

Copyright is owned by the Author of the thesis. Permission is given for a copy to be downloaded by an individual for the purpose of research and private study only. The thesis may not be reproduced elsewhere without the permission of the Author.

**CONSUMER INPUT AND PRODUCT CONCEPT TESTING
IN DEVELOPING DRIED FRUIT SNACK PROTOTYPE
FOR MALAYSIAN MARKET**

**Thesis presented in partial fulfilment of the requirement for the degree
of Master of Technology in Product Development at Massey University
New Zealand**

**AIDA HAMIMI IBRAHIM
1996**

Dedicated to my beloved:

parents,

Haji Ibrahim Omar and Hajjah Zakiyatum Nizam M. Samin

and sister, Nurul 'Ain Ibrahim

ABSTRACT

The input of the consumer when developing a dried snack fruit for the Malaysian market using the product development process was studied. A consumer panel made up of Malaysian students was used in each step of the product development process in this study.

Preliminary consumer research was carried out using the focus group and the survey method. The results indicated that the two ethnic groups, Malay and Chinese, within the Malaysian student community could be treated as a homogenous group as they had similar attitude and behaviour characteristics towards the dried snack fruit product. Both student groups had been studying in New Zealand for less than two years.

In the idea generation stage, the consumer panel generated 41 product ideas for the dried snack fruit using the nominal group technique. The 41 product ideas were reduced to three using a series of scoring techniques for screening. At this stage, consumer input was used to determine the market acceptability of the three possible products.

These three product ideas with a benchmark were tested in concept product testing using the target consumer panel to evaluate consumer acceptability. Two different forms, concept description and concept prototypes, of concept testing using two different techniques, the focus group technique and the survey method, were tested in order to determine any significant effects they had on consumer acceptability. It was found that the concept prototypes had a significant effect on the consumers' preferences for product concept appearance, attractiveness and, buying intention. The two different techniques however, did not have a significant effect on the consumer acceptability of the product concepts. Of the two techniques, the focus

group required less time for data collection compared to the survey technique, but the focus group was more expensive to run.

By using the ECHIP programme and the line scale with floating ideals, which was the input of the consumers in the sensory evaluation stage, an optimum product formulation for the dried fruit snack was obtained. The prototype consisted of six types of fruit namely, apple (0.25), kiwifruit (0.25), banana (0.175), pineapple (0.13) strawberry (0.125) and jackfruit (0.07) with their natural flavours. The prototype was tested on the target consumer using in- house tests in order to determine the acceptability potential of the prototype. The results showed that the idea of developing the dried fruit snack with their natural flavours was acceptable among the Malaysian students. Freeze drying was found to be the most preferred drying process for the dried snack fruit product. The acceptable package size of the product by consumer panel was 40gm.

Consumer input played a major role in the product development process in this project and it gave direction in the development of the dried snack fruit product for the Malaysian market. Consumer input was found to be vital during the preliminary consumer research, idea generation, concept testing, product formulation stages, and the final product testing phase in this study.

ACKNOWLEDGEMENTS

I wish to thank to my supervisor Mrs. Carol Pound, for her understanding, patience, guidance and supervision throughout the preparation of this project.

My appreciation and gratitude go to Professor Ray Winger, for giving this big opportunity to me to further my study at Department of Food Technology, Massey University.

My thank extended to Mr. Alistair Young, Mrs. Geedha Reid and all the staff of Department of Food Technology, Massey University, for their understanding and co-operation throughout the preparation of my project.

My special thanks also convey to Yurly, Bongkot, all postgraduate students of Department of Food Technology, and my friends for their understanding and moral support throughout my study.

Lastly, my sincere appreciation goes to abah, emak, and 'Ain for their support and understanding throughout my study life.

TABLE OF CONTENTS

ABSTRACT	i
ACKNOWLEDGEMENT	iii
TABLE OF CONTENTS	iv
LIST OF TABLES	xi
LIST OF FIGURES	xv
LIST OF DIAGRAMS	xvii
LIST OF APPENDICES	xviii

CHAPTERS	Pages
1 INTRODUCTION	1
1.1 PRODUCT DEVELOPMENT PROCESS	1
1.2 CONSUMER INPUT IN THE PRODUCT DEVELOPMENT PROCESS	3
1.3 PRODUCT CONCEPT TESTING	5
1.4 MARKET INFORMATION OF SNACK FOOD IN MALAYSIA	6
1.5 THE PRODUCT AIM, OBJECTIVES AND CONSTRAINTS	9
2 LITERATURE REVIEW	11
2.1 PRODUCT DEVELOPMENT PROCESS	11
2.1.1 New Product Strategy Development	12
2.1.2 Idea Generation	13
2.1.3 Screening Idea	14
2.1.4 Concept Testing	15
2.1.5 Economic Evaluation	17
2.1.6 Product Development	19
2.1.7 Product Testing	20
2.1.8 Commercialisation	21
2.2 THE TECHNIQUES OF PRODUCT DEVELOPMENT PROCESS USED IN THIS PROJECT	22
2.2.1 Consumer Survey	22
2.2.2 Nominal Group Technique in Idea Generation	27
2.2.3 The Technique of Concept Testing	29
2.2.4 Freeze Drying of Fruit	32
2.2.5 Scaling Methods in Product Testing	35

3	CONSUMER RESEARCH: ATTITUDE AND BEHAVIOUR OF MALAYSIAN STUDENTS TOWARD DRIED SNACK FOOD PRODUCTS	39
3.1	PRELIMINARY CONSUMER STUDY: FOCUS GROUP	39
3.1.1	Experimental Method	40
3.1.2	Result of the Focus Group Discussion on the Existing Snack Food	43
3.1.2.1	Flavour of Existing Snack Food Product	43
3.1.2.2	Texture of Existing Snack Food Product	43
3.1.2.3	Packaging Appearance of Existing Snack Food Product	44
3.1.2.4	Snacking Pattern of the Participants	45
3.1.3	Result of the Focus Group Discussion on the Proposed Product	46
3.1.3.1	Proposed Product Ingredient Combination	46
3.1.3.2	The Flavour of Proposed Product	46
3.1.3.3	Drying Process Preference for the Proposed Product	47
3.1.4	Conclusion from the Focus Group	47
3.2	CONSUMER SURVEY	48
3.2.1	Aim and Objectives	48
3.2.2	Sample	49
3.2.3	Questionnaire	50
3.2.4	Survey Method	50
3.2.5	Data Processing	50
3.2.6	Results of Consumer Survey	51
3.2.6.1	Frequency of Snacking and Snack Type Preference in General	51
3.2.6.2	Snack Buying Behaviour of Dried Snack Fruit	53
3.2.6.3	Criteria for Drying Snack Fruit Buying Choice	56
3.2.6.4	Comparison between the Proposed Dried Snack Fruit Product with the Existing Product	57
3.2.6.5	Preference Characteristics of Dried Snack Fruit Product Proposal	58
3.2.6.6	Expected Price of the Proposal Product	59
3.2.6.7	Buying Intention of the Proposed Product	60
3.2.6.8	Expected Frequency of Buying the Proposed Product	61
3.2.7	Discussion of Consumer Survey	62
3.2.7.1	Snacking Pattern and Snack Type Preference in General between the Two Ethnic Groups	62
3.2.7.2	Snacking Buying Behaviour for Dried Snack Fruit between the Two Ethnic Groups	63

3.2.7.3	Criteria for Dried Snack Fruit Product Buying Choice	64
3.2.7.4	The Comparison of the Proposed Dried Fruit Snack with the Existing Product	64
3.2.7.5	Characteristics of Product Proposal	65
3.2.7.6	Expected Price and Buying Intention of Product Proposal	66
3.2.3	Conclusion	67
4	IDEA GENERATION	68
4.1	EXPERIMENTAL METHOD	68
4.2	IDEAS PRODUCED USING NOMINAL GROUP TECHNIQUE	69
4.3	DISCUSSION OF IDEA GENERATION BY THE NOMINAL GROUP TECHNIQUE	71
4.4	CONCLUSION	72
5	SCREENING IDEAS	73
5.1	EXPERIMENT METHOD	73
5.1.1	Sequential Screening	73
5.1.2	Checklist Screening	74
5.1.3	Probability Screening	76
5.2	RESULTS SCREENING PRODUCT IDEAS FOR A DRIED FRUIT OR VEGETABLE SNACK FOOD	78
5.3	DISCUSSION OF SCREENING PRODUCT IDEAS FOR A DRIED FRUIT OR VEGETABLE SNACK FRUIT	84
5.4	CONCLUSION OF PRODUCT IDEAS FOR A DRIED SNACK FRUIT OR VEGETABLE SNACK FOOD	85
6	PRODUCT CONCEPT TESTING	86
6.1	SAMPLE IN PRODUCT CONCEPT TESTING	86
6.2	QUESTIONNAIRE	87
6.3	DATA PROCESSING	88
6.4	PRODUCT CONCEPT DESCRIPTION	88
6.5	PRODUCT PROTOTYPE	89
6.6	EXPERIMENTAL METHOD	92
6.6.1	Focus Group	92
6.6.2	Survey Method: Semi Self Administrative	93
6.7	RESULTS OF PRODUCT CONCEPT TESTING BETWEEN CONCEPT DESCRIPTION AND CONCEPT PROTOTYPE	93

6.7.1	Product Concept Preference between Concept Description and Concept Prototype of Product Concept Testing	94
6.7.2	Appearance Preference between Concept Description and Concept Prototype of Product Concept Testing	95
6.7.3	Flavour Preference between Concept Description and Concept Prototype of Product Concept Testing	97
6.7.4	Product Attractiveness Preference between Concept Description and Concept Prototype of Product Concept Testing	100
6.7.5	Buying Intention Preference between Concept Description and Concept Prototype of Product Concept Testing	102
6.7.6	Relationship between Buying Intention and Product Attributes Preference in Focus Group and Survey Method	105
6.7.7	Purchasing Price Preference between Concept Description and Concept Prototype of Product Concept Testing	105
6.8	RESULTS OF PRODUCT CONCEPT TESTING BETWEEN FOCUS GROUP AND SURVRY METHOD	106
6.8.1	Product Concept Preference between the Focus Group and the Survey Method	106
6.8.2	Product Attributes Preference between the Focus Group and the Survey Method	108
6.8.3	Buying Intention Preference and Purchasing Price Preference between the Focus Group and the Survey Method of the Product Concept	108
6.9	TIME REQUIREMENTS AND REALTIVE COST BETWEEN THE FOCUS GROUP AND THE SURVEY METHOD	108
6.10	RESULTS OF THE FOCUS GROUP DISCUSSION	110
6.10.1	When Concept Descriptions were Used as the Media	110
6.10.2	When Concept Prototypes were Used as the Media	112
6.11	DISCUSSION OF THE PRODUCT CONCEPT TESTING TESTING BETWEEN CONCEPT DESCRIPTION AND CONCEPT PROTOTYPE	113
6.11.1	Product Concept Preference between Concept Description and Concept Prototype	114
6.11.2	Product Attributes Preference between Concept Description and Concept Prototype	115
6.11.3	Buying Intention Preference of Product Concept between Concept Description and Concept Prototype	117

6.11.4	Purchasing Price Preference between Concept Description and Concept Prototype	117
6.12	DISCUSSION OF THE PRODUCT CONCEPT TESTING BETWEEN THE FOCUS GROUP AND THE SURVEY METHOD	118
6.13	TIME REQUIRMENT AND REALTIVE COSTS BETWEEN THE TWO TECHNIQUES	119
6.14	CONCLUSION	120
7	PRODUCT FORMULATION AND TESTING	122
7.1	AIM AND OBJECTIVE	122
7.2	EXPERIMENTAL METHODS	123
	7.2.1 Preference in Package Size	123
	7.2.2 Experimental Design	123
7.3	MATERIAL AND METHOD USED IN THE DRIED SNACK FRUIT PREPARATION	126
	7.3.1 Material	126
	7.3.2 Equipment	126
	7.3.3 Method	127
7.4	PHYSICAL TESTING ANALYSIS	128
	7.4.1 Texture Testing	128
	7.4.2 Colour Testing	128
	7.4.3 Moisture Content	129
	7.4.4 Sugar Content	129
7.5	SENSORY EVALUATIONBY CONSUMER PANEL	130
7.6	SAMPLE PREPARATION FOR SENSORY EVALUATION	130
7.7	QUESTIONNAIRE FOR SENSORY EVALUATION	131
7.8	CONSUMER PANEL TEST	131
7.9	CONSUMER TESTING PROCEDURE	131
7.10	DATA PROCESSING AND ANALYSIS OF RESULTS	133
7.11	RESULTS OF SENSORY EVALUATION IN PRODUCT FORMULATION	134
	7.11.1 Preference in Package Size	134
	7.11.2 Sensory Evaluation between Two Groups of Malaysian Students,Massey University and Wanganui Polytechnique	135
	7.11.3 Product Samples Preference by the Consumer Panel	136
	7.11.4 Sensory Attributes and Overall Acceptability by the Consumer Panels	137
7.12	RESULTS OF PHYSICAL ATTRIBUTES OF PROTOTYPES	141

7.13	EFFECT OF FRUIT PROTOTYPE TO THE SENSORY ATTRIBUTES	143
7.14	RELATIONSHIP BETWEEN PHYSICAL TESTING AND SENSORY ATTRIBUTES	146
7.15	PRODUCT OPTIMIZATION	147
7.16	AN APPROXIMATION COSTING OF DRIED SNACK FRUIT	150
7.17	DISCUSSION OF PRODUCT FORMULATION IN THIS PROJECT	151
	7.1.7.1 Sensory Attributes Acceptability of Dried Snack Fruit	151
	7.17.2 Sensory Attributes of the Product Sample Evaluated by Consumer Panels	152
	7.17.3 Relationship between Physical Tests and Sensory Attributes	154
7.18	CONCLUSION	155
8	FINAL CONSUMER TESTING OF PRODUCT	156
8.1	AIM AND OBJECTIVES	156
8.2	SAMPLE	156
8.3	QUESTIONNAIRE	157
8.4	SAMPLE PREPARATION	158
8.5	TESTING OF THE PRODUCT	158
8.6	DATA PROCESSING AND ANALYSIS OF RESULTS	159
8.7	THE RESULT OF CONSUMER TESTING	159
	8.7.1 Consumer Acceptability of the Dried Snack Fruit	159
	8.7.2 Price of Dried Snack Fruit	162
	8.7.3 The Purchase Intention of Dried Snack Fruit Sample	163
	8.7.4 The Pattern of Dried Snack Fruit Usage	164
	8.7.5 Frequency of Buying Pattern of Dried Snack Fruit	165
	8.7.6 Consumer Buying Intention	166
8.8	DISCUSSION OF CONSUMER TESTING	168
	8.8.1 Consumer Acceptability of the Dried Snack Fruit	168
	8.8.2 Marketing Information from Consumer Testing	169
	8.8.3 The Pattern of Dried Snack Fruit Usage	170
	8.8.4 Consumer Buying Intention	171
8.9	CONCLUSION OF CONSUMER TESTING	171

9	CONCLUSION AND RECOMMENDATION	173
9.1	CONSUMER RESEARCH IN THIS PROJECT	174
9.2	NOMINAL GROUP TECHNIQUE IN IDEA GENERATION	175
9.3	PRODUCT CONCEPT TESTING IN THIS PROJECT	175
9.4	CONSUMER PANEL IN SENSORY EVALUATION	177
9.5	CONSUMER FINAL PRODUCT TESTING	178
9.6	DEVELOPMENT OF DRIED SNACK FRUIT FOR MALAYSIANS	180
9.7	RECOMMENDATION FOR THE FURTHER WORK	182

REFERENCES

APPENDICES

LIST OF TABLES		Page
1.1	The consumer input in Product Development Process	4
2.1	The type of sample procedures	24
2.2	The advantages and disadvantages of contact methods	25
2.3	The terminology used in category scales	36
3.1	The description of the three mocked-up samples	41
3.2	Sequence of topics used for the focus group discussion	42
3.3	The demographic characteristics of the population sample in consumer survey	49
3.4	Frequency of snacking and snack type preference in general	51
3.5	Snack type preference	52
3.6	The frequency of snacking	54
3.7	Snack type preference of dried fruit snack	55
3.8	Criteria for dried snack fruit buying intention	56
3.9	Comparison between the proposed dried snack fruit product with the existing product	57
3.10	Preference characteristics of product proposal	58
3.11	Expected price of the proposed product	60
3.12	Buying intention	61
3.13	Expected of frequency of buying the proposed product	61
4.1	The list of ideas produced by the Nominal Group Technique	70
4.2	The preliminary product ideas evaluation results	71
5.1	The sub-criteria with their respective weight	76

5.2	The list of the product ideas that remained after sequential screening	80
5.3	The list of the product ideas that remained after checklist screening	82
5.4	The list of the product ideas that remained after probability screening	83
6.1	The demographics' characteristics of the population sample in product concept testing	87
6.2	Product concept description	90
6.3	Product concept preference between two forms of product concept	94
6.4	The cross tabulation of product appearance preference between concept description and concept prototype in focus group	95
6.5	The cross tabulation of product appearance preference between concept description and concept prototype in survey method	96
6.6	The cross tabulation of product flavour preference between concept description and concept prototype in focus group	98
6.7	The cross tabulation of product flavour preference between concept description and concept prototype in survey method	99
6.8	The cross tabulation of product attractiveness preference between concept description and concept prototype in focus group	100
6.9	The cross tabulation of product attractiveness preference between concept description and concept prototype in survey method	101
6.10	The cross tabulation of buying intention preference between concept description and concept prototype in focus group	102

6.11	The cross tabulation of buying intention preference between concept description and concept prototype in survey method	103
6.12	Correlation between buying intention and product attributes preference in focus group and survey method	105
6.13	Product concept preference between focus group and survey method	107
6.14	The time requirement and relative cost between the two technique	109
7.1	Ingredient level used in the mixture design	124
7.2	Experimental plan for mixture design when kiwifruit and apple were included	125
7.3	The demographic characteristics of the consumer panel testing	130
7.4	The P-value of the appearance and overall acceptability between Malaysian students from Wanganui Polytechnic and Massey University before and after eliminating the 'outsider' score	136
7.5	The preference of the product samples among the consumer panels	136
7.6	The sensory attributes and overall acceptability of the prototypes	137
7.7	The r-value between overall acceptability and sensory attributes mean ratio score obtained from the consumer panels	138
7.8	The physical attributes of the prototypes	142
7.9	The texture analysis of prototype	143
7.10	Correlation between the sensory attributes and fruits in prototypes	144
7.11	Regression equation between sensory attributes and fruits in the prototypes	144
7.12	Correlation between physical testing and sensory attributes	146
7.13	Regression equation between physical testing and sensory attributes	146

7.14	The percentage of fruits in sample 2,3, and 8	148
7.15	The upper and lower limit of mixture constraints	148
7.16	An optimum formulation for the dried snack fruit	150
7.17	The percentage of approximate costs to manufacture dried snack fruit	150
7.18	An approximate costing of dried snack fruit	151
8.1	The demographic characteristics of the population in consumer testing	157
8.2	The consumer acceptability of dried snack fruit	160
8.3	The maximum price for the dried snack fruit	162
8.4	The purchase intention of the dried snack fruit at the price of \$2.50/40gm	164
8.5	The usage pattern of the dried fruit snack	164
8.6	Frequency of buying pattern of dried snack fruit	165
8.7	Consumer buying intention	166

LIST OF FIGURES		Page
1.1	Product development process	2
1.2	The snack food product available in three supermarket in Kuala Lumpur	7
1.3	Market price of snack food product available in the three supermarket in Kuala Lumpur	8
3.1	Appearance of Cheezel and Munchos tomato spices packaging	45
3.2	The awareness of dried snack fruit among the Malaysian students	53
5.1	The histogram of reduction the number of product ideas through screening	79
5.2	The results of checklist screening	81
5.3	The results of probability screening	83
6.1	Changes of product concept appearance preference when the concept description were shown in focus group and survey method	97
6.2	Changes of product concept attractiveness preference when the concept prototypes were shown in focus group and survey method	104
6.3	Changes of buying intention preference when the concept prototypes were shown in focus group and survey method	104
6.4	Purchase price preference of product concept between concept description and concept prototype	106
7.0	Histogram of overall acceptability	139
7.1	Regression plot between colour and overall acceptability	140
7.2	Regression plot between taste and overall acceptability	140
7.3	Regression plot between fruit mixture and overall acceptability	141
7.4	Regression plot between a* and colour evaluation	146

7.5	Regression plot between a* and fruit mixture	147
7.6	The contour plot for the product formulation	149
8.1	The appearance of dried snack fruit packaging	158
8.2	Regression plot between flavour liking and overall acceptability	161
8.3	Regression plot between colour combination liking and overall acceptability	161
8.4	The chart of the proposed priced the respondent would like to pay for the weight of 40gm net	163
8.5	Regression plot between buying intention and purchase intention	167
8.6	Regression plot between buying intention and overall acceptability	168

LIST OF DIAGRAMS		Page
6.1	Freeze dried process for product concept prototype	91
7.1	Processing method for freeze dried snack fruit	127

LIST OF APPENDICES

1.1	Market information of snack food product available in three supermarket in Kuala Lumpur	194
3.1	Description of existing snack food	198
3.2	The questionnaire of consumer survey	199
3.3	The statistic analysis of consumer survey	203
5.1	Sequential screening	205
5.2	List of product ideas for market acceptance evaluation	208
5.3	Checklist screening	210
5.4	Probability screening	212
6.1	Questionnaire for focus group	213
6.2	Questionnaire for survey method	216
6.3	The statistic analysis of concept testing	220
6.4	The details of topics discussed in the focus group	222
6.5	Purchasing price preference between concept description and concept prototype	223
7.1	Questionnaire of sensory evaluation	224
7.2	Statistic analysis of sensory evaluation of Malaysian students (between Wanganui Polytechnic students and Massey University)	226
7.3	Results of consumer panel preference	227
7.4	Results of sensory evaluation	228
7.5	Results of physical testing	234
8.1	Questionnaire of final consumer testing	235
8.2	The statistic analysis of final consumer testing	237