHOP
__STEWING STEAK __LEG OF LAMB
__STEWING STEAK __MUTTON FOREQ'TER
__STEWING STEAK __HOGGET LOIN CHOP
__STEWING STEAK __MUTTON LOIN CHOP
__STEWING STEAK __LEG OF MUTTON
__STEWING STEAK __PORK CHOP
__STEWING STEAK __PORK PIECES
__STEWING STEAK __LEG OF PORK
__STEWING STEAK __SLICED HAM
__STEWING STEAK __LEG OF HAM
__STEWING STEAK __HAM STEAKS
__STEWING STEAK __MIDDLE BACON
--STEWING STEAK __SHOULDER BACON
__STEWING STEAK __FISH
_STEWING STEAK __CHICKEN
__STEWING STEAK __SHELL FISH
_STEWING STEAK __HAMBURGERS
__STEWING STEAK __TRIPE
__STEWING STEAK __LAMBS FRY
__STEWING STEAK __KIDNEY
__STEWING STEAK __PORK SAUSAGE
SEWING STEAK LUNCHEON

__STEWING STEAK __HAM N CHICKEN
__STEWING STEAK __SALAMI
__STEWING STEAK __SAVELOYS
__STEWING STEAK __FRANKFURTER
__STEWING STEAK __BLACK PUDDING
__STEWING STEAK __GARLIC SAUSAGE

__TOPSIDE __BEEF MINCE
__TOPSIDE __BEEF HEARTS
__TOPSIDE __BEEF TONGUE
__TOPSIDE __CORNED BEEF
__TOPSIDE __BEEF SAUSAGE
__TOPSIDE __LAMB FOREQ'TER
__TOPSIDE __LAMB LOIN CHOP
__TOPSIDE __LEG OF HOGGET
__TOPSIDE __LEG OF LAMB
__TOPSIDE __MUTTON FOREQ'TER
__TOPSIDE __HOGGET LOIN CHOP
_TOPSIDE __MUTTON LOIN CHOP
__TOPSIDE __LEG OF MUTTON
__TOPSIDE __PORK CHOPS
__TOPSIDE __PORK PIECES
__TOPSIDE __LEG OF PORK
__TOPSIDE __SLICED HAM
__TOPSIDE __LEG OF HAM
__TOPSIDE __HAM STEAK
__TOPSIDE __MIDDLE BACON
__TOPSIDE __SHOULDER BACON
__TOPSIDE __FISH

		A COMPLETE SUBSTITUTE	CANNOT BE SUBSTITUTED
TOPSIDE	__CHICKEN		
__TOPSIDE	__SHELL FISH		
__TOPSIDE	__TRIPE		
__TOPSIDE	__LAMBS FR		
__TOPSIDE	__KIDNEY		
__TOPSIDE	__PORK SAUSAGE		
__TOPSIDE	__LUNCHEON		
__TOPSIDE	__HAM N CHICKEN		
TOPSIDE	__SALAMI		
__TOPSIDE	__FRANKFURTER		
__TOPSIDE	__SAVELOY		
__TOPSIDE	__SAVELY		
__TOPSIDE	__BLACK PUDDING		
__TOPSIDE	__GARLIC SAUSAGE		
__BEEF MINCE	__BEEF TONGUE		
__BEEF MINCE	__BEEF HEARTS		
__BEEF MINCE	__CORNED BEEF		
__BEEF MINCE	__BEEF SAUSAGE		
__BEEF MINCE	__LAMB FOREQ'TER		
__BEEF MINCE	__LEG OF HOGGET		
__BEEF MINCE	__LAMB LOIN CHOPE		
__BEEF MINCE	__LEG OF LAMB		
__BEEF MINCE	__MUTTON FOREQ'TER		
__BEEF MINCE	__HOGGET LOIN CHOP		
__BEEF MINCE	__MUTTON LOIN CHOP		
__BEEF MINCE	__LEG OF MUTTON		
__BEEF MINCE	__PORK CHOPS		
__BEEF MINCE	__PORK PIECES		

		A COMPLETE SUBSTITUTE	CANNOT BE SUBSTITUTE
__BEEF MINCE	__LEG OF PORK		
__BEEF MINCE	__SLICED HAM		
__BEEF MINCE	__LEG OF HAM		
__BEEF MINCE	__HAM STEAKS		
__BEEF MINCE	__MIDDLE BACON		
__BEEF MINCE	__SHOULDER BACON		
__BEEF MINCE	__FISH		
__BEEF MINCE	__CHICKEN		
__BEEF MINCE	__TRIPE		
__BEEF MINCE	__LAMBS FRY		
__BEEF MINCE	__PORK SAUSAGE		
__BEEF MINCE	__KIDNEY		
__BEEF MINCE	__LUNCHEON		
__BEEF MINCE	__HAM N CHICKEN		
__BEEF MINCE	__SALAMI		
__BEEF MINCE	__FRANKFURTER		
__BEEF MINCE	__FRANKFURTER		
__BEEF MINCE	__SAVELOYS		
__BEEF MINCE	__BLACK PUDDING		
__BEEF MINCE	__GARLIC SAUSAGE		
__BEEF MINCE	__HAMBURGER		
__BEEF TONGUE	__BEEF HEARTS		
__BEEF TONGUE	__CORNED BEEF		
__BEEF TONGUE	__BEEF SAUSAGE		
__BEEF TONGUE	__LAMB FOREQ'TER		
__BEEF TONGUE	__LEG OF HOGGET		
__BEEF TONGUE	__LAMB LOIN CHOP		
__BEEF TONGUE	__LEG OF LAMB		

		A COMPLETE SUBSTITUTE	CANNOT BE SUBSTITUTED
__BEEF TONGUE	__HOGGET LOIN CHOPS		
__BEEF TONGUE	__MUTTON LOIN CHOPS		
__BEEF TONGUE	__LEG OF MUTTON		
__BEEF TONGUE	__PORK CHOP		
__BEEF TONGUE	__PORK PIECES		
__BEEF TONGUE	_ LEG OF PORK		
__BEEF TONGUE	__SLICED HAM		
__BEEF TONGUE	__LEG OF HAM		
__BEEF TONUE	__HAM STEAKS		
__BEEF TONGUE	__MIDDLE BACON		
__BEEF TONGUE	__SHOULDER BACON		
__BEEF TONGUE	__FISH		
__BEEF TONGUE	__CHICKEN		
__BEEF TONGUE	__SHELL FISH		
__BEEF TONGUE	__HAMBURGERS		
__BEEF TONGUE	__TRIPE		
__BEEF TONGUE	__LAMBS FRY		
__BEEF TONGUE	__KIDNEY		
__BEEF TONGUE	__PORK SAUSAGE		
__BEEF TONGUE	__LUNCHEON		
__BEEF TONGUE	__HAM N CHICKEN		
__BEEF TONGUE	__SALAMI		
__BEEF TONGUE	__FRANKFURTER		
__BEEF TONGUE	__SAVELOYS		
__BEEF TONGUE	__BLACK PUDDING		
__BEEF TONGUE	__GARLIC SAUSAGE		
__BEEF HEARTS	__CORNED BEEF		
__BEEF HEARTS	__BEEF SAUSAGE		
BEEF HEARTS	LAMB FOREQ'TER		

		A COMPLETE SUBSTITUTE	CANNOT BE SUBSTITUTED
__BEEF HEARTS	__LEG OF HOGGET		
__BEEF HEARTS	_LAMB LOIN CHOP		
__BEEF HEARTS	__LEG OF LAMB		
__BEEF HEARTS	__MUTTON FOREQ'TER		
__BEEF HEARTS	__HOGGET LOIN CHOPS		
__BEEF HEARTS	__MUTTON LOIN CHOP		
__BEEF HEARTS	__LEG OF MUTTON		
__BEEF HEARTS	__PORK CHOP		
__BEEF HEARTS	__PORK PIECES		
__BEEF HEARTS	__LEG OF PORK		
__BEEF HEARTS	__SLICED HAM		
__BEEF HEARTS	__LEG OF HAM		
__BEEF HEARTS	__HAM STEAKS		
__BEEF HEARTS	__MIDDLE BACON		
__BEEF HEARTS	__SHOULDER BACON		
__BEEF HEARTS	__FISH		
__BEEF HEARTS	__CHICKEN		
__BEEF HEARTS	__HAMBURGER		
__BEEF HEARTS	__SHELL FISH		
__BEEF HEARTS	__TRIPE		
__BEEF HEARTS	__LAMBS FRY		
__BEEF HEARTS	__KIDNEY		
__BEEF HEARTS	__PORK SAUSAGE		
__BEEF HEARTS	__LUNCHEON		
__BEEF HEARTS	__HAM N CHICKEN		
__BEEF HARTS	__SALAMI		
__BEEF HEARTS	__FRANKFURTERS		
__BEEF HEARTS	__SAVELOYS		
__BEEF HEARTS	__BLACK PUDDING		
BEEF HEARTS	GARLIC SAUSAGE		

		A COMPLETE SUBSTITUTE	CANNOT BE SUBSTITUTED
__CORNED BEEF	__LAMB FOREQ'TER	__	_
__CORNED BEEF	__BEEF SAUSAGE	_	_
__CORNED BEEF	__LEG OF HOGGET	_	_
__CORNED BEEF	__LAMB LOIN CHOP	_	_
__CORNED BEEF	__LEG OF LAMB	_	_
__CORNED BEEF	__MUTTON FOREQ'TER	_	_
__CORNED BEEF	__HOGGET LOIN CHOP	_	_
__CORNED BEEF	__MUTTON LOIN CHOP	_	_
__CORNED BEEF	__LEG OF LMUTTON	_	_
__CORNED BEEF	__PORK CHOP	_	_
__CORNED BEEF	__PORK PIECES	_	_
__CORNED BEEF	__LEG OF PORK	_	_
__CORNED BEEF	__SLICED HAM	_	_
__CORNED BEEF	__LEG OF HAM	_	_
__CORNED BEEF _	HAM STEAKS	_	_
__CORNED BEEF	__MIDDLE BACON	_	_
__CORNED BEEF	__SHOULDER BACON	_	_
__CORNED BEEF	__FISH	_	_
__CORNED BEEF	__CHICKEN	_	_
__CORNED BEEF	__SHELL FISH	_	_
__CORNED BEEFD	__HAMBURGERS	_	_
__CORNED BEEF	__TRIPE	_	_
__CORNED BEEF	__LAMBS FRY	_	_
__CORNED BEEF	__KIDNEY	_	_
__CORNED BEEF	__PORK SAUSAGE	_	_
__CORNED BEEF	__LUNCHEON	_	_
__CORNED BEEF	__HAM N CHICKEN	_	_
__CORNED BEEF	__SALAMI	_	_
__CORNED BEEF	__FRANKFURTERS	_	_
CORNED BEEF	SAVELOYS		

		A COMPLETE SUBSTITUTE	CANNOT BE SUBSTITUTED
__CORNED BEEF	__BLACK PUDDING	_	_
__CORNED BEEF	__GARLIC SAUSAGE	_	_
__BEEF SAUSAGE	__LAMB FOREQ'TER	_	_
__BEEF SAUSAGE	__LEG OF HOGGET	_	_
__BEEF SAUSAGE	__LAMB LOIN COP	_	
__BEEF SAUSAGE	__LEG OF LAMB	_	_
__BEEF SAUSAGE	__MUTTON FOREQ'TER	_	_
__BEEF SAUSAGE	__HOGGET LOIN CHOPS		_
__BEEF SDAUSAGE	__MUTTON LOIN CHOP	_	_
__BEEF SAUSAGE	__LEG OF MUTTON	_	_
__BEEF SAUSAGE	__PORK CHOP	_	_
__BEEF SAUSAGE	__PORK PIECES	_	_
__BEEF SAUSAGE	__LEG OF PORK	_	_
__BEEF SAUSAGE	__SLICED HAM	_	_
__BEEF SAUSAGE	__HAM STEAKS	_	_
__BEEF SAUSAGE	__MIDDLE BACON	_	_
__BEEF SAUSAGE	__SHOULDER BACON	_	_
__BEEF SAUSAGE	__FISH	__	_
BEEF SAUSAGE	__CHICKEN	_	_
__BEEF SAUSAGE	__SHELL FISH	_	_
__BEEF SAUSAGE	__HAMBURGERS	_	_
__BEEF SAUSAGE	__TRIPE	_	_
__BEEF SAUSAGE	__LAMBS FRY	_	_
__BEEF SAUSAGE	__PORK SAUSAGE	_	_
__BEEF SAUSAGE	__LUNCHEON	_	_
__BEEF SAUSAGE	__HAM AND CHICKEN	_	_
__BEEF SAUSAGE	__SALAMI	_	_
__BEEF SAUSAGE	__FRANKFURTER	_	_
BEEF SAUSAGE	BLACK PUDDING		

		A COMPLETE SUBSTITUTE	CANNOT BE SUBSTITUTED
__BEEF SAUSAGE	__SAVELOYS	_	_
__BEEF SAUSAGE	__GARLIC SAUSAGE	_	_
LAMB F_QTER	__LEG OF HOGGET	_	_
__LAMB F'QTER	__LAMB LOIN CHOP	_	_
__LAMB F'QTER	LEG OF LAMB	_	_
__LAMB F'QTER	__MUTTON F'QTER	_	_
__LAMB F'QTER	__HOGGET LOIN CHOP	_	_
__LAMB F'QTER	__MUTTON LOIN CHOP	_	_
__LAMB F'QTER	__LEG OF MUTTON	_	_
__LAMB FOREQUARTER	__PORK CHOPS	_	_
__LAMB FOREQUARTER	__PORKK PIECES	_	_
__LAMB FOREQUARTER	__LEG OF PORK	__	
__LAMB FOREQUARTER	__SLICED HAM	_	_
__LAMB FOREQUARTER	__HAM STEAKS	_	_
__LAMB FOREQUARTER	__MIDDLE BACON	_	_
__LAMB FOREQUARTER	__SHOULDER BACON	_	
__LAMB FOREQUARTER	__FISH	_	_
__LAMB FOREQUARTER	__CHICKEN	_	_
__LAMB FOREQUARTER	__SHELL FISH	_	_
__LAMB FOREQUARTER	__HAMBURGER	_	_
__LAMB FOREQUARTER	__HAMBURGER	_	_
__LAMB FOREQUARTER	__LAMBS FRY	_	_
__LAMB FOREQUARTER	__KIDNEY	_	_
__LAMB FOREQUARTER	__LUNCHEON	_	_
__LAMB FOREQUARTER	__HAM N CHICKEN	_	_
__LAMB FOREQUARTER	__SALAMI	_	_
__LAMB FOREQUARTER	__FRANKFURTER	_	_

		A COMPLETE SUBSTITUTE	CANNOT BE SUBSTITUTED
__LAMB FOREQUARTER	__BLACK PUDDING	_	_
__LAMB FOREQUARTER	__GARLIC SAUSAGE	_	_
__LEG OF HOGGET	__LAMB LOIN CHOPS	_	_
__LEG OF HOGGET	__LEG OF LAMB	_	_
__LEG OF HOGGET	__MUTTON FOREQUARTER		_
__LEG OF HOGGET	__HOGGET LOIN CHOP	_	_
__LEG OF HOGGET	__MUTTON LOIN CHOP	_	_
__LEG OF HOGGET	__LET OF MUTTON	_	_
__LEG OF HOGGET	__PORK CHOP	_	_
__LEG OF HOGGET	__PORK JKPIECES	_	_
__LEG OF HOGGET	__LEG OF PORK	_	_
__LEG OF HOGGET	__SLICED HAM	_	_
++LEG OF HOGGET	__LEG OF HAM	_	_
__LEG OF HOGGET	__HAM STEAKS	_	_
__LEG OF HOGGET	__MIDDLE BACON	_	_
__LEG OF HOGGET	__SHOULDER BACON	_	_
__LEG OF HOGGET	__FISH	_	_
__LEG OF HOGGET	__CHOCKEN	__	_
__LEG OF HOGGET	__SHELL FISH	_	_
__LEG OF HOGGET	__HAMBURGER	_	_
LEG OF HOGGET	__TRIPE	_	_
__LEG OF HOGGET	__LAMBS FRY	_	_
__LEG OF HOGGET	__KIDNEY	_	_
LEG OF HOGGET	__PORK SAUSAGES	_	_
__LEG OF HOGGET	_LUNCHEON	_	_
__LEG OF HOGGET	__HAM N CHICKEN	_	_
__LEG OF HOGGET	__SALAMI	_	_
__LEG OF HOGGET	__FRANKFURTERS	_	_
__LEG OF HOGGET	__SAVELOYS	_	_

		A COMPLETE SUBSTITUTE	CANNOT BE SUBSTITUTED
__LEG OF HOGGET	__GARLIC SAUSAGE	_	_
__LAMB LOIN CHOPS	__LEG OF LAMB	_	_
__LAMB LOIN CHOPS	__MUTTON F'QTER	_	_
__LAMB LOIN CHOPS	__HOGGET LOIN CHOPS		_
__LAMB LOIN CHOPS	__MUTTON LOIN CHOP	_	_
__LAMB LOIN CHOPS	__LEG OF MUTTON	_	_
__LAMB LOIN CHOPS	__PORK CHOPS	_	_
__LAMB LOIN CHOPS	__PORK PIECES	_	_
__LAMB LOIN CHOPS	__LEG OF PORK	_	_
__LAMB LOIN CHOPS	__SLICED HAM	_	_
__LAMB LOIN CHOPS	__LEG OF HAM	_	_
__LAMB LOIN CHOPS	__HAM STEAKS	_	_
__LAMB LOIN CHOPS	__MIDDLE BACON	_	_
__LAMB LOIN CHOPS	__SHOULDER BACON	_	_
__LAMB LOIN CHOPS	__FISH	__	_
__LAMB LOIN CHOPS	__CHICKEN	_	_
__LAMB LOIN CHOPS	__HAMBURGERS	_	_
__LAM LOIN CHOPS	__LAMBS FRY	_	_
__LLAMB LOIN CHOPS	__TRIPE	_	_
__LAMB LOIN CHOPS	__SHELL FISH	_	_
__LAMB LOIN CHOPS	__PORK SAUSAGE	_	_
__LAMB LOIN CHOPS	__KIDNEY	_	_
__LAMB LOIN CHOPS	__LUNCHEON	_	_
__LAMB LOIN CHOPS	HAM N CHICKEN	_	
__LAMB LOINC CHOPS	__SALAMI	_	_
__LAMB LOINC CHOPS	__FRANKFURTERS	_	_
__LAMB LOIN CHOPS	__SAVELOYS	_	_
__LAMB LOIN CHOPS	__BLACK PUDDING	_	_

		A COMPLETE SUBSTITUTE	CANNOT BE SUBSTITUTED
__LEG OF LAMB	__MUTTON FOREQ'TER	___	_
__LEG OF LAMB	__HOGGET LOIN CHOPS		_
__LEG OF LAMB	__MUTTON LOIN CHOPS		_
__LEG OF LAMB	__LEG OF MUTTON	_	_
__LEG OF LAMB	__PORK COPS	_	_
__LEG OF LAMB	__PORK PIECES	_	_
__LEG OF LAMB	__LEG OF PORK		_
__LEG OF LAMB	__SLICED HAM	_	_
__LEG OF LAMB	__LEG OF HAM	_	_
__LEG OF LAMB	__HAM STEAKS	_	_
__LEG OF LAMB	__MIDDLE BACON		
__LEG OF LAMB	__SHOULDER BACON	_	_
__LEG OF LAMB	__FISH	__	_
__LEG OF LAMB	__CHICKEN	_	_
__LEG OF LAMB	__SHELLFISH	_	_
__LEG OF LAMB	__TRIPE	_	_
__LEG OF LAMB	__LAMBS FRY	_	_
__LEG OF LAMB	__KIDNEY	_	_
__LEG OF LAMB	__PORK SAUSAGE	_	_
__LEG OF LAMB	__LUNCHEON	_	_
__LEG OF LAMB	__HAM N CHICKEN	_	_
__LEG OF LAMB	__SALAMI	_	_
__LEG OF LAMB	__FRANKFURTERS	_	_
__LEG OF LAMB	__SAVELOYS	_	_
__LEG OF LAMB	__BLACK PUDDING	_	_
__LEG OF LAMB	__GARLIC SAUSAGE	_	_

		A COMPLETE SUBSTITUTE	CANNOT BE SUBSTITUTED
__MUTTON F'QTER	__HOGGET LOIN CHOP	_	_
__MUTTON F'QTER	__MUTTON LOIN CHOPS		_
__MUTTON F'QTER	__LEG OF MUTTON	_	_
__MUTTON F'QTER	__PORK CHOPS	_	_
__MUTTON F'QTER	__PORK PIECES		
__MUTTON F'QTER	__LEG OF PORK	_	_
__MUTTON F'QTER	__SLICED HAM	_	_
__MUTTON F'QTER	__LEG OF HAM	_	_
__MUTTON F'QTER	__HAM STEAKS	_	_
__MUTTON F'QTER	__MIDDLE BACON	_	_
__MUTTON F'QTER	__SHOULDER BACON	_	_
__MUTTON F'QTER	__FISH	_	_
__MUTTON F'QTER	__CHICKEN	_	_
__MUTTON F'QTER	__SHELL FISH	_	_
__MUTTON F'QTER	__TRIPE	_	_
__MUTTON F'QTER	__LAMBS FRY	_	_
__MUTTON F'QTER	__KIDNEY	_	_
__MUTTON F'QTER	__PORK SAUSAGE	_	_
__MUTTON F'QTER	__LUNCHEON	_	_
__MUTTON F'QTER	__HAM N CHICKEN	_	_
__MUTTON F'QTER	__SALAMI	_	_
__MUTTON F'QTER	__FRANKFURTER	_	_
__MUTTON F'QTER	__ SAVELOYS	_	_
__MUTTON F'QTER	__BLACK PUDDING	_	_
__MUTTON F'QTER	__GARLIC SAUSAGE	_	_
__HOGGET LOIN CHOP	__MUTTON LOIN CHOP	_	_
__HOGGET LOIN CHOPS	__LEG OF MUTTON	_	_
__HOGGET LOIN CHOP	__PORK CHOP	_	_
__HOGGET LOIN CHOP	__SLICED HAM	_	_
__HOGGET LOIN CHOP	__LEG OF HAM		
__HOGGET LOIN CHOP	__HAM STEAKS	_	_
__HOGGET LOIN CHOP	__MIDDLE BACON	_	_
__HOGGET LOIN CHOP	__SHOULDER BACON		
__HOGGET LOIN CHOP	__FISH	_	_
__HOGGET LOIN CHOP	__CHICKEN	_	_
__HOGGET LOIN CHOP	__SHELLFISH	_	_
__HOGGET LOIN CHOP	__HAMBURGERS	_	_
__HOGGET LOIN CHOP	__TRIPE	_	_
__HOGGET LOIN CHOPS	__LAMBS FRY_	_	_
__HOGGET LOIN CHOP	__KIDNEY		_
__HOGGET LOIN CHOP	__PORK SAUSAGE	_	_
_HOGGET LOIN CHOP	__LUNCHEON	_	_
__HOGGET LOIN CHOP	__HAM N CHICKEN	_	_
__HOGGET LOIN CHOP	__SALAMI	_	_
__HOGGET LOIN CHOP	__FRANKFURTERS	_	
__HOGGET LOIN CHOP	__SAVELOYS	_	_
__HOGGET LOIN CHOP	__BLACK KJPUDDING	_	_
__HOGGET LOIN CHOP	__GARLIC SAUSAGE	_	_
__MUTTON LOIN CHOPS	__LEG OF MUTTON	_	_
__MUTTON LOIN SHOP	__PORK CHOPS	_	_
__MUTTON LOIN CHOPS	__PORK PIECES_	_	_
__MUTTON LOIN CHOP	__LEG OF PORK	_	_
__MUTTON LOIN CHOP	__SLICED HAM	_	_
__MUTON LOIN CHOP	__LEG OF HAM	_	_
__MUTTON LOIN CHOP	__HAM STEAKS	_	_
__MUTTON LOIN CHOP	__MIDDLE BACON	_	_
__MUTTON LOIN CHOP	__SHOULDER BACON	_	_
__MUTTON LOIN CHOP	__FISH	_	_

		A COMPLETE SUBSTITUTE	CANNOT BE SUBSTITUTED
__MUTTON LOINCHOP	__SHELLFISH	_	_
__MUTTON LOIN CHOP	__HAMBURGER	_	_
__MUTTON LOIN CHOP	__TRIPE	_	_
__MUTTON LOIN CHOP	__LAMBS FRY	_	_
__MUTTON LOIN CHOP	__KIDNEY	_	_
__MUTTON LOIN CHOP	__PORK SAUSAGE	_	_
__MUTTON LOIN CHOP	__LUNCHEON	_	_
__MUTTON LOIN CHOP	__HAM N CHICKEN	_	_
__MUTTON LOIN CHOP	__SALAMI	_	_
__MUTTON LOIN CHOP	__FRANKFURTERS	_	_
__MUTTON LOIN CHOP	__SAVELOYS	_	_
__MUTTON LOIN CHOP	__BLACK PUDDING	_	_
__MUTTON LOIN CHP	__GARLIC SAUSAGE	_	_
__LEG OF MUTTON	__PORK CHOPS	_	_
__LEG OF MUTTON	__PORK PIECES	_	_
__LEG OF LMUTTON	__LE OF PORK	_	_
__LEG OF MUTTON	__SLICED HAM	_	_
__LEG OF MUTTON	__LEG OF HAM	_	_
__LEG OF MUTTON	__HAM STEAKS	_	_
__LEG OF MUTTON	__MIDDLE BACON	_	_
__LEG OF MUTTON	__SHOULDER BACON	_	_
__LEG OF LMUTTON	__FISH	_	_
__LEG OF MUTTON	__CHICKEN	_	_
__LEG OF MUTTON	__SHELLFISH	_	_
__LEG OF MUTTON	__TRIPE	_	_
__LEG OF MUTTON	__LAMBS FRY	_	_
__LEG OF MUTTON	__KIDNEY	_	_
__LEG OF MUTTON	__PORK SAUSAGE	_	_

		A COMPLETE SUBSTITUTE	CANNOT BE SUBSTITUTED
__LEG OF MUTTON	__HAM-N-CHICKEN	_	_
__LEG OF MUTTON	__SALAMI	_	_
__LEG OF MUTTON	__FRANKFURTERS	_	_
__LEG OF MUTTON	__BLACK PUDDING	_	_
__LEG OF MUTTON	__GARLIC SAUSAGE	_	_
__PORK CHOPS	__PORK PIECES	_	_
__PORK CHOPS	__LEG OF PORK	_	_
__PORK CHPS	__SLICED HAM	_	_
__PORK CHOPS	__LEG OF HAM	_	_
__PORK CHOPS	__HAM STEAKS	_	_
__PORK CHOPS	__MIDDLE BACON	_	_
__PORK CHOPS	__SHOULDER BACON	_	_
__PORK CHOPS	__FISH	__	
__PORK CHOPS	__CHICKEN	_	_
__PORK CHOPS	__SHELLFISH	_	_
__PORK CHOPS	__HAMBURGERS	_	_
__PORK CHOPS	__TRIPE	_	_
__PORK CHOPS	__LAMBS FRY	_	_
__PORK CHOPS	__KIDNEY	_	_
__PORK CHOPS	__PORK SAUSAGE	_	_
__PORK CHOPS	__LUNCHEON	_	_
__PORK CHOPS	__HAM N CHICKEN	_	_
__PORK CHOPS	__SALAMI	_	_
__PORK CHOPS	__FRANKFURTERS	_	_
__PORK CHOPS	__SAVELOYS	_	_
__PORK CHOPS	__BLACK PUDDING	_	_
__PORK CHOPS	__GARLIC SAUSAGE	_	_

		A COMPLETE SUBSTITUTE	CANNOT BE SUBSTITUTED
PORK PIECES	__LEG OF PORK	_	_
__PORK PIECES	__SLICED HAM	_	_
PORK PIECES	__LEG OF HAM	_	_
__PORK PIECES	__HAM STEAKS	_	_
__PORK PIECES	__MIDDLE BACON	_	_
__PORK PIECES	__SHOULD BACON	_	_
PORK PIECES	__FISH	_	_
__PORK PIECES	__CHICKEN	_	_
__PORK PIECES	__CHICKEN	_	_
__PORK PIECES	__SHELLFISH	_	_
__PORK PIECES	__HAMBURGERS	_	_
__PORK PIECES	__TRIPE	_	_
__PORK PIECES	__LAMBS FRY	_	_
__PORK PIECESS	__KIDNEY	_	_
__PORK PIECES	__PORK SAUSAGE	_	_
__PORK PIECES	__LUNCHEON	_	_
__PORK PIECES	__HAM N CHICKEN	_	_
__PORK PIECES	__SALAMI	_	_
__PORK PIECES	__FRANKFURTERS	_	_
__PORK PIECES	__BLACK PUDDING	_	_
__PORK PIECES	__GARLIC SAUSAGE	_	_
LEG OF PORK	__SLICED HAM	_	_
__LEG OF PORK	__LEG OF HAM	_	_
__LEG OF PORK	__HAM STEAKS	_	_
__LEG OF PORK	__MIDDLE BACON	_	_
__LEG OF PORK	__SHOULDER BACON	_	_
__LEG OF PORK	__CHICKEN	_	_
__LEG OF PORK	__SHELLFISH	_	_

		A COMPLETE SUBSTITUTE	CANNOT BE SUBSTITUTED
__LEG OF PORK	__HAMBURGERS	_	_
__LEG OF PORK	__TRIPE	_	_
__LEG OF PORK	__LAMBS FRY	_	_
__LEG OF PORK	__KIDNEY	_	_
__LEG OF PORK	__PORK SAUSAGE	_	_
__LEG OF PORK	__LUNCHEON	_	_
__LEG OF PORK	__HAM N CHICKEN	_	_
__LEG OF PORK	__SALAMI	_	_
__LEG OF PORK	__FRANKFURTERS	_	_
__LEG OF PORK	__BLACK PUDDING	_	_
__LEG OF PORK	__SAVELOYS	_	_
__LEG OF PORK	__GARLIC SAUSAGE	_	_
__SLICED HAM	__LEG OF HAM	_	_
__SLICED HAM	__HAM STEAKS	_	_
__SLICED HAM	__MIDDLE BACON	_	_
__SLICED HAM	__SHOULDER BACON	_	_
__SLICED HAM	__FISH	_	_
__SLICED HAM	__CHICKEN	_	_
__SLICED HAM	__SHELLFISH	_	_
__SLICED HAM	__HAMBURGERS	_	_
__SLICED HAM	__TRIPE	_	_
__SLICED HAM	__LAMBS FRY	_	_
__SLICED HAM	__KIDNEY	_	_
__SLICED HAM	__PORK SAUSAGE	_	_
__SLICED HAM	__LUNCHEON	_	_
__SLICED HAM	__HAM N CHICKEN	_	_
__SLICED HAM	__SALAMI	_	_
__SLICED HAM	__FRANKFURTERS	_	_

		A COMPLETE SUBSTITUTE	CANNOT BE SUBSTITUTED
__SLICED HAM	__BLACK PUDDING	_	_
_SLICED HAM	__GARLIC SAUSAGE	_	_
__LEG OF HAM	__HAM STEAKS	_	_
__LEG OF HAM	__MIDDLE BACON	_	_
__LEG OF HAM	__SHOULDER BACON	_	_
__LEG OF HAM	__FISH	__	_
__LEG OF HAM	__CHICKEN	_	_
__LEG OF HAM	__SHELLFISH	_	_
__LEG OF HAM	__HAMBURGERS	_	_
__LEG OF HAM	__TRIPE	_	_
__LEG OF HAM	__LAMBS FRY		
__LEG OF HAM	__KIDNEY	_	_
__LEG OF HAM	__PORK SAUSAGE	_	_
__LEG OF HAM	__LUNCHEON	_	_
__LEG OF HAM	__HAM N CHICKEN	_	_
__LEG OF HAM	__SALAMI	_	_
__LEG OF HAM	__FRANKFURTERS	_	_
__LEG OF HAM	__BLACK PUDDING	_	_
__LEG OF HAM	__GARLIC SAUSAGE	_	_
__HAM STEAKS	__MIDDLE BACON	_	_
__HAM STEAKS	__SHOULDER BACON	_	_
____HAM STEAKS	__FISH	_	_
__HAM STEAKS	__CHICKEN	_	_
__HAM STEAKS	__SHELLFISH	_	_
__HAM STEAKS	__HAMBURGERS	_	_
__HAM STEAKS	__TRIPE	_	_
__HAM STEAKS	__LAMBS FRY	_	_
__HAM STEAKS	__KIDNEY	_	_

		A COMPLETE SUBSTITUTE	CANNOT BE SUBSTITUTED
__HAM STEAKS	__HAM N CHICKEN	__	_
__HAM STEAKS	__SALAMI	_	_
__HAM STEAKS	__FRANKFURTERS	_	_
__HAM STEAKS	__BLACK PUDDING	_	_
__HAM STEAKS	__GARLIC SAUSAGE	_	_
MIDDLE BACON	__SHOULDER BACON		
__MIDDLE BACON	__FISH	_	_
__MIDDLE BACON	__CHICKEN	_	_
__MIDDLE BACON	__SHELLFISH	_	_
__MIDDLE BACON	__HAMBURGERS	_	_
__MIDDLE BACON	__TRIPE	_	_
__MIDDLE BACON	__LAMBS FRY	_	_
__MIDDLE BACON	__KIDNEY	_	_
__MIDDLE BACON	__PORK SAUSAGE	_	_
__MIDDLE BACON	__LUNCHEON	_	_
__MIDDLE BACON	__HAM N CHICKEN	_	_
__MIDDLE BACON	__SALAMI	_	_
__MIDDLE BACON	__FRANKFURTERS	_	_
__MIDDLE BACON	__BLACK PUDDING	_	_
__MIDDLE BACON	__GARLIC SAUSAGE	_	_
__MIDDLE BACON	__SAVELOYS	_	_
_			
__HAM STEAKS	__SAVELOYS	_	_
__SHOULDER BACON	__FISH	_	_
__SHOULDER BACON	__CHICKEN	_	_
__SHOULDER BACON	__SHELLFISH	_	_
__SHOULDER BACON	__HAMBURGERS	_	_

		A COMPLETE SUBSTITUTE	CANNOT BE SUBSTITUTED
__SHOULDER BACON	__LAMBS FRY	_	_
__SHOULDER BACON	__KIDNEY	_	_
__SHOULDER BACON	__PORK SAUSAGES	_	_
__SHOULDER BACON	__LUNCHEON	_	_
__SHOULDER BACON	__HAM N CHICKEN	_	_
__SHOULDER BACON	__SALAMI	_	_
__SHOULDER BACON	__FRANKFURTERS	_	_
__SHOULDER BACON	__SAVELOYS	_	_
__SHOULDER BACON	__BLACK PUDDING	_	_
__SHOULDER BACON	__GARLIC SAUSAGE		
__FISH	__CHICKEN	_	_
___FISH	__SHELLFISH	_	_
__FISH	__HAMBURGERS	_	_
__FISH	__TRIPE	_	_
__FISH	__LAMBS FRY	_	_
__FISH	__KIDNEY	_	_
__FISH	__PORK SAUSAGE	_	_
__FISH	__LUNCHEON	_	_
__FISH	__HAM N CHICKEN	_	_
__FISH	__SALAMI	_	_
__FISH	__FRANKFURTERS	_	_
__FISH	__SAVELOYS	_	_
__FISH	__BLACK PUDDING	_	_
__FISH	__GARLIC SAUSAGE	_	_
__CHICKEN	__SHELLFISH	_	_
__CHICKEN	__HAMBURGERS	_	_
__CHICKEN	__TRIPE	_	_
__CHICKEN	__LAMBS FRY		

		A COMPLETE SUBSTITUTE	CANNOT BE SUBSTITUTED
__CHICKEN	__KIDNEY	_	_
__CHICKEN	__PORK SAUSAGE	_	_
_CHICKEN	__LUNCHEON	_	_
__CHICKEN	__HAM N CHICKEN	_	_
__CHICKEN	__SALAMI	_	_
__CHICKEN	__FRANKFURTERS	_	_
__CHICKEN	__SAVELOYS	_	_
__CHICKEN	__BLACK PUDDING	_	_
__CHICKEN	__GARLIC SAUSAGE	_	_
__SHELLFISH	__HAMBURGERS	_	_
__SHELLFISH	__TRIPE	_	_
__SHELLFISH	__LAMBS FRY	_	_
__SHELLFISH	__KIDNEY	_	_
__SHELLFISH	__PORK SAUSAGE	_	_
__SHELLFISH	__LUNCHEON	_	_
__SHELLFISH	__HAM N CHICKEN	_	_
__SHELLFISH	__SALAMI	_	_
__SHELLFISH	__FRANKFURTERS	_	_
__SHELLFISH	__SAVELOYS	_	_
__SHELLFISH	__BLACK PUDDING	_	_
__SHELLFISH	__GARLIC SAUSAGE	_	_
_ TRIPE	__LAMBS FRY	_	_
__TRIPE	__KIDNEY	_	_
__TRIPE	__PORK SAUSAGE	_	_
__TRIPE	__LUNCHEON	_	_
__TRIPE	HAM N CHICKEN	_	_
TRIPE	SALAMI		

		A COMPLETE SUBSTITUTE	CANNOT BE SUBSTITUTED
__TRIPE	__FRANKFURTERS	_	_
__TRIPE	__SAVELOYS	_	_
__TRIPE	__BLACK PUDDING	_	_
__TRIPE	__GARLIC SAUSAGE	_	_
__LAMBS FRY	__KIDNEY	_	_
__LAMBS FRY	__PORK SAUSAGE	_	_
__LAMBS FRY	__LUNCHEON	_	_
__LAMBS FRY	__HAM N CHICKEN	_	_
__LAMBS FRY	__SALAMI	_	_
__LAMBS FRY	__FRANKFURTERS	_	_
__LAMBS FRY	__SAVELOYS	_	_
LAMBS FRY	__BLACK PUDDING	_	_
__LAMBS FRY	__GARLIC SAUSAGE	_	_
KIDNEY	__PORK SAUSAGE	_	_
__KIDNEY	__LUNCHEON	_	_
__KIDNEY	__HAM N CHICKEN	_	_
__KIDNEY	__SALAMI	_	_
__KIDNEY	__FRANKFURTERS	_	_
__KIDNEY	__SAVELOYS	_	_
__KIDNEY	__BLACK PUDDING	_	_
__KIDNEY	__GARLIC SAUSAGE	_	_
PORK SAUSAGE	__LUNCHEON	_	_
__PORK SAUSAGE	__HAM N CHICKEN	_	_
__PORK SAUSAGE	__SALAMI	_	_
__PORK SAUSAGE	__FRANKFURTERS	_	_

		A COMPLETE SUBSTITUTE	CANNOT BE SUBSTITUTED
__PORK SAUSAGE	__GARLIC SAUSAGE	_	_
__LUNCHEON	__HAM N CHICKEN	_	_
__LUNCHEON	__SALAMI	_	_
__LUNCHEON	__FRANKFURTERS	_	_
__LUNCHEON	__SAVELOYS	_	_
__LUNCHEON	__BLACK PUDDING	_	_
__LUNCHEON	__GARLICK SAUSAGE	_	_
__HAM N CHICKEN	__SALAMI		
__HAM N CHICKEN	__FRANKFURTERS		
__HAM N CHICKEN	__SAVELOYSD	_	_
__HAM N CHICKEN	__BLACK PUDDING	_	_
__HAM N CHICKEN	__GARLIC SAUSAGE	_	_
__SALAMI	__FRANKFURTERS	_	_
__SALAMI	__SAVELOYS	_	_
__SALAMI	__BLACK PUDDING	_	_
__SALAMI	__GARLIC SAUSAGE	_	_
__SAVELOYS	__BLACK PUDDING	_	_
__SAVELOYS	__GARLIC SAUSAGE	_	_
__FRANKFURTERS	__SAVELOYS	_	_
__FRANKFURTERS	__BLACK PUDDING	_	_
__FRANKFURTERS	__GARLIC SAUSAGE	_	_
__BLACK PUDDING	__GARLIC SAUSAGE	_	_

Appendix 8.2 Scale Values for the 15 Meats 3-Dimensional Substitutability Space.

Meat	Scale Values		
	Dimension 1 x-axis	Dimension 2 y-axis	Dimension 3 z-axis
Salami	-0.552	0.741	0.447
Beef	0.870	0.220	0.106
Veal	0.774	0.076	0.403
Mutton	0.758	-0.238	-0.041
Hogget	0.838	-0.131	-0.015
Lamb	0.800	-0.153	0.021
Pork	-0.713	-0.228	-0.225
Bacon	-0.788	0.713	-0.495
Ham	-0.388	0.689	-0.104
Sausages	-0.888	0.640	0.021
Offal	-1.355	-0.905	-0.556
Fish	-0.548	-0.494	0.469
Chicken	0.282	-0.217	-0.259
Turkey	0.200	-0.507	-0.704
Shellfish	-0.714	-0.662	0.930

Appendix 8.3 Lower Half Matrix of Substitutability Measurements for the 41 Meat Cuts.

Wienersnitzel	0.00														
Rump steak	0.12	0.00													
Porterhouse steak	0.59	0.45	0.00												
Stewing steak	0.75	1.09	1.52	0.00											
Topside	0.32	0.48	0.72	0.67	0.00										
Beef mince	0.73	0.73	1.63	0.20	0.47	0.00									
Beef tongue	1.36	0.00	1.43	0.63	1.08	0.89	0.00								
Beef hearts	3.49	0.00	1.77	1.63	1.95	1.64	0.80	0.00							
Beef tripe	0.23	0.16	0.31	1.03	0.14	0.66	1.19	1.76	0.00						
Corned beef	0.86	0.91	1.43	0.48	0.72	0.44	0.61	1.34	0.80	0.00					
Beef sausage	0.27	0.44	0.84	0.39	0.21	0.33	1.07	1.62	0.40	0.66	0.00				
Lamb forequarter	0.09	0.31	0.41	0.66	0.06	0.75	1.02	1.94	0.14	1.06	0.20	0.00			
Lamb loin chops	0.17	0.36	0.66	0.69	0.09	0.66	1.20	2.22	0.27	1.07	0.47	0.30	0.00		
Leg of lamb	0.45	0.05	0.19	1.18	0.44	0.99	1.33	2.22	0.08	1.42	1.14	0.27	0.70	0.00	
Lamb's fry	0.72	1.08	1.29	0.20	0.61	0.10	0.66	1.51	0.78	0.08	0.98	1.21	0.98	1.52	0.00
Lamb's kidney	0.30	0.56	0.76	0.40	0.23	0.47	1.02	1.93	0.44	0.87	0.02	0.81	0.25	0.97	0.72
	0.00														
Hogget loin chops	0.65	1.27	1.08	0.00	0.60	0.08	0.75	1.61	0.70	0.32	0.81	1.25	0.87	1.43	0.49
	1.07	0.00													
Leg of hogget	0.33	0.63	1.00	0.27	0.41	0.13	0.79	1.51	0.59	0.47	0.47	0.87	0.26	1.08	1.27
	0.30	0.58	0.00												
Mutton forequarter	0.50	0.22	0.24	1.07	0.41	1.15	1.51	2.22	0.41	1.21	0.82	0.34	0.62	0.03	1.12
	0.66	1.18	0.63	0.00											
Leg of mutton	0.23	0.05	0.53	0.69	0.16	0.74	1.41	2.22	0.16	1.09	0.64	0.07	0.32	0.19	1.02
	0.44	0.96	0.41	0.67	0.00										
Pork chops	0.80	0.48	0.31	1.42	0.87	1.20	1.76	2.22	0.80	1.36	1.19	0.83	1.00	0.31	1.34
	1.03	1.41	0.98	0.70	1.03	0.00									
Pork pieces	0.57	0.20	0.06	0.98	0.51	1.08	1.62	2.22	0.59	1.61	0.91	0.50	0.77	0.16	1.11
	0.67	0.89	0.77	0.18	0.69	0.14	0.00								
Leg of pork	0.89	0.58	0.13	1.43	0.97	1.63	2.22	2.22	0.86	2.21	1.32	0.73	1.13	0.63	1.50
	1.03	1.32	1.03	0.59	1.04	0.15	0.66	0.00							
Sliced ham	0.00	0.16	0.06	0.93	0.33	0.82	1.61	1.94	0.24	1.32	0.74	0.38	0.61	0.07	1.01
	0.59	0.94	0.73	0.11	0.40	0.29	0.09	0.73	0.00						
Leg of ham	0.06	0.56	0.86	0.31	0.13	0.30	0.89	2.22	0.14	0.90	0.12	0.17	0.08	0.48	0.49
	0.08	0.50	0.25	0.48	0.14	1.12	0.76	1.19	0.76	0.00					
Ham steaks	0.16	0.47	0.85	0.26	0.13	0.29	1.03	1.94	0.16	0.87	0.05	0.16	0.09	0.44	0.43
	0.11	0.23	0.25	0.55	0.08	1.06	0.87	1.34	0.76	0.31	0.00				
Middle bacon	0.54	0.15	0.08	1.00	0.45	1.08	1.52	2.22	0.25	1.26	0.58	0.30	0.66	0.06	1.11
	0.69	1.03	0.73	0.06	0.41	0.39	0.02	0.49	0.08	0.59	0.50	0.00			
Shoulder bacon	0.91	0.44	0.18	1.76	0.81	1.63	1.77	2.22	0.64	1.76	0.98	0.85	1.34	0.41	1.41
	0.98	1.58	1.03	0.25	0.77	0.11	0.18	0.26	0.12	0.87	0.88	0.53	0.00		
Fish	0.01	0.25	0.42	0.23	0.11	0.00	0.82	1.36	0.11	0.21	0.03	0.11	0.05	0.25	0.29
	0.11	0.24	0.14	0.29	0.11	0.41	0.44	0.73	0.28	0.00	0.01	0.55	0.49	0.00	
Chicken	1.43	1.37	1.53	0.58	0.00	1.10	0.61	1.35	1.19	0.61	0.98	1.53	1.28	1.93	0.44
	1.20	0.39	0.50	1.52	1.23	1.64	1.76	3.49	1.43	1.18	0.95	1.62	2.21	0.31	0.00
Shellfish	1.44	1.95	1.76	1.34	1.94	1.34	0.45	0.01	1.94	1.19	1.43	1.52	1.76	2.22	0.98
	1.52	1.24	1.11	1.94	1.77	3.49	1.94	1.94	1.52	1.41	1.43	1.92	1.93	0.98	0.88
	0.00														
Hamburgers	0.76	0.87	1.34	0.16	0.60	0.18	0.43	0.97	0.98	0.03	0.61	0.74	0.50	1.14	0.05
	0.43	0.11	0.25	1.19	0.64	1.14	0.97	1.34	0.82	0.40	0.49	1.18	1.51	0.37	0.13
	1.18	0.00													
Pork sausages	1.13	1.15	1.52	0.45	0.89	0.48	0.21	1.00	1.18	0.49	0.91	0.97	1.11	1.52	0.25
	0.68	0.43	0.70	1.52	0.90	1.53	1.52	1.63	1.26	0.68	0.94	1.61	1.93	0.62	0.57
	0.92	0.30	0.00												
Luncheon	1.36	1.21	1.42	0.43	0.98	0.52	0.84	1.27	1.07	0.00	0.73	1.18	1.06	1.93	0.24
	1.06	0.10	0.50	1.63	1.07	1.65	1.63	1.76	0.95	0.77	0.67	1.32	2.21	0.20	0.27
	1.02	0.14	0.21	0.00											
Ham'n'chicken	1.43	1.65	1.76	0.79	1.36	0.89	0.51	1.33	1.19	0.26	1.34	1.27	1.91	1.93	0.56
	1.40	0.50	0.93	1.52	1.42	1.63	1.94	2.22	1.13	0.91	0.76	1.32	3.49	0.33	0.18
	0.97	0.24	0.08	0.57	0.00										
Salami	1.43	1.77	1.62	0.85	1.28	0.88	0.55	1.25	1.19	0.27	1.26	1.34	1.51	2.22	0.44
	1.41	0.52	0.85	1.42	1.34	1.76	1.94	2.22	1.03	1.07	0.81	1.32	2.21	0.34	0.24
	1.08	0.20	0.10	0.57	0.08	0.00									
Frankfurters	1.63	1.77	1.62	0.69	1.02	0.88	0.32	0.98	1.13	0.26	1.12	1.26	1.11	1.40	0.44
	0.92	0.46	0.72	1.26	0.98	1.43	1.50	1.75	1.18	0.87	0.88	1.03	1.93	0.58	0.54
	0.98	0.34	0.03	0.49	0.26	0.19	0.00								
Saveloys	2.23	2.23	1.94	0.88	1.42	1.52	0.33	0.99	1.33	0.66	1.75	1.62	1.93	1.94	0.91
	1.61	0.79	1.11	1.76	1.52	1.94	1.94	2.22	1.61	1.12	1.03	1.61	3.49	0.61	0.56
	0.88	0.51	0.05	0.76	0.36	0.66	0.30	0.00							
Black pudding	1.77	1.95	1.76	1.13	1.26	1.20	0.44	1.20	1.33	0.93	1.74	1.42	1.75	3.49	0.77
	1.93	0.44	0.81	1.63	1.63	1.63	1.94	2.22	1.25	1.06	0.83	1.74	3.49	0.56	0.90
	1.02	0.33	0.13	0.88	0.32	0.38	0.09	0.25	0.00						
Garlic sausage	2.23	3.49	1.94	1.52	1.43	1.43	0.03	0.52	1.33	0.75	1.62	1.94	1.74	1.94	0.78
	1.41	0.67	1.18	2.23	1.52	2.23	1.94	2.22	1.62	1.25	0.95	1.49	3.49	0.93	1.00
	0.42	0.70	0.45	1.25	1.08	1.01	0.69	0.24	0.77	0.00					
	3.49	3.49	1.94	1.32	1.38	1.21	0.18	0.77	1.51	0.48	1.50	1.62	1.61	1.50	0.74
	1.50	0.79	0.90	1.63	1.43	1.76	1.76	1.94	1.52	1.12	1.14	1.24	3.49	0.62	0.66
	0.61	0.42	0.30	0.68	0.39	0.44	0.83	0.66	0.25	0.36	0.00				
	1.01	0.54	0.28	1.86	0.91	1.73	1.87	2.32	0.74	1.86	1.08	0.95	1.44	0.51	1.51
	1.08	1.68	1.13	0.35	0.87	0.21	0.28	0.36	0.22	0.97	0.98	0.63	0.10	0.59	2.31
	2.03	1.61	2.03	2.31	3.49	2.31	2.03	3.49	3.49	3.49	3.49	0.00			
	1.11	0.64	0.38	1.96	1.01	1.83	1.97	2.42	0.84	1.96	1.18	1.05	1.54	0.61	1.61
	1.18	1.78	1.23	0.45	0.97	0.31	0.38	0.46	0.32	1.07	1.08	0.73	0.20	0.69	2.41
	2.13	1.71	2.13	2.41	3.49	2.41	2.13	3.49	3.49	3.49	3.49	0.10	0.00		
	1.21	0.74	0.48	2.06	1.11	1.93	2.07	2.52	0.94	2.06	1.28	1.15	1.64	0.71	1.71
	1.28	1.88	1.33	0.55	1.07	0.41	0.48	0.56	0.42	1.17	1.18	0.83	0.30	0.79	2.51
	2.23	1.81	2.23	2.51	3.49	2.51	2.23	3.49	3.49	3.49	3.49	0.20	0.10	0.00	

Appendix 8.4 Scale Values for the 41 Meat Cuts in the Meat Substitutability Space.

Meat	Scale Values		
	Dimension 1	Dimension 2	Dimension 3
Wienersnitzel	-0.366	-0.582	-0.493
Rump steak	-0.497	-0.854	-0.134
Porterhouse steak	-0.111	-0.570	-0.899
Stewing steak	0.988	-0.485	-0.493
Topside	0.882	0.216	-0.637
Beef mince	0.076	-0.848	-0.258
Beef tongue	0.246	0.391	0.462
Beef hearts	0.155	0.504	-0.158
Beef tripe	0.641	0.810	0.114
Corned beef	0.642	0.539	0.232
Beef sausages	0.462	0.036	-0.373
Lamb forequarter	0.573	0.920	-0.495
Lamb loin chops	0.909	0.480	-0.028
Leg of lamb	0.305	-0.096	-0.771
Lamb's liver	-0.168	0.488	-0.858
Lamb's kidney	0.383	0.526	-0.916
Hogget loin chops	0.554	-0.683	-0.616
Leg of hogget	-0.196	-0.757	0.649
Mutton forequarter	1.110	-0.257	0.451
Mutton loin chops	0.434	-0.222	0.667
Leg of mutton	0.823	-0.311	0.224
Pork chops	0.217	-1.047	-0.006
Pork pieces	0.594	-0.884	0.436
Leg of pork	0.178	-0.742	0.901
Sliced ham	-0.598	-0.655	0.226
Leg of ham	-0.702	-0.203	0.587
Ham steaks	-0.815	-0.661	-0.305
Middle bacon	-0.686	0.365	-0.692
Shoulder bacon	-0.660	0.541	0.045
Fish	-0.298	0.034	-0.823
Chicken	-0.400	0.918	-0.241
Shellfish	-0.670	0.533	-0.065
Hamburger	-0.439	0.129	0.610
Pork sausages	-0.595	0.203	0.161
Luncheon	-0.696	0.530	0.481
Ham'n'chicken	-0.397	-0.057	0.935
Salami	0.013	0.526	0.712
Frankfurters	0.565	0.393	1.173
Saveloys	-0.228	0.969	0.620
Black pudding	-1.263	-0.055	0.099
Garlic sausage	-1.053	-0.083	-0.527

Appendix 8.5a Scale Values for the 8 Beef Cut in the Substitutability Space

Meat	Dimension 1 x-axis	Dimension 2 y-axis	Dimension 3 z-axis
Wienersnitzel	-0.463	0.670	0.198
Rump steak	-0.573	0.393	-0.676
Porterhouse steak	-0.083	-0.043	0.019
Stewing steak	1.579	0.071	-0.038
Topside	0.063	-0.799	-0.267
Beef mince	0.314	0.502	0.454
Corned beef	-0.499	-0.685	0.470
Beef sausage	0.662	-0.108	-0.159

APPENDIX 8.5b : Mean Substitutability Ratings Beef Cuts

Meat	Weinersnitzel	Rump Steak	Porterhouse Steak	Stewing Steak	Topside	Beef Mince	Corned Beef	Beef Sausages
Weinersnitzel	1.00							
Rump Steak	4.55	1.00						
Porterhouse Steak	4.40	4.88	1.00					
Stewing Steak	5.60	5.73	5.75	1.00				
Topside	5.35	5.27	5.13	5.44	1.00			
Beef Mince	3.31	5.00	5.40	4.96	5.33	1.00		
Corned Beef	5.25	5.44	3.40	5.72	4.16	5.07	1.00	
Beef Sausage	4.95	5.20	5.52	4.20	4.92	4.56	4.92	1.00

Appendix 8.6a Scale Values for 8 Sheep Meat Cuts in the Meat Substitutability Space

Meat	Scale Values		
	Dimension 1 x-axis	Dimension 2 y-axis	Dimension 3 z-axis
Lamb forequarter	0.089	-0.632	0.173
Leg of hogget	0.125	-0.113	-0.679
Lamb loin chops	-1.015	-0.113	0.393
Leg of lamb	1.135	-0.090	0.116
Mutton forequarter	-0.152	-0.968	-0.436
Hogget loin chops	-0.635	0.433	-0.802
Leg of mutton	0.563	0.513	-0.627

APPENDIX 8.6b: Mean Substitutability Ratings for 8 Sheep Meat Cuts

Meat	Lamb Foreq'ter	Leg of Hogget	Lamb Loin Chops	Leg of Lamb	Mutton Foreq'ter	Hogget Loin Chops	Mutton Loin Chops	Leg of Mutton
Lamb Foreq'ter	1.00							
Leg of Hogget	2.81	1.00						
Lamb Loin Chops	4.12	4.01	1.00					
Leg of Lamb	3.95	4.11	4.96	1.00				
Mutton Foreq'ter	2.83	4.43	4.75	5.03	1.00			
Hogget Loin Chops	4.60	4.68	4.23	5.44	4.77	1.00		
Mutton Loin Chops	4.52	4.01	4.76	5.08	4.84	4.68	1.00	
Leg of Mutton	4.39	4.09	5.23	3.84	4.92	4.01	4.49	1.00

Appendix 3.7a Scale Values for 8 Pork Cuts in the Meat Substitutability Space

Meat	Scale Values		
	Dimension 1 x-axis	Dimension 2 y-axis	Dimension 3 z-axis
Pork chops	0.513	-0.364	0.961
Pork pieces	-1.078	-0.083	-0.023
Leg of pork	0.053	1.150	0.124
Sliced ham	0.357	-0.263	-0.778
Leg of ham	0.742	0.410	0.194
Ham steaks	0.653	-0.642	-0.451
Middle bacon	-0.487	0.333	-0.440
Shoulder bacon	-0.753	-0.541	0.411

APPENDIX 8.7b: Mean substitutability Ratings for 8 Pig Meat cuts

	Pork Chops	Pork Pieces	Leg of Pork	Sliced Ham	Leg of Ham	Ham Steaks	Middle Bacon	Shoulder Bacon
Pork Chops	1.00							
Pork PIeces	5.68	1.00						
Leg of Pork	5.49	5.43	1.00					
Sliced Ham	5.40	5.48	5.00	1.00				
Leg of Ham	4.45	5.40	4.47	4.21	1.00			
Ham steaks	4.73	5.49	5.20	4.11	4.93	1.00		
Middle Bacon	4.99	3.99	4.37	4.45	4.79	5.55	1.00	
Shoulder Bacon	4.75	3.81	5.24	4.52	5.56	5.67	4.77	1.00

Appendix 8.8a Scale Values for 9 Sausage Products in the Meat Substitutability Space

Meat	Scale Values		
	Dimension 1 x-axis	Dimension 2 y-axis	Dimension 3 z-axis
Beef sausage	-0.072	0.253	-0.436
Pork sausage	1.109	0.146	-0.436
Luncheon	0.351	-1.292	-0.018
Ham'n'chicken	-0.192	0.171	1.083
Salami	0.353	0.480	0.317
Frankfurters	-0.421	-0.564	-0.371
Saveloys	-0.853	-0.064	0.339
Black pudding	-1.003	0.434	-0.462
Garlic sausage	0.727	0.435	-0.607

APPENDIX 8.8b · Mean Substitutability Ratings for 9 Sausage Products

Meat	Beef Sausage	Pork Sausage	Luncheon	Ham-n-Chicken	Salami	Frankfurters	Saveloys	Black Pudding	Garlic Sausage
Beef Sausage	1.00								
Pork Sausage	3.88	1.00							
Luncheon	4.97	5.44	1.00						
Ham n Chicken	4.48	4.56	4.84	1.00					
Salami	3.95	4.28	5.12	3.72	1.00				
Frankfurters	2.96	5.21	4.12	5.16	4.27	1.00			
Saveloys	3.51	5.28	4.92	3.96	4.81	4.29	1.00		
Black Pudding	4.04	5.72	5.91	4.44	4.57	4.33	4.05	1.00	
Garlic Sausage	3.92	4.36	4.51	5.08	3.71	5.47	4.81	4.44	1.00

Appendix 8.9a Scale Values for 6 Offal Cuts in the Meat Substitutability Space

Meat	Scale Values Dimension 1 x-axis	Dimension 2 y-axis	Dimension 3 z-axis
Beef tongue	-1.142	0.397	-0.307
Beef hearts	-0.556	-0.725	-0.541
Tripe	0.328	-0.720	0.614
Lambs' fry (liver)	0.450	0.432	0.637
Lambs' kidney	0.751	-0.020	-0.457
Black pudding	0.169	0.636	-0.560

APPENDIX 8.9b: Substitutability Ratings for 6 Offal Cuts

Meat	Beef Tongue	Beef Hearts	Tripe	Lamb's Fry	Lamb's Kidney	Black Pudding
Beef Tongue	1.00					
Beef Hearts	5.13	1.00				
Tripe	5.87	5.08	1.00			
Lamb's Fry	5.39	5.33	4.43	1.00		
Lamb's Kidney	5.67	4.97	4.88	4.15	1.00	
Black Pudding	5.43	5.15	4.72	4.57	3.85	1.00

Appendix 8.10a Scale Values for 11 Convenience Cuts in the Meat Substitutability Space

Meat	Scale Values Dimension 1 x-axis	Dimension 2 y-axis	Dimension 3 z-axis
Rump steak	-0.435	-0.053	0.499
Mutton chops	-0.411	-0.774	-0.527
Hogget chops	0.404	-0.346	-0.594
Lamb chops	0.924	-0.371	0.230
Pork chops	0.086	-0.308	0.848
Middle bacon	0.786	0.807	-0.070
Sliced ham	0.099	0.864	-0.786
Beef sausages	0.624	-0.650	-0.143
Fish	-0.133	0.633	0.830
Chicken	-0.849	0.540	-0.279
Shellfish	-1.115	-0.344	-0.018

APPENDIX 8.10b: Mean Substitutability Ratings for 11 Convenience Meat Cuts

Meat	Steak	Mutton Chops	Hogget Chops	Lamb Chops	Pork Chops	Middle Bacon	Sliced Ham	Beef Sausage	Fish	Chicken	Shellfish
Rump Steak	1.00										
Mutton Chops	4.93	1.00									
Hogget CHops	3.47	4.68	1.00								
Lamb Chops	5.11	4.76	4.23	1.00							
Pork Chops	3.32	5.23	5.19	4.45	1.00						
Middle Bacon	5.15	5.71	5.21	4.48	4.99	1.00					
Sliced Ham	5.01	5.47	4.13	5.80	5.40	4.45	1.00				
Beef Sausages	5.20	4.63	3.43	3.36	4.44	5.12	4.96	1.00			
Fish	4.65	5.76	5.04	5.08	4.39	5.25	5.12	5.05	1.00		
Chicken	3.63	4.27	5.71	5.56	4.96	5.07	4.27	5.65	4.83	1.00	
Shellfish	4.67	4.67	5.08	5.64	5.07	5.39	5.79	5.37	5.03	4.40	1.00

Appendix 8.11a Scale Values for 10 Roasting Cuts in the Meat Substitutability Space.

Meat	Scale Values		
	Dimension 1 x-axis	Dimension 2 y-axis	Dimension 3 z-axis
Topside	0.258	-0.124	-0.908
Corned beef	-0.141	0.723	-0.587
Lamb forequarter	-0.513	-0.369	0.357
Leg of lamb	0.116	-0.950	0.441
Leg of hogget	-0.341	0.030	0.273
Mutton forequarter	0.480	0.313	-0.146
Leg of mutton	-0.321	-0.860	-0.478
Leg of pork	0.540	0.509	0.678
Leg of ham	1.285	0.134	0.162
Chicken	-1.364	0.593	0.207

APPENDIX 8.1b: Mean Substitutability Ratings for 10 Roast Meat Cuts

Meat	Topside	Corned Beef	Lamb Foreq'ter	Leg of Lamb	Leg of Hogget	Mutton Foreq'ter	Leg of Mutton	Leg of Pork	Leg of Ham	Chicken
Topside	1.00									
Corned Beef	4.16	1.00								
Lamb Foreq'ter	4.99	5.01	1.00							
Leg of Lamb	4.83	5.12	3.95	1.00						
Leg of Hogget	4.79	3.44	2.81	4.11	1.00					
Mutton Foreq'ter	4.37	4.03	2.83	5.03	4.43	1.00				
Leg of Mutton	4.36	4.92	4.39	3.84	4.09	4.92	1.00			
Leg of Pork	4.64	4.63	4.64	4.85	4.44	4.28	5.57	1.00		
Leg of Ham	5.04	4.80	5.53	5.00	4.55	4.53	5.43	4.47	1.00	
Chicken	5.44	4.71	4.80	5.09	4.41	5.11	5.24	5.57	5.57	1.00

Appendix 9.1 Scale Values for the 15 meats Thurston Case V preference similarity space.

Meat	Scale Values Dimension-1 x-axis	Dimension-2 y-axis	Dimension-3 z-axis
Salami	-0.661	0.604	-0.034
Beef	0.037	-0.453	-0.682
Veal	-0.579	-0.577	-0.105
Mutton	-0.992	-0.127	0.387
Hogget	-0.109	-0.962	0.134
Lamb	0.639	-0.589	0.038
Pork	0.908	0.426	-0.392
Bacon	0.219	-0.560	-0.323
Ham	0.736	0.833	0.071
Smallgoods	-1.146	0.376	0.597
Offal	-1.183	0.797	-0.644
Fish	0.837	0.111	0.451
Chicken	1.198	0.550	0.178
Turkey	0.091	-0.296	0.229
Shellfish	0.006	-0.134	0.096

APPENDIX 11.1

SIGNIFICANCE LEVELS FOR PEARSON PRODUCT-MOMENT CORRELATION COEFFICIENTS

Sample Size	VALUES OF CORRELATIONS REQUIRED 5% Level	1% Level
5	.755	.875
10	.576	.714
15	.483	.605
20	.425	.538
25	.380	.488
30	.338	.440
35	.320	.417
40	.300	.394
45	.280	.370
50	.262	.346
60	.248	.328
70	.233	.308
80	.220	.290
90	.206	.272
100	.194	.255
150	.158	.209
200	.137	.182
250	.125	.163
500	.088	.115

Source: Child [9, p.95]

APPENDIX TABLE 11.2.

$N = 50$

Number of variables	Significance level as percentage	Factor number											
		1	2	3	4	5	6	7	8	9	10	15	20
10	5	·262	·276	·292	·312	·337	·370	·414	·478	·585	·828	—	—
	1	·346	·364	·386	·413	·446	·489	·547	·631	·773	—	—	—
20	5	·262	·268	·276	·284	·292	·302	·312	·324	·337	·353	·478	—
	1	·346	·354	·364	·375	·386	·399	·413	·429	·446	·466	·631	—
30	5	·262	·266	·270	·276	·281	·286	·292	·298	·305	·312	·358	·432
	1	·346	·351	·357	·364	·371	·378	·386	·394	·403	·413	·473	·571
40	5	·262	·265	·268	·272	·276	·279	·284	·288	·292	·297	·324	·361
	1	·346	·350	·354	·359	·364	·369	·375	·380	·386	·392	·429	·477
50	5	·262	·263	·264	·265	·267	·268	·270	·271	·273	·274	·282	·290
	1	·346	·349	·352	·356	·360	·364	·368	·372	·377	·381	·407	·439

APPENDIX TABLE 11.2

$N = 100$

Number of variables	Significance level as percentage	Factor number											
		1	2	3	4	5	6	7	8	9	10	15	20
10	5	·194	·204	·216	·231	·250	·274	·306	·354	·433	·613	—	—
	1	·255	·268	·285	·304	·328	·360	·403	·465	·570	·806	—	—
20	5	·194	·198	·204	·210	·216	·223	·231	·240	·250	·261	·354	·867
	1	·255	·261	·268	·276	·285	·294	·304	·316	·328	·343	·465	—
30	5	·194	·197	·200	·204	·208	·212	·216	·221	·226	·231	·265	·320
	1	·255	·259	·263	·268	·273	·279	·285	·290	·297	·304	·349	·421
40	5	·194	·196	·198	·201	·204	·207	·210	·213	·216	·220	·240	·267
	1	·255	·258	·261	·264	·268	·272	·276	·280	·285	·289	·316	·351
50	5	·194	·195	·197	·200	·202	·204	·206	·208	·211	·214	·228	·246
	1	·255	·257	·260	·262	·265	·268	·271	·274	·277	·281	·300	·323

APPENDIX 11.3: Rotated Factor Pattern Matrices of Attitude Data for All Meats

ATTITUDE	Mean Score	Varimax Rotation of Factors			Equimax Rotation of Factors			Oblique Rotation of Factors Deltafo Factor Pattern			Quartimax Rotation of Factors		
		Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3
Flavour Strength	3.95	0.1485	0.5346	0.1488	0.1224	0.5355	0.1682	-0.0307	0.0157	0.5871			
Acceptability of Colour	3.98	0.1922	0.6516	0.1595	0.1614	0.6536	0.1837	-0.0248	-0.0050	0.7134			
Acceptability of Flavour	4.29	0.3292	0.6728	0.1247	0.2989	0.6802	0.1587	0.1267	-0.0645	0.6959			
Number of Dishes	2.62	-0.0359	0.2855	0.7070	-0.0795	0.2665	0.7109	-0.1386	0.6643	0.3061			
Preparation Time	3.59	0.5803	0.5911	-0.1443	0.5654	0.6139	-0.1023	0.4470	-0.3647	0.5334			
Nutritional Value of Meats	3.96	0.3184	0.5047	0.3249	0.2847	0.5068	0.3516	0.1835	0.1727	0.4813			
Value for Money	3.88	0.2018	0.6415	0.4218	0.1589	0.6373	0.4458	-0.0043	0.2618	0.6789			
Bone Content	4.99	0.7552	0.4941	0.0496	0.7341	0.5181	0.09756	0.6935	-0.1765	0.3463			
Tenderness	4.83	0.5667	0.4623	0.3769	0.5315	0.4717	0.4145	0.4917	0.1933	0.3439			
Wastage	4.97	0.7835	0.3383	0.1713	0.7621	0.3603	0.2169	0.7897	-0.0253	0.1366			
Cooking Time	3.74	0.5398	0.1855	0.6945	0.4993	0.1864	0.7240	0.5742	0.5776	-0.0054			
Spicing Requirement	4.64	0.8160	0.2737	0.1159	0.7994	0.2983	0.1616	0.8516	-0.0735	0.0517			
Prestige, i.e. serving or special occasions	2.75	0.0912	0.0486	0.7688	0.0527	0.0326	0.7733	0.1035	0.7552	-0.0275			
Stringiness of Meat	4.21	0.8355	0.1624	0.0387	0.8265	0.1896	0.0829	0.9162	-0.13199	-0.0839			
Fat Content of Meat	4.18	0.7182	0.2322	0.3954	0.6899	0.2466	0.4351	0.7589	0.2350	0.0136			
Juiciness of Meat	3.86	0.5715	0.3109	0.4250	0.5393	0.3195	0.4593	0.5571	0.2782	0.1555			
Expense	2.78	0.4037	0.2405	0.5056	0.3704	0.2415	0.5300	0.3895	0.3968	0.1202			
Convenience	3.27	0.7779	0.1932	0.2507	0.7578	0.2132	0.2926	0.8411	0.0864	-0.0430			
PROPORTION OF VARIANCE		50.2	11.2	8.2				50.2	11.2	8.2			

APPENDIX 11.4: Rotated Factor Pattern Matrices of Attitude Data for 7 Beef Cuts

Attitude	Mean Score	Varimax Rotation of Factors				Equimax Rotation of Factors				Oblique Rotation of Factors				Quartimax Rotation of Factors			
		Factor 1	Factor 2	Factor 3	Factor 4	Factor 1	Factor 2	Factor 3	Factor 4	Factor 1	Factor 2	Factor 3	Factor 4	Factor 1	Factor 2	Factor 3	Factor 4
Flavour Strength	4.45			0.7763			0.7741					0.8321				0.7647	
Acceptability of colour	5.10			0.5881			0.5790					0.5826				0.5977	
Acceptability of flavour	5 32			0.5371			0.5567					0.4888				0.5553	
Number of Dishes	4.21		0.4992		0.6390				0.8249		0.7051		0.4817		0.5897		0.5194
Preparation Time	4.54	0.4723		0.4736		0.4457	0.4706					0.4189		0.4817		0.4601	
Nutritional Value of Meat	5.03			0.5329			0.5163					0.5591				0.5350	
Value for Money	5.04			0.5881			0.5516					0.6426				0.5798	
Bone Content	7.25	0.7902				0.7998				0.8426				0.7800			
Tenderness	6.00		0.5086						0.6193		0.5765				0.5489		
Wastage	6.58	0.8466				0.8485				0.9047				0.8395			
Cooking Time	4.79		0.8363					0.6029	0.5787		0.7948				0.8354		
Spicing Requirement	5.23	0.6523				0.5900				0.6338				0.6708			
Prestige (Special Occasions)	3.08		0.5816						0.5256		0.6550				0.6085		
Stringiness of Meat	4.47	0.7035				0.6830				0.7445				0.7055			
Fat Content of Meat	5.58	0.6940	0.4425			0.5938		0.6096		0.6512				0.7269			
Juiciness of Meat	5.09		0.6041	0.4140				0.5645			0.4656				0.5816	0.4060	
Expense	3.38		0.5954					0.4878			0.5219				0.5829		
Convenience	4.24	0.4330	0.4734					0.5737			0.40			0.4677	0.4250		
Proportion of Variance	34.1	15.2	10.1	5.6		34.1	15.2	10.1	5.6	34.1	15.2	10.1	5.6	34.1	15.1	10.1	5.6

APPENDIX 11.5: Rotated Factor Pattern Matrices of Attitude Data for 12 sheep Meat Cuts

ATTITUDE	Mean Score	Varimax Rotation of Factors			Equimax Rotation of Factors			Oblique Rotation of Factors			Quartimax Rotation of Factors		
		Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3
Flavour Strength	3.24		0.6609			0.6696				0.7201	0.6100		
Acceptability of Colour	3.90		0.6853			0.6859				0.8196	0.6743		
Acceptability of Flavour	4.02		0.7265			0.7285	0.4062			0.8441	0.7736		
Number of Dishes	1.94			0.7579			0.7612		0.6508			0.6877	
Preparation Time	3.53	0.5297	0.6026		0.5112	0.6189				0.5451	0.7323		
Nutritional Value of Meat	3.66		0.5294			0.5325				0.5808	0.6600		
Value for Money	3.58		0.6190	0.5550		0.6174	0.5649			0.7355	0.7395		
Bone Content	2.77		0.4320	0.6457		0.4298	0.6528			0.4923	0.6782	0.4431	
Tenderness	3.86	0.6377	0.6370		0.6179	0.6555				0.5485	0.8486		
Wastage	3.82	0.5825		0.4191	0.5715		0.4255	0.6429			0.7608		
Cooking Time	2.75	0.7107		0.5226	0.7042		0.5270	0.9288			0.7971		
Spicing Requirements	4.48	0.8154			0.8031	0.4198		0.6822	-0.4958		0.8046		
Prestige (Special Occasions)	2.23			0.8318			0.8315	0.4155	0.6867			0.7466	
Stringiness of Meat	3.91	0.7509			0.7393			0.6460	-0.4139		0.7618		
Fat Content of Meat	3.32	0.5691		0.5425	0.5609		0.5473	0.7376			0.7385		
Juiciness of Meat	3.61	0.6770			0.6643	0.4074		0.6233			0.7930		
Expense of Meat	2.80	0.4995		0.5611	0.4951			0.7412			0.6220		
Conveninence of Meat	2.55	0.5869		0.4857	0.5799		0.4901	0.7575			0.7086		
Proportion of Variance		51.9	12.9	7.6				51.9	12.9	7.6	51.9	12.9	7.6

APPENDIX 11.6 : Rotated Factor Matrices of Attitude Data for 8 Pig Meat Cuts

Attitude	Mean Score	Varimax Rotation of Factors			Equimax Rotation of Factors			Oblique Rotation of Factors			Quartimax Rotation of Factors		
		Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3
Flavour Strength	5.15			0.5471			0.5558			0.5272			0.4454
Acceptability of Colour	4.82			0.4546			0.4876				0.5603		
Acceptability of Flavour	5.65			0.5565			0.5930			0.4332	0.6426		
Number of Dishes	3.35		0.7081			0.7053			0.7519			0.6558	
Preparation Time	4.59	0.5267		0.5397	0.4763		0.5840	0.5463		0.4237	0.6749		
Nutritional Value of Meat	4.06		0.5834			0.5756	0.4112		0.6154		0.4157	0.5181	
Value for Money	3.84		0.5576			0.5496	0.4062		0.5754		0.4396	0.4817	
Bone Content	5.59	0.6975		0.4982	0.6517		0.5622	0.7047			0.8720		
Tenderness	6.16	0.5308	0.4561		0.5020	0.4455		0.4873			0.7277		
Wastage	5.79	0.7128			0.6873			0.7328			0.8189		
Cooking Time	5.12	0.6727	0.5405		0.6685	0.5333		0.6702			0.7588		
Spicing Requirements	6.06	0.7865			0.7683			0.8416			0.8263		
Prestige (Special Occasions)	4.24		0.6103			0.6081			0.5916			0.5143	
Stringiness of Meat	5.44	0.8381			0.8222			0.9245			0.8277		
Fat Content of Meat	4.49	0.5581	0.5918		0.5613	0.5869		0.5372	0.4730		0.6432		
Juiciness of Meat	4.39	0.5047	0.4849		0.4810	0.4755		0.4585			0.6906		
Expense of Meat	2.31		0.5553			0.5533			0.5722			0.4990	
Convenience of Meat	4.39	0.7060			0.6738			0.7756			0.7486		
Proportion of variance		45.7	11.0	7.4				45.7	11.0	7.4	45.7	11.0	7.4

APPENDIX 11.7: Rotated Factor Matrices of Attitude Data for 5 Offal Cuts.

Attitude	Mean Score	Varimax Rotation of Factors			Equimax Rotation of Factors			Oblique Rotation of Factors			Quartimax Rotation of Factors		
		Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3
Flavour Strength	2.52	0.5184		0.5677	0.4380		0.6271	0.4537		0.4827	0.7072		
Acceptability of Colour	2.10			0.5406			0.5427			0.5733	0.4475		0.4150
Acceptability of Flavour	2.17	0.4133		0.6591			0.7013			0.6155	0.7132		
Number of Dishes	0.99		0.7258			0.7327			0.6961		0.4629	0.6070	
Preparation Time	1.71	0.5954		0.5157	0.5182		0.5826	0.5480			0.79847		
Nutritional Value of meat	3.10	0.6932		0.5024	0.6198		0.5849	0.6864			0.8199		
Value for Money	3.05		0.5028	0.6398		0.5238	0.6678			0.5932	0.7563		
Bone Content	4.37	0.7801			0.7309			0.8467			0.8181		
Tenderness	3.30	0.5314	0.5131		0.4799	0.5317		0.5090			0.7521		
Wastage	3.68	0.7932			0.7520			0.8702			0.8556		
Cooking Time	2.29		0.7089			0.7233			0.6002		0.7039	0.4701	
Spicing Requirements	2.78	0.7546			0.7087			0.8083			0.8586		
Prestige (Special Occasions)	1.44		0.7251			0.7329			0.6879		0.5272	0.5592	
Stringiness of Meat	2.71	0.8079			0.7757			0.9153			0.8046		
Fat content of Meat	3.35	0.7760			0.7260			0.8291			0.8711		
Juiciness of Meat	2.37	0.4995	0.5274		0.4597	0.5434		0.4951			0.6928		
Expense of Meat	2.61	0.6743			0.6204			0.6947			0.8017		
Convenience of Meat	1.90	0.6249	0.5011		0.5832	0.5205		0.6478			0.78899		
Proportion of Variance		57.6	8.9	6.2	57.6	8.9	6.2	57.6	8.9	6.2	57.6	8.9	6.2

Appendix 12.1 Mean 'Meat Quality on Buying' Attitude Scores for 9 'Hypothetical Product' Representatives

Attitude	Lamb forequarter	Mutton neck chops	Garlic sausage	Luncheon	Beef tongue	Stewing steak	Hogget loin chops	Ham steak	Rump steak
Stringiness	5.0	2.7	3.6	5.7	2.5	3.9	4.1	5.3	4.5
Spicing requirement	5.2	3.5	4.0	6.8	2.1	4.2	5.1	6.0	5.6
Wastage	4.2	2.9	4.3	7.0	3.1	5.9	4.2	6.0	7.0
Convenience	2.3	1.5	3.2	6.8	1.1	3.3	4.1	4.4	5.2
Fat content	3.1	2.0	2.9	5.8	2.7	4.9	3.8	5.1	6.4
Bone content	2.8	2.0	4.0	6.8	3.5	7.4	2.9	5.8	6.9
Tenderness	4.9	2.6	3.2	6.1	3.0	6.1	4.1	5.6	6.0
Juiciness	4.5	2.5	1.8	3.6	2.0	5.1	4.0	4.8	4.9
Preparation time	4.1	2.6	2.6	5.2	1.3	4.3	4.0	4.1	3.5
Cooking time	2.8	1.6	3.5	6.9	1.3	3.4	3.6	5.3	6.2

Appendix 12.2 Mean 'Meat Quality on Eating' Attitude Scores for the 9 'Hypothetical Product' Representatives

Attitudes	Sliced ham	Mutton neck chops	Luncheon	Beef tongue	Lamb neck chops	Rump steak	Garlic sausage	Hogget loin chops	Chicken
Bone content	6.8	1.9	6.8	3.5	2.7	7.3	4.0	2.9	5.0
Tenderness	6.9	2.3	6.1	3.0	4.2	6.2	3.2	4.1	6.7
Acceptability of flavour	6.1	3.0	3.4	1.8	4.1	5.9	2.2	4.5	6.3
Acceptability of colour	5.6	2.9	3.2	1.9	3.9	5.9	1.9	4.1	4.8
Flavour strength	6.1	2.4	4.1	1.9	3.2	5.2	2.8	3.5	4.3
Value for money	4.3	2.5	3.7	2.2	3.6	5.4	1.8	3.7	6.3
Preparation time	5.3	2.3	5.2	1.3	3.8	5.0	2.6	4.0	5.5
Nutritional value	4.7	2.7	3.1	2.1	3.6	5.7	1.8	3.9	6.3

Appendix 12.3 Mean 'Meat Quality on Cooking and Serving' Attitude Scores for 9 Hypothetical Product Representatives

Attitude	Ham-on the-bone	Mutton loin chops	Leg of lamb	Luncheon	Salami	Chicken	Beef tongue	Hogget loin chops	Lamb forequarter
Juiciness	5.1	2.6	5.0	3.6	1.9	5.5	2.0	4.0	4.5
Value for money	4.1	2.9	4.7	3.7	2.0	6.3	2.2	3.7	4.1
Prestige	6.8	1.6	3.6	2.4	1.6	3.8	1.2	2.2	2.8
Number of dishes	2.8	1.3	2.8	1.9	0.9	5.2	0.7	2.1	2.3
Cooking time	5.3	2.6	3.1	6.9	3.8	5.1	1.3	3.6	2.8
Expense	2.0	2.4	3.2	4.5	2.0	4.3	2.0	3.1	3.1

Appendix 13.1 Attitudes Scores of Low, Medium and High Meat Consumers to 7 Beef Cuts

		SCORES			
	Sample	Low meat Consumers	Medium meat Consumers	High meat Consumers	Significance
Fat content					
Wienersnitzel	6.4	6.0	6.8	6.3	0.62
Rump steak	5.9	5.0	6.3	6.0	0.15
Porterhouse steak	5.8	3.7	6.6	6.7	0.000
Stewing steak	4.9	4.0	5.0	5.5	0.05
Topside	5.3	4.8	5.9	4.8	0.26
Beef mince	5.5	4.1	6.3	5.5	0.01
Corned beef	5.3	4.5	5.5	5.8	0.20
Cooking time					
Wienersnitzel	6.2	5.4	6.6	6.5	0.29
Rump steak	5.9	5.0	6.5	5.9	0.11
Porterhouse steak	6.0	4.9	6.6	6.3	0.03
Stewing steak	3.4	2.4	3.4	4.2	0.04
Topside	3.3	2.0	3.6	4.1	0.02
Beef mince	5.5	4.7	5.8	5.7	0.25
Corned beef	3.3	2.2	3.9	3.4	0.05
Expense					
Wienersnitzel	3.4	2.4	4.1	3.3	0.03
Rump steak	2.8	2.0	2.8	3.5	0.12
Porterhouse steak	2.7	1.9	2.5	3.6	0.04
Stewing steak	4.1	3.2	4.2	4.9	0.04
Topside	3.2	2.9	3.2	3.5	0.66
Beef mince	4.5	3.7	4.8	5.0	0.12
Corned beef	3.0	2.4	3.0	3.3	0.35
Value for money					
Wienersnitzel	5.1	4.0	5.9	5.1	0.07
Rump steak	5.4	4.3	5.8	5.6	0.09
Porterhouse steak	5.1	3.2	5.5	6.3	0.000
Stewing steak	5.2	4.4	5.3	5.8	0.24
Topside	4.8	3.4	5.5	5.2	0.02
Beef mince	4.7	3.8	4.8	5.5	0.12
Corned beef	5.0	3.8	5.2	5.8	0.04

Appendix 13.2 Attitudes of High, Medium and Low Total Meat Consumers to 4 Lamb Cuts

Attitude	LAMB FOREQUARTER Low meat consumers	Medium meat consumers	High meat consumers	Significance	LAMB NECK CHOPS Low meat consumers	Medium meat consumers	High meat consumers	Significance
Wastage	2.9	4.5	5.1	0.01	3.0	4.6	3.6	0.14
Convenience	1.0	2.6	3.0	0.00	2.5	2.9	2.8	0.85
Fat content	2.1	4.4	4.8	0.00	2.5	3.7	3.8	0.27
Bone content	2.1	2.6	3.8	0.03	2.1	2.8	3.0	0.45
Tenderness	4.1	4.8	5.8	0.22	3.5	4.2	4.7	0.46
Juiciness	3.3	4.8	5.2	0.09	3.0	3.8	3.7	0.66
Colour acceptability	3.5	4.5	5.3	0.08	3.6	4.1	3.8	0.35
Value for money	2.9	3.9	5.5	0.00	3.0	3.9	3.8	0.55
Cooking time	1.4	3.2	3.7	0.00	2.4	3.7	2.8	0.18
Expense	1.7	3.6	3.5	0.01	2.2	3.4	2.7	0.21

Attitude	LAMB LOIN CHOPS Low meat consumers	Medium meat consumers	High meat consumers	Significance	LEG OF LAMB Low meat consumers	Medium meat consumers	High meat consumers	Significance
Wastage	3.8	5.0	4.7	0.35	4.7	4.9	5.3	0.78
Convenience	4.0	5.3	4.9	0.25	1.8	2.8	2.5	0.22
Fat content	3.7	5.2	4.4	0.11	3.4	5.4	4.8	0.02
Bone content	3.2	3.3	3.9	0.48	3.1	4.4	4.0	0.12
Tenderness	4.3	4.9	5.4	0.46	5.4	6.1	6.1	0.65
Juiciness	4.8	5.2	4.7	0.76	4.7	5.1	4.9	0.85
Colour acceptability	4.2	4.5	5.0	0.31	4.5	4.7	5.0	0.41
Value for money	4.1	4.4	4.7	0.74	3.4	5.1	5.3	0.03
Cooking time	4.0	5.1	4.5	0.33	2.3	3.4	3.5	0.12
Expense	2.9	3.8	3.3	0.49	2.4	3.7	3.5	0.14

Table 13.3 Attitude of High, Medium and Low Total Meat Consumers to 4 Hogget Cuts

Attitude	HOGGET FOREQUARTER Low meat consumers	Medium meat consumers	High meat consumers	Significance	HOGGET NECK CHOPS Low meat consumers	Medium meat consumers	High meat consumers	Significance
Spicing requirement	3.2	4.2	5.8	0.07	3.0	3.6	4.3	0.50
Wastage	2.0	4.1	5.0	0.00	2.7	3.9	3.5	0.34
Convenience	0.9	2.1	3.2	0.00	1.9	2.2	3.3	0.22
Fat content	1.4	3.4	5.1	0.00	2.1	3.2	4.5	0.01
Bone content	1.6	2.4	3.5	0.02	1.7	2.5	2.4	0.35
Tenderness	2.5	3.5	5.5	0.00	2.3	3.1	4.7	0.02
Juiciness	2.2	3.5	5.3	0.00	2.4	3.1	3.8	0.29
Flavour acceptability	3.0	3.4	5.3	0.02	3.4	3.3	5.1	0.06
Colour acceptability	3.0	3.7	4.9	0.01	2.8	3.4	3.8	0.22
Flavour strength	2.8	2.2	4.5	0.01	2.8	2.9	3.4	0.75
Value for money	2.7	3.1	4.5	0.09	3.3	3.1	4.0	0.49
Nutritional content	2.9	3.1	5.3	0.02	3.6	2.8	3.8	0.49
Prestige	1.5	2.5	3.0	0.15	1.8	1.7	1.6	0.97
Cooking time	1.2	2.6	3.5	0.00	1.9	2.8	2.7	0.36
Expense	1.2	3.2	3.9	0.00	1.7	3.2	3.0	0.09

Attitude	HOGGET LOIN CHOPS Low meat consumers	Medium meat consumers	High meat consumers	Significance	LEG OF HOGGET Low meat consumers	Medium meat consumers	High meat consumers	Significance
Spicing requirement	4.7	4.9	5.9	0.48	4.1	4.4	5.3	0.55
Wastage	3.4	4.5	4.5	0.35	4.6	2.5	2.6	0.01
Convenience	3.1	4.4	4.5	0.22	1.2	2.1	2.8	0.01
Fat content	2.4	3.9	5.1	0.00	1.8	4.0	4.9	0.00
Bone content	2.4	2.8	3.5	0.25	2.7	3.7	4.1	0.17
Tenderness	3.8	3.2	5.6	0.01	3.8	3.9	5.2	0.24
Juiciness	3.5	3.7	4.8	0.25	3.1	3.7	5.5	0.02
Flavour acceptability	4.6	3.8	5.5	0.08	3.8	3.9	5.8	0.04
Colour acceptability	3.7	3.9	4.8	0.18	3.9	4.1	5.3	0.14
Flavour strength	2.7	3.4	4.6	0.11	3.1	3.0	4.4	0.23
Value for money	3.5	3.6	4.2	0.65	3.5	3.9	5.4	0.08
Nutritional content	3.9	3.4	4.7	0.36	3.6	3.4	5.4	0.06
Prestige	1.2	2.5	2.8	0.08	2.0	3.1	3.5	0.18
Cooking time	3.0	3.7	4.2	0.33	1.9	2.7	3.3	0.09
Expense	2.0	3.4	3.5	0.07	1.7	3.4	3.7	0.01

Appendix 13.4 Attitudes of High, Medium and Low Total Meat Consumers to 4 Mutton Cuts

Attitude	MUTTON FOREQUARTER Low meat consumers	Medium meat consumers	High meat consumers	Significance	MUTTON NECK CHOPS Low meat consumers	Medium meat consumers	High meat consumers	Significance
Spicing requirement	3.1	3.1	4.4	0.39	3.2	2.8	3.9	0.53
Wastage	1.7	3.1	3.7	0.06	2.1	2.7	3.3	0.41
Convenience	0.7	1.5	2.2	0.04	1.6	1.7	2.5	0.32
Fat content	1.0	2.1	2.9	0.02	1.2	2.3	3.0	0.06
Tenderness	2.1	2.1	3.8	0.07	2.4	1.7	3.2	0.09
Flavour acceptability	2.7	2.4	3.9	0.09	2.4	2.3	4.2	0.02
Cooking time	1.0	1.6	2.2	0.09	1.5	1.8	2.2	0.55
Expense	1.0	2.5	3.3	0.01	1.3	2.5	3.0	0.07

Attitude	MUTTON LOIN CHOPS Low meat consumers	Medium meat consumers	High meat consumers	Significance	LEG OF MUTTON Low meat consumers	Medium meat consumers	High meat consumers	Significance
Spicing requirement	3.4	3.4	5.1	0.20	3.8	4.1	4.9	0.61
Wastage	2.4	3.3	3.5	0.40	2.7	3.9	4.1	0.27
Convenience	1.9	2.5	3.7	0.12	1.5	1.4	2.1	0.40
Fat content	1.4	2.4	3.1	0.10	1.7	3.0	3.4	0.07
Tenderness	2.7	2.1	3.4	0.23	3.3	3.1	4.2	0.41
Flavour acceptability	2.8	2.5	4.3	0.05	3.7	2.9	4.4	0.15
Cooking time	1.9	2.6	3.3	0.21	1.6	1.9	2.5	0.33
Expense	1.4	2.6	3.2	0.05	1.5	2.5	3.0	0.09

Appendix 13.5 Attitude of High, Medium and Low Total Meat Consumers to 4 Pig Meat Cuts

Attitude	PORK CHOPS Low meat consumers	Medium meat consumers	High meat consumers	Significance	LEG OF PORK Low meat consumers	Medium meat consumers	High meat consumers	Significance
Stringiness	5.0	5.6	5.9	0.59	4.7	6.1	6.2	0.23
Spicing requirement	5.7	5.7	7.5	0.08	5.7	7.3	7.7	0.14
Wastage	3.9	5.5	5.7	0.01	4.3	5.6	5.4	0.21
Bone content	3.0	3.5	4.9	0.01	4.8	6.4	6.1	0.27
Fat content	2.7	4.4	4.6	0.01	3.3	3.9	3.8	0.72
Tenderness	5.1	4.9	5.9	0.32	5.0	4.9	6.0	0.40
Juiciness	4.0	4.4	4.7	0.59	4.1	4.3	4.4	0.96
Value for money	3.3	3.9	5.3	0.02	3.4	4.4	4.7	0.26
Prestige	3.8	4.8	5.2	0.31	5.6	5.3	6.1	0.66
Cooking time	3.7	5.2	5.4	0.01	2.0	2.9	3.4	0.10
Expense	1.7	2.5	2.9	0.17	1.6	2.0	2.2	0.64

Attitude	HAM-ON-THE-BONE Low meat consumers	Medium meat consumers	High meat consumers	Significance	HAM STEAKS Low meat consumers	Medium meat consumers	High meat consumers	Significance
Stringiness	5.7	7.7	7.3	0.06	3.4	6.5	4.5	0.01
Spicing requirement	4.1	7.2	6.0	0.01	6.4	6.6	6.3	0.93
Wastage	5.0	6.9	5.8	0.04	4.5	6.8	6.3	0.06
Bone content	3.9	3.9	4.3	0.74	3.6	4.2	4.3	0.60
Fat content	4.1	6.3	6.5	0.01	4.	5.5	5.8	0.44
Tenderness	5.7	6.4	5.7	0.64	3.7	6.6	5.8	0.01
Juiciness	4.0	5.7	5.5	0.16	3.6	5.5	5.0	0.09
Value for money	3.1	4.4	4.6	0.12	2.8	4.7	4.2	0.05
Prestige	5.6	7.4	7.2	0.10	3.5	5.1	3.7	0.16
Cooking time	4.3	5.9	5.3	0.30	3.0	6.6	5.5	0.00
Expense	1.7	2.1	2.0	0.84	1.4	2.4	3.0	0.05

Appendix 13.6 Attitudes of High, Medium and Low Total Meat Consumers to Fish, Shellfish and Chicken

Attitude	FISH Low meat consumers	FISH Medium meat consumers	FISH High meat consumers	FISH Significance	SHELLFISH Low meat consumers	SHELLFISH Medium meat consumers	SHELLFISH High meat consumers	SHELLFISH Significance
Stringiness	6.4	7.0	6.0	0.43	3.0	5.1	6.5	0.01
Spicing requirement	5.2	6.1	6.5	0.21	3.1	3.2	4.8	0.21
Wastage	7.4	8.0	7.8	0.64	3.2	5.1	5.8	0.06
Fat content	7.8	8.3	8.7	0.34	3.1	5.0	6.8	0.01
Juiciness	5.1	5.5	6.5	0.20	2.5	4.2	5.6	0.01
Flavour acceptability	6.4	5.0	6.1	0.12	2.5	3.1	5.1	0.02
Colour acceptability	4.9	4.4	3.9	0.29	1.9	3.6	3.6	0.04
Flavour strength	4.8	4.9	4.7	0.75	2.4	3.9	4.7	0.08
Value for money	5.8	6.7	6.8	0.26	1.9	3.1	4.1	0.05
Preparation time	5.1	5.2	5.3	0.95	1.5	2.7	4.1	0.01
Nutritional content	6.4	6.3	6.3	0.99	2.7	4.4	5.3	0.06
Prestige	3.5	3.4	3.0	0.81	3.2	4.1	5.2	0.22
Cooking time	6.0	7.1	6.5	0.13	2.7	4.4	5.6	0.05
Expense	3.6	4.0	3.9	0.66	0.8	2.1	3.1	0.01

Appendix 13.6 (Cont.)

Attitude	CHICKEN Low meat consumers	Medium meat consumers	High meat consumers	Significance
Stringiness	5.3	6.0	5.0	0.40
Spicing requirement	2.2	4.8	7.4	0.00
Wastage	6.4	6.8	6.6	0.80
Fat content	6.2	7.4	7.2	0.09
Juiciness	4.7	5.5	6.3	0.09
Flavour acceptability	6.4	5.8	7.0	0.30
Colour acceptability	4.6	5.2	4.3	0.27
Flavour strength	4.4	4.1	4.3	0.75
Value for money	5.6	6.4	6.9	0.11
Preparation time	5.4	5.3	5.8	0.72
Nutritional content	6.7	6.3	5.8	0.52
Prestige	4.2	4.1	2.9	0.09
Cooking time	4.9	5.2	5.3	0.80
Expense	4.0	4.4	4.4	0.66

Appendix 13.7 Attitudes of High, Medium and Low Meat Consumers to 4 Offal Cuts

Attitude	BEEF TONGUE Low meat consumers	Medium meat consumers	High meat consumers	Significance	BEEF TRIPE Low meat consumers	Medium meat consumers	High meat consumers	Significance
Flavour acceptability	1.6	1.5	2.2	0.05	0.8	1.3	2.0	0.03
Colour acceptability	1.8	1.4	2.3	0.02	1.0	1.0	1.6	0.00
Preparation time	0.7	1.5	1.8	0.27	0.5	0.7	1.7	0.08

Attitude	LAMB'S KIDNEY Low meat consumers	Medium meat consumers	High meat consumers	Significance	LAMB'S LIVER Low meat consumers	Medium meat consumers	High meat consumers	Significance
Flavour acceptability	2.4	2.6	3.5	0.12	4.8	3.6	4.4	0.25
Colour acceptability	1.7	2.9	2.9	0.04	3.6	3.5	3.9	0.78
Preparation time	2.0	2.3	2.7	0.74	3.5	2.8	4.0	0.30

Appendix 13.8 Attitudes of High, Medium and Low Meat Consumers to 4 Sausage Products

Attitude	PORK SAUSAGES Low meat consumers	Medium meat consumers	High meat consumers	Significance	LUNCHEON Low meat consumers	Medium meat consumers	High meat consumers	Significance
Spicing requirement	5.1	7.3	7.6	0.02	4.3	5.9	6.7	0.14
Fat content	4.0	4.9	4.7	0.56	4.1	7.3	5.3	0.01
Tenderness	5.3	6.2	5.0	0.37	4.5	6.9	6.3	0.03
Flavour acceptability	3.7	3.6	4.0	0.25	2.7	3.5	3.5	0.07
Colour acceptability	3.0	3.1	3.6	0.09	2.8	3.5	2.9	0.05
Nutritional content	3.1	2.8	2.8	0.91	2.2	3.4	3.4	0.24
Expense	3.7	4.4	4.4	0.58	3.4	5.3	4.2	0.08

Attitude	SAVELOYS Low meat consumers	Medium meat consumers	High meat consumers	Significance	SALAMI Low meat consumers	Medium meat consumers	High meat consumers	Significance
Spicing requirement	5.0	7.3	5.0	0.05	3.9	3.8	4.6	0.75
Fat content	3.2	6.0	5.6	0.00	3.0	3.2	4.0	0.66
Tenderness	4.4	6.4	6.2	0.07	2.9	3.4	3.5	0.85
Flavour acceptability	2.5	3.3	3.5	0.05	3.0	1.9	2.0	0.10
Colour acceptability	2.2	3.7	3.2	0.01	3.2	2.1	2.1	0.12
Nutritional content	1.3	2.9	3.1	0.04	1.4	1.5	2.7	0.21
Expense	2.7	4.8	4.4	0.03	1.8	2.0	2.2	0.88

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