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SOLVENT FRACTIONATION OF NEW
ZEALAND MUTTON TALLOW

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ABSTRACT

Samples of inedible bulk mutton tallow were collected monthly throughout two killing seasons from one meat killing plant. These samples plus one sample from another plant, were analysed for fatty acid and triglyceride composition. In these samples, four fatty acids (myristic (14:0), palmitic (16:0), stearic (18:0) and oleic (18:1)) comprised 88.6% of the total fatty acids, and there was an average of 16% trisaturated triglycerides, 38% disaturated triglycerides and 46% of triglycerides with a greater degree of unsaturation. Overall, there was a significant decrease in the proportion of 14:0, and a significant increase in the proportion of 18:0, from November to June; and there was a significant difference in the mean proportion of 16:0, and also 18:1, between the two seasons. There was a significant difference in the proportion of cis monounsaturated triglycerides, and the more highly unsaturated triglycerides, between some of the different tallows analysed. There was a significant decrease in the proportion of 2-oleo disaturated triglycerides from November to June, with a range from 10.0% (May, 1978) to 20.5% (November, 1976).

An acetone fractionation scheme was developed with the main aim of concentrating these 2-oleo disaturated triglycerides into one fraction (the intermediate fraction) which may be useful as a cocoa butter replacer. The first precipitate (the hard fraction) was separated by filtration, and the filtrate was adjusted for solvent : fat ratio and then further cooled to precipitate the intermediate fraction. After separation of this precipitate, acetone was distilled from the filtrate to produce a final fraction (the soft fraction).

A screening experiment showed that the solvent : fat ratio at each crystallisation, the temperature to which the fat solution was cooled at each crystallisation, the water content of the acetone and the degree of agitation during crystallisation all affected the fractionation. The effect of these variables upon one sample of mutton tallow was studied, and mathematical models were developed to predict the yields of the three fractions and the melting properties of the intermediate fraction. The model predicting the melting properties of the intermediate

fraction was used to estimate the fractionation conditions which would give an intermediate fraction with melting properties most similar to those of cocoa butter. From this, a fractionation was performed with first and second crystallisation temperatures of 9.2°C and 5.2°C respectively, solvent to fat ratios at the first and second crystallisations of 1.0:1 and 10.0:1 respectively, a water concentration in the acetone of 0.6% and a defined agitation condition. The yields of the hard, intermediate and soft fractions were 34.5 wt %, 2.5 wt % and 63.0 wt % of the tallow respectively. The intermediate fraction contained 51.0% of 2-oleo disaturated triglycerides (compared to 68.9% in cocoa butter) and had very similar melting properties to cocoa butter. Then the fractionation scheme was modified to give a greater yield of the intermediate fraction (8.3 wt %) but the melting properties of this intermediate fraction were less similar to those of cocoa butter. This latter fractionation scheme was scaled up (from 20 g tallow to 200 g and 1 kg). On each scale an intermediate fraction with consistent yield and melting properties was obtained. The yields of the other two fractions varied, however, and overall there was a considerable difference in the behaviour of the fractionations on each scale. Attempts on the 1 kg scale to produce an intermediate fraction with properties similar to those of the best 20 g intermediate fraction (i.e. similar to cocoa butter) were unsuccessful. The highest proportion of the important 2-oleo disaturated triglycerides attained in a 1 kg scale intermediate fraction was 36.3%, and this fraction melted over a wider temperature range than cocoa butter. This intermediate fraction may be useful as a cocoa butter substitute in a coating chocolate, but is unlikely to be able to replace cocoa butter in chocolate. The hard fraction produced from this 1 kg fractionation (23.0 wt % of the tallow) showed promise in a baking shortening blend with butter, but was too hard to be useful as a pastry shortening. The soft fraction performed well as a deep-frying medium and in mayonnaise.

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CONTENTS

	<u>Page</u>
<u>ABSTRACT</u>	ii
<u>ACKNOWLEDGEMENTS</u>	iv
<u>CONTENTS</u>	v
<u>LIST OF FIGURES</u>	xiii
<u>LIST OF TABLES</u>	xx
1. <u>PRELUDE</u>	1
1.1 Plastic Shortenings	1
1.2 Liquid Shortenings	2
1.3 Fluid Shortenings	2
1.4 Frying Shortenings	2
1.5 Margarine Shortenings	3
1.6 Salad Oils	3
1.7 Cocoa Butter Replacer Fats	3
1.8 Development of New Zealand Mutton Tallow as a Source of Edible Oils and Fats	6
2. <u>LITERATURE REVIEW</u>	8
2.1 <u>Introduction</u>	8
2.2 <u>Melting and Solidification of Fats</u>	8
2.2.1 The Effect of Chemical Structure Upon the Melting of Triglycerides	8
2.2.2 Solid/Liquid Phase Behaviour of Mixtures of Triglycerides	9
2.2.2.1 Solid Solutions	10
2.2.2.2 Crystalline Compound Formation	12
2.2.2.3 Layer Crystals	12
2.2.3 Phase Behaviour of Natural and Commercial Fats	13
2.2.3.1 Phase Behaviour and Composition of Cocoa Butter	13
2.2.4 Polymorphism	16
2.2.5 Crystal Habit	18
2.2.6 Conclusions	19

	<u>Page</u>
2.3 <u>Fractionation Methods</u>	19
2.3.1 Fractionation Crystallisation	19
2.3.2 Fractional Extraction	20
2.3.3 Liquid/Liquid Extraction	20
2.3.4 Comparison of Fractionation	21
Methods	21
2.3.5 Comparison of Fractional Crystallisation Methods	22
2.4 <u>Solvent Fractionation</u>	23
2.4.1 Formation of the Solid Phase	23
2.4.2 Separation of the Liquid and Solid Phases	24
2.4.3 Factors Influencing the Nature of the Precipitate	25
2.4.3.1 Solvent Type	25
2.4.3.2 Water Content of the Solvent	27
2.4.3.3 Solvent/Fat Ratio	28
2.4.3.4 Cooling Rate	29
2.4.3.5 Degree of Agitation During Crystallisation	30
2.4.4 Conclusions on Solvent Fractionation	31
2.5 <u>Tallow Composition</u>	32
2.5.1 Fatty Acid Composition of Mutton Tallows	32
2.5.1.1 Breed	33
2.5.1.2 Body Site	33
2.5.1.3 Diet	34
2.5.1.4 Age	34
2.5.1.5 Season	35
2.5.1.6 Sex	35
2.5.2 Triglyceride Composition of Mutton Tallows	35
2.5.3 Comparison of Beef and Mutton Tallows	38
2.5.4 Variation in Tallow Composition	38

	<u>Page</u>
2.6 <u>Solvent Fractionation Schemes for Tallow</u>	40
2.6.1 Introduction	40
2.6.2 Analytical Fractionation Schemes	40
2.6.3 Schemes to Produce Fractions for Specific Uses	42
2.7 <u>General Conclusions from Literature Survey</u>	45
3. <u>METHODS OF ANALYSIS</u>	47
3.1 <u>Chemical Analysis</u>	47
3.1.1 Thin Layer Chromatography (TLC)	47
3.1.1.1 Preparation and Development of Plates	47
3.1.1.2 Preparative TLC	48
3.1.1.3 Argentation TLC	48
3.1.1.4 TLC of 2-Monoglycerides	49
3.1.2 Fatty Acid Analysis	49
3.1.2.1 Preparation of Fatty Acid Methyl Esters	50
3.1.2.2 Gas Liquid Chromatography (GLC)	50
3.1.3 Quantitative Measurement of Triglyceride Bands	50
3.1.4 Preparation of 2-Monoglycerides	51
3.2 <u>Thermal Analysis-Differential Scanning Calorimetry (DSC)</u>	51
4. <u>TRIGLYCERIDE AND FATTY ACID ANALYSIS OF SELECTED NEW ZEALAND MUTTON TALLOW</u>	54
4.1 Introduction	54
4.2 Methods of Collection and Analysis of the Tallows	54
4.3 Fatty Acids in the Tallows Analysed	55
4.4 Identification of Triglycerides in Mutton Tallow	61
4.5 Proportion of the Different Triglyceride Types in the Tallows Analysed	63
4.6 Proportion of 2-oleo Disaturated Triglycerides	66
4.7 Conclusions	68

	<u>Page</u>
5. <u>DEVELOPMENT OF A SOLVENT FRACTIONATION SCHEME</u> <u>FOR NEW ZEALAND MUTTON TALLOW</u>	70
5.1 Introduction	70
5.2 Outline of the Fractionation Method	71
5.3 The Independent Variables	71
5.3.1 First Crystallisation Temperature	72
5.3.2 Second Crystallisation Temperature	72
5.3.3 Solvent to Fat Ratio at Each	
Crystallisation	72
5.3.4 Water Content of the Acetone	72
5.3.5 Agitation Speed	73
5.3.6 Crystallisation Time	73
5.3.7 Tallow Source	73
5.4 Dependent Variables	74
5.5 Screening Experiment	75
5.5.1 Experiment Design	75
5.5.2 Results of the Screening	
Experiment	76
5.5.3 Empirical Equations Relating	
Dependent and independent Variables	76
5.5.3.1 Yield of the Hard Fraction	78
5.5.3.2 Yield of the Intermediate	
Fraction	79
5.5.3.3 Yield of the Soft Fraction	79
5.5.3.4 CBLF of the Intermediate	
Fraction	80
5.5.3.5 Residual Plots	81
5.5.4 Main Effects	81
5.5.5 Interactive and Quadratic	
Effects	82
5.5.6 Choosing Variables for Future	
Experimentation	83
5.5.7 Conclusions from the Screening	
Experiment	84
6. <u>OPTIMISING THE MELTING PROPERTIES OF THE</u> <u>INTERMEDIATE FRACTION</u>	85
6.1 Introduction	85
6.2 Fractionation Method	85

	<u>Page</u>
6.3 Experimental Design	85
6.4 Levels of the Independent Variables	87
6.5 Results	91
6.6 Empirical Equations Relating Dependent and Independent Variables	91
6.7 Decoding the Models	93
6.8 Interpretation of the Models	94
6.8.1 Isolated Effect of the Variables	94
6.8.2 Consideration of the Combined Effect of the Six Independent Variables	95
6.9 Comparison of Results of the Screening Experiment and this Experiment	99
6.10 Extrapolation of Some of the Independent Variables	101
6.11 Further Study of the Effect of Altering S_1 and S_2	101
6.12 Stages of Fractionation	102
6.13 Consideration of Further Experiments	102
6.14 Conclusions	103
 7. <u>FURTHER STUDY OF THE INDEPENDENT VARIABLEES</u> <u>AROUND THE PREVIOUS PREDICTED OPTIMUM</u>	 105
7.1 Introduction	105
7.2 Methods	105
7.3 Experimental Design	106
7.4 Levels of the Independent Variables	106
7.5 Results	107
7.6 Empirical Equations Relating Dependent to Independent Variables	107
7.6.1 Residuals from the Fitted Models	108
7.6.2 Isolated Effect of the Variables	112
7.7 Interpretation of the Results	113
7.8 Stages of the Fractionation	115
7.9 Temperature History of the Fat Solution During Crystallisation	116
7.10 Conclusions	117

	<u>Page</u>
8. <u>SCALE-UP OF THE FRACTIONATION</u>	118
8.1 Introduction	118
8.2 Fractionation of Two Hundred Grams of Tallow	118
8.2.1 Methods	118
8.2.2 Results	120
8.2.3 Yields of the Three Fractions	121
8.3 Fractionation of One Kilogram of Tallow	121
8.3.1 Methods	121
8.3.2 Results	123
8.3.3 Comparison of the One Kilogram Fractionations with those of the Smaller Scale Fractionations	124
8.3.4 Further Attempts to Fraction- ate One Kilogram of Tallow	125
8.4 Comparison of all Fractionations	127
8.5 Conclusions	131
8.6 Discussion and Conclusions on the Fractionation Method	132
9. <u>EVALUATION OF THE FRACTIONATION PRODUCTS</u>	134
9.1 Introduction	134
9.2 Fatty Acid Composition of the Fractions	135
9.2.1 Hard Fractions	135
9.2.2 Intermediate Fractions	137
9.2.3 Soft Fractions	137
9.3 Proportion of Each of the Triglyceride Groups	137
9.4 Fatty Acid Composition of the Triglyceride Groups	140
9.5 Proportion of 2-oleo Disaturated Triglycerides in the Intermediate Fractions	141
9.6 Differential Scanning Calorimetry	142
9.6.1 Hard Fractions	142
9.6.2 Intermediate Fractions	142
9.6.3 Soft Fractions	143
9.7 Comparison with Other Fats	143

	<u>Page</u>
9.7.1 Hard Fractions	143
9.7.2 Intermediate Fractions	144
9.7.3 Soft Fractions	148
9.8 <u>Summary of Composition of the Fractions</u>	151
9.9 <u>Further Testing of the Fractions</u>	152
9.9.1 Evaluation of the Soft Tallow Fraction as a Frying Medium	153
9.9.2 Evaluation of the Soft Tallow Fraction for Mayonnaise Manufacture	153
9.9.3 Evaluation of Tallow Fractions for use in Baking	154
9.9.4 Evaluation of the Hard Tallow Fraction as a Pastry Fat	155
9.9.5 Nuclear Magnetic Resonance (NMR) of the Intermediate Fraction	155
9.10 <u>Discussion and Conclusions on Uses for the Fractions</u>	156
10. <u>GENERAL CONCLUSIONS AND CONSIDERATIONS FOR FUTURE WORK</u>	159
 <u>APPENDICES</u>	
1 Polymorphism of Triglycerides	162
2 Solvents which have been used for Solvent Fractionation of Fat Substances	165
3 Results of the Triglyceride and Fatty Acid Analyses of Selected New Zealand Mutton Tallows	167
4 Regression Equations and Regression Statistics from the Screening Experiment	181
5 Regression Equations and Regression Statistics from the Central Composite Design; and an Example of the Method used to compare Observed Responses with Responses Predicted from the Fitted Equations.	185
6 Regression Equations and Regression Statistics from the Box and Behnken Design (Chapter 7)	190

	<u>Page</u>
7 Results of the Fatty Acid and Triglyceride Analyses of Some Selected Tallow Fractions	193
8 Further Aspects of Tallow Quality.	204
<u>ABBREVIATIONS AND NOMENCLATURE</u>	207
<u>REFERENCES</u>	209

LIST OF FIGURES

<u>Figure</u>	<u>Title</u>	<u>Between pp.</u>
2.1	Phase diagram of two triglyceride species which form ideal liquid and solid solutions	10-11
2.2	Binary phase diagram for a system exhibiting incomplete solid solubility	10-11
2.3	Binary eutectic phase diagram	11-12
2.4	Binary monotectic phase diagram	11-12
2.5	Differential scanning calorimeter (DSC) diagram for two samples of cocoa butter (a) pressed from shell-free West African cocoa (b) pressed from shell-free Brazilian cocoa	13-14
2.6	Fractionation scheme of Riemenschneider <u>et al</u>	40-41
2.7	Crystallisation sequence for separating sheep body triglycerides into six fractions of widely different iodine value	40-41
2.8	Unilever's fractionation scheme for mutton tallow	42-43
2.9	Fractionation scheme of Luddy <u>et al</u>	43-44
3.1	General scheme for analysis of the fat samples	47-48
3.2	Calculating the CBLF of a fat sample giving a DSC profile with only one peak	53-54
4.1	A plot of the proportion of 14:0 and 18:0 in the tallows analysed against the month the tallow was produced, and the least squares regression for the same	58-59
4.2	Argentation TLC of tallow triglycerides	61-62

LIST OF FIGURES (continued)

<u>Figure</u>	<u>Title</u>	<u>Between pp.</u>
4.3	Seasonal variation in the proportion of trisaturated, trans monounsaturated, cis monounsaturated and more unsaturated triglycerides in mutton tallows	63-64
4.4	Seasonal trend in the proportion of 2-oleo disaturated triglycerides in mutton tallows from the Smithfield works, and the least-squares linear regression line for this data	66-67
5.1	Outline of the two-stage solvent fractionation process	71-72
5.2	Half-normal plot for the yield of hard fraction	78-79
5.3	Half-normal plot for the yield of the intermediate fraction	78-79
5.4	Half-normal plot for the yield of the soft fraction	79-80
5.5	Half-normal plot for the CBLF of the intermediate fraction	79-80
5.6	Plot of residual v. Y for the yield of the hard fraction	81-82
5.7	Plot of residual v. Y for the yield of the intermediate fraction	81-82
5.8	Plot of residual v. Y for the yield of the soft fraction	81-82
5.9	Plot of residual v. Y for the CBLF of the intermediate fraction	81-82
5.10	Effect of fitting quadratic terms to a regression equation	83-84

LIST OF FIGURES (continued)

<u>Figure</u>	<u>Title</u>	<u>Between pp.</u>
6.1	Plot of residual v. Y for the yield of hard fraction model	92-93
6.2	Plot of residual v. Y for the yield of intermediate fraction model	92-93
6.3	Plot of residual v. Y for the yield of soft fraction model	92-93
6.4	Plot of residual v. Y for the CBLF of the intermediate fraction model	92-93
6.5	The isolated effect of T_1 on the dependent variables	
	(a) Yield of the hard fraction	94-95
	(b) Yield of the intermediate fraction	94-95
	(c) Yield of the soft fraction	94-95
	(d) CBLF of the intermediate fraction	94-95
6.6	The isolated effect of T_2 on the dependent variables	
	(a) Yield of the intermediate fraction	95-96
	(b) Yield of the soft fraction	95-96
	(c) CBLF of the intermediate fraction	95-96
6.7	The isolated effect of S_1 on the dependent variables	
	(a) Yield of the hard fraction	95-96
	(b) Yield of the intermediate fraction	95-96
	(c) Yield of the soft fraction	95-96
	(d) CBLF of the intermediate fraction	95-96

LIST OF FIGURES (continued)

<u>Figure</u>	<u>Title</u>	<u>Between pp.</u>
6.8	The isolated effect of S_2 on the dependent variables	
	(a) Yield of the intermediate fraction	95-96
	(b) Yield of the soft fraction	95-96
	(c) CBLF of the intermediate fraction	95-96
6.9	The isolated effect of W on the dependent variables	
	(a) Yield of the hard fraction	96-97
	(b) Yield of the intermediate fraction	96-97
	(c) Yield of the soft fraction	96-97
	(d) CBLF of the intermediate fraction	96-97
6.10	The isolated effect of A on the dependent variables	
	(a) Yield of the hard fraction	96-97
	(b) Yield of the intermediate fraction	96-97
	(c) Yield of the soft fraction	96-97
	(d) CBLF of the intermediate fraction	96-97
6.11	DSC profile of the intermediate fraction produced under the predicted optimum conditions and the DSC profile of a cocoa butter sample	97-98
6.12	Comparison of the DSC profiles of the intermediate fraction produced under the conditions of section 6.10 and cocoa butter	101-102
7.1	The isolated effect of T_1 on the dependent variables	
	(a) Yield of hard fraction	112-113
	(b) Yield of intermediate fraction	112-113
	(c) Yield of the soft fraction	112-113
	(d) CBLF of the intermediate fraction	112-113

LIST OF FIGURES (continued)

<u>Figure</u>	<u>Title</u>	<u>Between pp.</u>
7.2	The isolated effect of T_2 on the dependent variables	
	(a) Yield of intermediate fraction	112-113
	(b) Yield of soft fraction	112-113
	(c) CBLF of the intermediate fraction	112-113
7.3	The isolated effect of S_1 on the dependent variables	
	(a) Yield of the hard fraction	112-113
	(b) Yield of the intermediate fraction	112-113
	(c) Yield of the soft fraction	112-113
	(d) CBLF of the intermediate fraction	112-113
7.4	The isolated effect of S_2 on the dependent variables	
	(a) Yield of the intermediate fraction	112-113
	(b) Yield of the soft fraction	112-113
	(c) CBLF of the intermediate fraction	112-113
7.5	DSC profile of the intermediate tallow fraction produced with $T_1 = 9.2^{\circ}\text{C}$, $T_2 = 5.2^{\circ}\text{C}$, $S_1 = 4:1$, $S_2 = 12:1$; and the DSC profile of a cocoa butter sample	114-115
7.6	DSC profile of the intermediate tallow fraction produced with $T_1 = 9.2^{\circ}\text{C}$, $T_2 = 5.2^{\circ}\text{C}$, $S_1 = 4:1$, $S_2 = 6:1$; and the DSC profile of a cocoa butter sample	114-115
7.7	Temperature history of the fat solution during crystallisation	
	(a) First crystallisation	116-117
	(b) Second crystallisation	116-117

LIST OF FIGURES (continued)

<u>Figure</u>	<u>Title</u>	<u>Between pp.</u>
8.1	Cooling curves for the fractionation of 200 g of tallow	
	(a) First crystallisation	119-120
	(b) Second crystallisation	119-120
8.2	DSC profile of the intermediate tallow fraction produced by fractionating 200 g of tallow with air cooling; and the DSC profile of a cocoa butter sample	120-121
8.3	Apparatus used for the fractionation of 1 kg of tallow	122-123
8.4	Cooling curves for the fractionation of 1 kg of tallow	
	(a) First crystallisation	122-123
	(b) Second crystallisation	122-123
8.5	DSC profile of the intermediate fraction produced by fractionating 1 kg of tallow with stirrer speed of 25 rpm; and the DSC profile of a cocoa butter sample	123-124
8.6	DSC profiles of the intermediate fractions produced by fractionating 1 kg of tallow with $T_1 = 11.5^{\circ}\text{C}$ and slow and fast cooling rates; and the DSC profile of a cocoa butter sample	126-127
8.7	The effect of varying S_1 upon the yield of hard fraction	127-128

LIST OF FIGURES (continued)

<u>Figure</u>	<u>Title</u>	<u>Between pp.</u>
8.8	DSC profile of the intermediate fraction produced by fractionating 1 kg of tallow with $S_1 = 1:1$; and the DSC profile of a cocoa butter sample	127-128
3.9	DSC profile of the intermediate tallow fraction produced by fractionating 1 kg of tallow with $S_1 = 1.5:1$; and the DSC profile of a cocoa butter sample	127-128
9.1	DSC profiles of the hard fractions produced from 1 kg of tallow, and of a fraction of Luddy <u>et al</u> , 1977	143-144
9.2	DSC profile of the soft fraction produced by fractionating 1 kg of tallow with $S_1 = 4:1$, the two softest fractions produced by Luddy <u>et al</u> (1977) and a commercial salad oil (Luddy <u>et al</u> , 1977)	148-149

LIST OF TABLES

<u>Table</u>	<u>Title</u>	<u>Page</u>
2.1	Fatty acid composition of cocoa butter	15
2.2	Triglyceride composition of cocoa butter	15
2.3	Composition of the disaturated triglycerides in cocoa butter	16
2.4	Fatty acid composition of mutton tallow from various countries	33
2.5	Triglyceride composition of mutton tallow from various countries	36
2.6	Fatty acid composition of beef tallow from various countries	37
2.7	Triglyceride composition of beef tallow from various countries	37
2.8	Triglyceride composition of fractions by the scheme of Riemenschneider, Luddy, Swain and Ault (1946)	41
2.9	Triglyceride composition of fractions by the scheme of Hilditch and Shrivastava (1949)	41
2.10	Composition of products from solvent fractionation of Japanese mutton tallow	44
4.1	Total fatty acid composition of mutton tallow from the 1976/1977 season	56
4.2	Total fatty acid composition of mutton tallow from the 1977/1978 season	57
4.3	Comparison of the minimum, maximum and average proportion of selected fatty acids in the Smithfield tallow with published values	60

LIST OF TABLES (continued)

<u>Table</u>	<u>Title</u>	<u>Page</u>
4.4	Comparison of the fatty acid composition of mutton tallow (Smithfield November 1976 1½ R) determined by direct analysis and by calculation from the amount of each triglyceride group separated by argentation TLC and their respective fatty acid compositions	62
4.5	Comparison of the minimum, maximum and average proportion of the different triglyceride groups in the Smithfield tallows analysed with published values	65
4.6	Fatty acid composition at the 2-position of tallow triglycerides (Ocean Beach, May 1977) determined by direct analysis and by analysis of the triglyceride groups separated by argentation TLC	67
5.1	Definition of independent variables selected for the screening experiment	74
5.2	Effects determined using a 2^{8-4}_{IV} fold-over design	76
5.3	The experimental design used and the responses to the independent variables	77
6.1	Levels of the independent variables	87
6.2	The experimental design and the responses of the dependent variables	88
6.3	Fitted models for each of the response variables	92
6.4	Decoded models for each of the response variables	93
6.5	Predicted and measured values of the four response variables at the predicted optimum of the CBLF model	98

LIST OF TABLES (continued)

<u>Table</u>	<u>Title</u>	<u>Page</u>
6.6	Comparison of the significant terms in the fitted empirical models for the screening experiment and the central composite design	99
6.7	Levels of S_1 and S_2 and yields of fractions produced	102
7.1	Levels of the independent variables	107
7.2	The experimental design and the values of the response variables obtained	109
7.3	Empirical models for the response variables	110
7.4	Residuals from the fitted models	111
7.5	Summary of the effect of altering S_1 and S_2 around the optimum	115
8.1	Yields and characteristics of fractions obtained from 20 g and 200 g tallow using similar temperature and solvent : fat ratios	121
8.2	The effect of agitation speed and cooling rate upon the fractionation of 1 kg of tallow	124
8.3	A comparison of the yields of the three fractions produced from the fractionations of different amounts of tallow	125
8.4	The fractionation of 1 kg of tallow with different levels of T_1 or S_1	128
8.5	Comparison of the results of selected fractions from each of the three scales	130
9.1	Fatty acid composition of tallow and fractions obtained by solvent crystallisation	136
9.2	Proportions of the different triglyceride groups in each of the fractions and the original tallow	138

LIST OF TABLES (continued)

<u>Table</u>	<u>Title</u>	<u>Page</u>
9.3	Proportion of 2-oleo disaturated triglycerides in the intermediate fractions analysed, and the original tallow	141
9.4	Fatty acid composition of the 200 g hard fraction, the 1 kg hard fraction with $S_1 = 4:1$, and fraction 2 by Luddy <u>et al</u> (1977) from North American beef tallow (see figure 2.9)	143
9.5	Fatty acid compositions of each of the intermediate fractions analysed, cocoa butter and several fats which have been used to replace all or a portion of cocoa butter in chocolate or chocolate-type products.	145
9.6	Triglyceride composition of each of the intermediate fractions analysed, cocoa butter and some cocoa butter replacer fats	146
9.7	Fatty acid composition of the soft fraction produced by fractionating 1 kg of tallow ($S_1 = 4:1$), two North American beef tallow fractions (fractions 4 and 5 from figure 2.9), a commercial soyabean salad oil, zero-erucic acid rapeseed oil and a commercial shortening for heavy-duty frying (Sheppard, Iverson and Weihrauch, 1978)	150