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**INVESTIGATIONS INTO MUSCULARITY AS A  
CHARACTERISTIC OF SHEEP CARCASSES AT  
VARIOUS STAGES OF GROWTH**

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requirements for the degree of

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## **DEDICATION**

**This thesis is dedicated to my wife, RAJA, for her love and support  
and to my daughters and son, FADIAH, LEENA, AND YOUSEF.**

## ABSTRACT

Muscularity is a meat animal characteristic defined as the depth of muscle relative to skeletal dimensions. It is usually assessed subjectively, but a possible objective measure involves obtaining an average muscle depth by taking the square root of the weight per unit length of muscles around the femur, and expressing this relative to femur length. A series of experiments was conducted to assess this objective measure of muscularity (MUSC), and the value of muscularity as a meat production trait. These involved evaluation of first, the pattern of change in MUSC with growth of sheep from birth to near maturity, secondly, relationships between MUSC in different parts of the carcass, thirdly, relationships between MUSC and muscle fibre size and number, fourthly, breed differences in MUSC, fifthly, relationships between MUSC measured objectively and subjectively, and finally, indirect predictors of MUSC based on simple measurements.

Southdown rams from lines selected for high- or low-backfat depths (n=40 per line) were studied at birth, 10, 20, 40, 60, and 80 kg liveweight and at near maturity. Muscularity and M:B ratios from different groups of muscles and bones, together with other indexes of carcass shape, including the depth to width ratio of a transverse section of *M.longissimus* and a carcass weight to length ratio ( $CWT:L^3$ ), increased at a decreasing rate with increasing carcass weight. For most ratios this increase was parallel for both lines with the high-backfat line having higher values, but for muscularity in the femur region the differences between the lines increased with growth. Muscularity based on the muscles around the femur showed line differences most clearly. Line differences in muscularity did not appear to be associated with consistent differences in bone shape.

Proportions of muscle fibre types in the *M.semitendinosus* were generally similar for the two selection lines.

Data from 211 carcasses from 4 trials were evaluated to study differences between breed and sex groups of sheep in the pattern of change in muscularity with increasing carcass weight. Leg muscularity increased for all groups with increasing

carcass weight, and the rate of increase was similar at carcass weights above 10 kg. The Southdown breed had higher muscularity values and M:B ratios than Texel crosses, which in turn had higher values than all other groups. For some comparisons, there were important sex effects. At a similar carcass weight, Coopworth rams had slightly higher muscularity values (+1.7%;  $P < 0.10$ ), but lower M:B values (-8.8%;  $P < 0.001$ ) than Poll Dorset-cross cryptorchids.

Relationships between objective measures of muscling and subjective scores of muscularity or conformation were studied using data from 95 lambs and 90 bulls. Muscularity calculated from the leg cut rather than whole side or eye-muscle dimensions had the closest relationships with subjective scores of muscularity or conformation ( $R^2\%$  = 69 to 80% for lambs and 56% for bulls), with leg M:B being only slightly inferior ( $R^2\%$  = 62% for lambs and 52% for bulls). Muscularity and M:B ratio calculated from the side were the next best as predictors, but variables based on the eye muscle were poor.

Data from 5 trials were used to examine indirect objective methods to predict leg muscularity for sheep carcasses. Muscularities based on *M.semimembranosus* or *M.biceps femoris* were accurate predictors when compared with indexes based on other individual muscles. Muscularities based on the topside and outside commercial boneless cuts were also good predictors. Indexes of muscularity calculated from carcass linear and eye-muscle dimensions were poor as predictors. Leg width to length (W/L) ratios obtained from lateral leg photographs proved useful as predictors. Individual W/L values or groups of W/L values combined as bands were moderately effective as predictors for some trials. However, the regression prediction equations varied between trials.

It is concluded that the objective measure of carcass muscularity investigated here is a carcass characteristic that reflects important differences in carcass shape, and that differences in this characteristic between carcasses are not necessarily accompanied by corresponding changes in muscle to bone ratio.

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## TABLE OF CONTENTS

	Page
ABSTRACT .....	i
ACKNOWLEDGEMENTS .....	iii
TABLE OF CONTENTS .....	v
LIST OF TABLES .....	xi
LIST OF FIGURES .....	xvii
LIST OF APPENDICES .....	xxi
 CHAPTER 1. ....	 1
INTRODUCTION .....	1
 CHAPTER 2. ....	 4
LITERATURE REVIEW .....	4
 2.1 INTRODUCTION .....	 4
 2.2 PATTERNS OF GROWTH AND DEVELOPMENT IN THE SHEEP WITH RESPECT TO CARCASS COMPOSITION CHARACTERISTICS .....	  4
2.2.1 CARCASS COMPOSITION CHARACTERISTICS OF IMPORTANCE .....	4
1. Dressing-out percentage .....	5
2. Proportions of muscle, fat, and one .....	5
3. Distribution of muscle, fat, and one.....	6
4. Carcass shape .....	6
 2.2.2 METHODS OF ANALYSING GROWTH DATA .....	 8
2.2.2.1 Tissue percentage and ratios .....	8
2.2.2.2 The allometric equation .....	9
2.2.2.3 Maturity coefficient .....	11



2.2.3 PATTERNS OF GROWTH .....	15
1. Bone growth .....	17
2. Muscle growth .....	17
3. Fat growth .....	18
2.3 CARCASS MUSCULARITY .....	27
2.3.1 DEFINITION OF CARCASS MUSCULARITY .....	27
2.3.2 EVALUATION OF CARCASS MUSCULARITY .....	29
2.3.2.1 Subjective evaluation .....	29
2.3.2.2 Objective evaluation .....	32
2.3.2.2.1 Measurements Taken on the cross-section of the <i>M.longissimus</i> .....	32
2.3.2.2.2 Linear measurements .....	33
2.3.2.2.3 Weight to length ratios .....	33
2.3.2.2.4 Profile dimensions .....	34
2.3.2.2.5 Others .....	39
2.3.3 RELATIONSHIPS BETWEEN CARCASS MUSCULARITY AND OTHER CARCASS CHARACTERISTICS .....	40
2.3.3.1 Dressing-out percentage .....	40
2.3.3.2 Carcass muscle percentage .....	41
2.3.3.3 Linear measurements .....	43
2.3.3.4 Eye muscle area and depths .....	44
2.3.3.5 Muscle distribution .....	46
2.3.4 FACTORS AFFECTING CARCASS MUSCULARITY .....	47
2.3.4.1 Slaughter weight and age .....	47
2.3.4.2 Sex .....	48
2.3.4.3 Breeds (Between and within breeds) .....	48
2.3.4.4 Nutrition .....	50
2.4 MUSCLE FIBRE-SIZE AND FIBRE-TYPE CHARACTERISTICS AND THEIR RELEVANCE TO MUSCULARITY .....	53

2.4.1 CHANGES DURING GROWTH AND DEVELOPMENT (NUMBER, SIZE, LENGTH AND TYPE)..... 54

2.4.2 FACTORS AFFECTING MUSCLE FIBRE SIZE, NUMBER AND TYPE ... 57

2.4.2.1 Genetic effects ..... 57

2.4.2.2 Sex effects ..... 62

2.4.2.3 Nutrition effects ..... 63

2.4.2.4 Exercise effects ..... 66

2.4.2.5 Effect of stretch over the skeletal frame ..... 68

2.4.2.6 Effects of anabolic substances ..... 69

CHAPTER 3.

CHANGES IN MUSCULARITY AND CARCASS COMPOSITION OF SOUTHDOWN RAMS SELECTED FOR HIGH- AND LOW-BACKFAT DEPTH WITH GROWTH FROM BIRTH TO MATURITY ..... 73

INTRODUCTION ..... 73

MATERIALS AND METHODS ..... 74

Animal and experimental design ..... 74

Slaughter procedures and measurements on carcass and non-carcass components ..... 75

Dissection procedures and measurements ..... 76

Bone measurements ..... 77

Muscle fibre measurements ..... 79

Calculation of derived indexes ..... 80

Statistical methods ..... 81

RESULTS ..... 84

Non-carcass components measurements ..... 84

Carcass linear dimensions measurements ..... 87

Measurements on the leg, rack, and shoulder cuts ..... 89

Bone weight and dimensions ..... 94

Muscularity indexes, M:B ratios, and other ratios ..... 99

Muscle fibre measurements .....	106
Fat, water and dressing-out percentages .....	110
DISCUSSION .....	112
Differences between the Southdown backfat selection lines in the way in which muscularity and associated composition characteristics change with growth .....	112
The consistency of line differences in measures of muscularity and other composition characteristics in different anatomical regions .....	114
Relationships between muscularity differences between the lines and differences in carcass linear measurements and in the size and shape of bones .....	116
Relationships between muscularity differences between the lines and differences in muscle fibre type, size and number .....	118
SUMMARY AND CONCLUSIONS .....	119
CHAPTER 4.	
DIFFERENCES IN MUSCULARITY BETWEEN BREED AND SEX GROUPS .....	122
INTRODUCTION .....	122
MATERIAL AND METHODS .....	123
Animal and experimental design .....	123
Slaughter procedure and carcass measurements .....	124
Dissection procedures and measurements .....	125
Calculation of derived indexes .....	125
Statistical methods .....	126
RESULTS .....	126
Muscularity indexes and M:B ratios .....	129
Eye muscle dimensions and ratios .....	135
Carcass linear dimensions measurements and ratios .....	139

DISCUSSION .....	142
Breed and sex differences in muscularity and M:B ratios .....	142
Breed and sex differences in eye muscle and carcass linear dimensions and ratios .....	146
SUMMARY AND CONCLUSIONS .....	149
 CHAPTER 5.	
RELATIONSHIPS BETWEEN OBJECTIVE AND SUBJECTIVE MEASUREMENTS OF CARCASS MUSCULARITY .....	151
INTRODUCTION .....	151
MATERIAL AND METHODS .....	152
Animals and carcass measurements .....	152
Calculation of derived indexes .....	153
Statistical methods .....	154
RESULTS .....	154
Characteristics indicating differential growth .....	155
Characteristics indicating absolute growth .....	166
DISCUSSION .....	167
Carcass shape and muscularity or muscle to bone ratio .....	167
Carcass shape and eye muscle dimensions .....	168
Carcass shape and carcass length .....	168
Carcass shape and percent meat yield .....	169
Repeatability of subjective scores .....	169
SUMMARY AND CONCLUSIONS .....	170

## CHAPTER 6.

### THE INDIRECT PREDICTION OF LEG MUSCULARITY FOR SHEEP CARCASSES .....

172

### INTRODUCTION .....

172

### MATERIALS AND METHODS .....

173

Animals and experimental design ..... 173

Slaughter procedures and carcass measurements ..... 174

Photographic measurements (PHM) ..... 175

A calipers-holding device (CHD) ..... 179

Dissection procedures and cut preparation ..... 182

Calculation of derived indexes ..... 182

Statistical methods ..... 183

### RESULTS .....

184

Prediction from individual muscles and commercial cuts ..... 184

Prediction from carcass linear and eye muscle dimensions ..... 193

Prediction from a calipers-holding device and measurements on photographs .... 194

### DISCUSSION .....

206

The assessment of the accuracy of prediction ..... 206

Prediction from individual muscles and commercial cuts ..... 207

Prediction from carcass linear and eye-muscle dimensions ..... 208

Prediction from a calipers-holding device (CHD) and the photographic methods 209

### SUMMARY AND CONCLUSIONS .....

212

## CHAPTER 7.

### SUMMARY AND CONCLUSIONS .....

213

### REFERENCES .....

216

### APPENDICES .....

238

## LIST OF TABLES

Table	Page
<hr/>	
2.1 Allometric growth coefficients (b) and maturity coefficients (q) showing how total muscle or individual muscle weights, total fat or fat depots weights, and total bone or individual bone weights changed relative to carcass weight for sheep from published studies. The values in brackets following some b values are the intercepts for the log/log relationship .....	19
2.2 Changes with increasing carcass weight for fat, muscle and bone percentages and for muscle to bone ratios for sheep from published studies .....	24
2.3 An outline of muscle-fibre-type classification systems, showing the alternative terms used .....	53
3.1 The experimental design showing the birth year, age at slaughter, weight at slaughter and time of slaughter .....	75
3.2 Predicted weights of non-carcass components at a carcass weight (CW) of 25kg for Southdown rams from high- and low-backfat selection lines ranging in carcass weight from about 1.5kg (birth) to 40kg. Double-log regression equations were used to calculate allometric growth ratios (AGR) and predicted weights .....	86
3.3 Predicted values of carcass linear dimensions at a carcass weight (CW) of 25kg for Southdown rams from high- and low-backfat selection lines ranging in carcass weight from about 1.5kg (birth) to 40kg. Double-log regression equations were used to calculate allometric growth ratios (AGR) and predicted components .....	88

3.4 Predicted leg characteristics at a total leg muscle and bone weight of 2096g for Southdown rams from high- and low-backfat selection lines ranging in carcass weight from about 1.5kg (birth) to 40kg. Double-log regression equations were used to calculate allometric growth ratios (AGR) and predicted values .....	91
3.5 Predicted rack characteristics at a total rack muscle and bone weight of 498g for Southdown rams from high- and low-backfat selection lines ranging in carcass weight from about 1.5kg (birth) to 40kg. Double-log regression equations were used to calculate allometric growth ratios (AGR) and predicted values .....	92
3.6 Predicted shoulder characteristics at a total shoulder muscle and bone weight of 757g for Southdown rams from high- and low-backfat selection lines ranging in carcass weight from about 1.5kg (birth) to 40kg. Double-log regression equations were used to calculate allometric growth ratios (AGR) and predicted values .....	93
3.7 Predicted bone weights and dimensions at specific bone lengths for Southdown rams from high- and low-backfat selection lines ranging in carcass weight from about 1.5kg (birth) to 40kg. Double-log regression equations were used to calculate allometric growth ratios (AGR) and predicted bone weights and dimensions .....	96
3.8 Shape parameters (a and b allometric coefficients with regression coefficients) for the weight and circumference of the bones relative to their length, in Southdown rams from high- and low-backfat selection lines ranging in carcass weight from about 1.5kg (birth) to 40kg .....	98
3.9 Predicted shape ratios at a carcass weight (CW) of 25kg for Southdown rams from high- and low-backfat selection lines ranging in carcass weight from about 1.5kg (birth) to 40kg. Regression equations of the shape ratio against log carcass weight were used to calculate predicted ratios at 25kg carcass weight .....	100

3.10 Predicted muscularity values (MUSC) and M:B ratios for several parts of the leg at a carcass weight (CW) of 25kg for Southdown rams from high- and low-backfat selection lines ranging in carcass weight from about 1.5kg (birth) to 40kg. Carcass component against log carcass weight regression equations were used to calculate predicted ratios .....	100
3.11 Predicted muscularity values (MUSC) and M:B ratios for several parts of the shoulder at a carcass weight (CW) of 25kg for Southdown rams from high- and low-backfat selection lines ranging in carcass weight from about 1.5kg (birth) to 40kg. Carcass component against log carcass weight regression equations were used to calculate predicted ratios .....	101
3.12 Simple correlations ( $r\%$ ) between muscularity indexes, M:B ratios with muscularity indexes, and between M:B ratios for several parts of the leg and the shoulder cuts for Southdown rams of both lines .....	102
3.13 Predicted muscle fibre proportions of the three muscle fibre types (red, intermediate and white) for a frozen middle subsample, and mean fibre area, total number of fibres and muscle area for total middle transverse section from <i>M.semitendinosus</i> at a carcass weight (CW) of 25kg for Southdown rams from high- and low-backfat selection lines ranging in carcass weight from about 1.5kg (birth) to 40kg. Quadratic regression equations were used to calculate predicted values .....	107
3.14 Predicted fat and water percentage from <i>M.longissimus</i> and predicted dressing-out percentage at a carcass weight (CW) of 25kg for Southdown rams from high- and low-backfat selection lines ranging in carcass weight from about 1.5kg (birth) to 40kg. Linear regression equations were used to calculate predicted values .....	111
4.1 An outline of the experimental designs for the four trials .....	124
4.2 Least-squares means for carcass weight, leg weight, fat depth C, and leg fat percentage for animals of Trials 1, 2, 3, and 3 + 4, after correction to a constant carcass weight <sup>a</sup> , except in the case of carcass weight .....	128



4.3 Least-squares means for muscularity indexes, M:B ratios and associated carcass characteristics for animals of Trials 1, 2, 3, and 3 + 4, after correction to a constant carcass weight <sup>a</sup> .....	130
4.4 Regression equations relating M:B and muscularity in the femur area for the 4 trials. Group differences within trials were not significant .....	133
4.5 Least-squares means for eye-muscle dimensions and ratios of the <i>M.longissimus</i> animals of Trials 1, 2, 3, and 4 after correction to a constant carcass weight <sup>a</sup> .....	136
4.6 Least-squares means for carcass linear dimensions and ratios for animals of Trials 1, 2, 3, and 4 after correction to a constant carcass weight <sup>a</sup> .....	140
5.1 Means for measures of muscularity, M:B and associated characteristics of lamb carcasses, which were subjectively placed into three muscling classes (data set 1) .....	157
5.2 Means for measures of muscularity, M:B and associated characteristics of lamb carcasses which were subjectively placed into four conformation classes (data set 1) .....	158
5.3 Means for measures of muscularity, M:B and associated characteristics of lamb carcasses, which were subjectively placed into five conformation classes (data set 2) .....	159
5.4 Means for measures of muscularity, M:B and associated carcass characteristics of bull carcasses, which were subjectively placed into four conformation classes (data set 3) .....	160
5.5 Relationships between subjective muscling or conformation score (y) and measures of muscularity, M:B, B:A, EMA ratios, and CWT:L <sup>3</sup> ratio (x) (data sets 1,2, and 3) in term of coefficients of determination (R <sup>2</sup> %) .....	161

5.6 Relationships between selected measurements made on carcasses (data sets 1,2, and 3) in terms of coefficients of determination ( $R^2\%$ ) .....	162
6.1 An outline of the experimental designs for the 6 trials .....	174
6.2 Means, standard deviations, and coefficients of variation for the standard muscularity (MUSC(FL)) and potential predictors of muscularity based on dissected muscle, commercial boneless cuts, or linear and area measurements for the 5 trials .....	186
6.3 Simple correlation coefficients ( $r \times 100$ ) between standard muscularity (MUSC(FL)) and potential predictors of muscularity for the 5 trials .....	187
6.4 Simple regression equations relating standard muscularity (MUSC(FL) = Y = dependent variable) and some potential predictors of muscularity for the 5 trials .....	189
6.5 The accuracy of potential predictors of standard muscularity (MUSC(FL)) when included along with carcass weight (CWT) in multiple regression equations. Measures of accuracy given are the coefficient of determination ( $R^2\%$ ) and the residual standard deviation (RSD) for the 5 trials .....	192
6.6 Means, standard deviations, and coefficients of variation for some potential predictors of muscularity based on leg width to length (W/L) ratios for the 5 trials .....	197
6.7 Simple correlation coefficients ( $r \times 100$ ) between a standard muscularity (MUSC(FL)) derived from the five muscles around the femur and measures of muscle depth to length ratio, using a calipers holding device (CHD) or from lateral photographs .....	198
6.8 Coefficient of determination ( $R^2\%$ ) and Mallow's $C_p$ values from fitting the 10 W/L values used to calculate Band 4 in multiple regression models for the five trials .....	201

6.9 The accuracy of potential predictors of standard muscularity (MUSC(FL)) when included along with carcass weight (CWT) in multiple regression equations. Measures of accuracy given are the coefficient of determination ( $R^2\%$ ) and the residual standard deviation (RSD) for the 5 trials .....	202
6.10 Means for selected W/L values (mm/m) and B4 for 12 carcasses when measured after projecting the slides so that the actual difference between the distal and proximal anatomical landmarks was 96,98,100,102,and 104% of the measured distance on the screen .....	203
6.11 Simple correlation coefficients ( $r \times 100$ ) between the different positions described in Table 6.10 for several W/L values and B4 of 12 carcasses .....	204

# LIST OF FIGURES

Table	Page
2.1 Three objective measurements of thigh conformation used with beef carcasses.	
(a) Measurements taken on the left side of beef carcass as reported by Bass <i>et al.</i> (1977).	
(b) Measurements of thigh conformation in young bull carcasses as reported by Sorensen (1984).	
(c) Measurements taken on beef carcasses using video image analysis as reported by Eldridge (1989) .....	36
3.1 A scatterplot of muscularity (femur) against log carcass weight as an example of a diverging pattern between the two lines. Linear regression lines with 99% confidence limits are shown separately for high (solid line and circles) and low (dashed line and filled triangles) backfat selection lines for Southdown rams .....	103
3.2 A scatterplot of muscle:bone ratio (femur) against log carcass weight as an example of a parallel pattern for the two lines. Linear regression lines with 99% confidence limits are shown separately for high (solid line and circles) and low (dashed line and filled triangles) backfat selection lines for Southdown rams .....	104
3.3 A scatterplot of muscularity (scapula) against log carcass weight as an example of a pattern where the regression lines crossed over. Linear regression lines with 99% confidence limits are shown separately for high (solid line and circles) and low (dashed line and filled triangles) backfat selection lines for Southdown rams .....	105

3.4 A plot of group means for percentages of the three muscle fibre types in <i>M.semitendinosus</i> (red, intermediate, and white) against carcass weight. Data for both lines are combined as there were no significant line effects .....	108
3.5 Quadratic regression lines with 99% confidence limits showing the increase in mean number of fibres per cross section of <i>M.semitendinosus</i> (A) and mean muscle fibre area (B) with increasing carcass weight. Data for both lines are combined as there were no significant line effects .....	109
4.1 Patterns of change in muscularity with increasing carcass weight for animals from Trials 1, 2, 3, and 4. Group means ( $\pm$ SE bars) are shown within weight groups .....	131
4.2 Patterns of change in M:B ratio with increasing carcass weight for animals from Trials 1, 2, 3, and 4. Group means ( $\pm$ SE bars) are shown within weight groups .....	132
4.3 Linear regression lines relating M:B ratio and muscularity for the Coopworth and Dorset Horn X Coopworth male lambs in Trials 3 and 4, respectively. Measurements were based on the weight of 5-muscles around the femur and femur weight or length .....	134
4.4 Patterns of change in B:A ratio with increasing carcass weight for animals from Trials 1, 2, 3, and 4. Group means ( $\pm$ SE bars) are shown within weight groups .....	137
4.5 Patterns of change in EMA ratio ( $\text{EMA}^{1.5}/\text{Carcass weight}$ ) with increasing carcass weight for animals from Trials 1, 2, 3, and 4. Group means ( $\pm$ SE bars) are shown within weight groups .....	138
4.6 Patterns of change in the $\text{CWT:L}^3$ ratio with increasing carcass weight for animals from Trials 1, 2, 3, and 4. Group means ( $\pm$ SE bars) are shown within weight groups .....	141

5.1 Mean ( $\pm$ SE) carcass weights and carcass muscle and fat percentages for 5 MLC lamb conformation classes (data set 2). The significance of differences between adjacent means are shown (NS= $P>0.10$ ; *= $P<0.05$ ; **= $P<0.01$ ) .....	163
5.2 Mean ( $\pm$ SE) leg muscularity indexes (MUSC(FL)) and muscle to bone ratios (M:B(FW)) for 5 MLC lamb conformation classes (data set 2). The significance of differences between adjacent means are shown (NS= $P>0.10$ ; *= $P<0.05$ ; ***= $P<0.001$ ) .....	164
5.3 Mean ( $\pm$ SE) leg muscularity indexes (MUSC(CFL)) and muscle to bone ratios (M:B(CFW)) for 5 MLC beef conformation classes (data set 3). The significance of differences between adjacent means are shown (***= $P<0.001$ ) .....	165
6.1 A lateral view of a carcass showing the positions of the distal (top of hook (gambrel)) and proximal (dorsal part of tuber ischii) anatomical landmarks used to determine where to make leg width measurements either on photographs or on the intact side .....	177
6.2 A diagram showing the outline of two legs of contrasting muscularity that have been adjusted proportionately to a constant distance between the distal and proximal anatomical landmarks. The locations of selected widths are shown on the legs .....	178
6.3 A photograph showing the calipers-holding device (CHD) being used to measure leg width at a set proportion of leg length .....	180
6.4 A diagrammatic outline of the calipers-holding device (CHD). Key components include the two triangles (ABC and AED) connected at A, the vertical rod FG that could be moved left or right, and the platform AEIH on which the calipers were placed .....	181
6.5 Linear regressions relating the standard muscularity index (based on the weight of five leg muscles and femur length) to an index of muscularity based on the weight of <i>M.semimembranosus</i> and femur length for the high-	

(L1) and low- (L2) backfat Southdown selection lines (Trial 1), the Coopworth (CPW, Trial 3), the Dorset Horn X Coopworth (DSXCPW, Trial 4), the Romney (ROM, Trial 5), and the Border Leicester X Romney (BLXROM, Trial 6) groups ..... 190

6.6 Linear regressions relating the standard muscularity index (based on the weight of five leg muscles and femur length) to an index of muscularity based on the weight of M.biceps femoris and femur length for the high- (L1) and low- (L2) backfat Southdown selection lines (Trial 1), the Coopworth (CPW, Trial 3), the Dorset Horn X Coopworth (DSXCPW, Trial 4), the Romney (ROM, Trial 5), and the Border Leicester X Romney (BLXROM, Trial 6) groups ..... 191

6.7 Mean changes in adjusted leg width to length ratios (W/L) with an increasing percentage of the distance from the distal to the proximal anatomical landmarks for carcasses from the high- and low-backfat selection lines. Of the 21 values shown the first 11 and the last 2 were significantly higher for the high-backfat line ..... 199

6.8 Linear regressions relating the standard muscularity index (MUSC(FL)) to B4 for the high- (L1) and low- (L2) backfat Southdown selection lines (Trial 1), the Coopworth (CPW, Trial 3), the Dorset horn X Coopworth (DSXCPW, Trial 4), the Romney (ROM, Trial 5), and the Border Leicester X Romney (BLXROM, Trial 6) groups ..... 200

6.9 Changes in mean ( $\pm$  SE) values of B4 for 6 carcasses of each of the two Southdown selection lines when measured after projecting the slides so that the actual differences between the distal and proximal anatomical landmarks were 96, 98, 100, 102 and 104% of the measured distance on the screen ..... 205

## LIST OF APPENDICES

Table	Page
<hr/>	
<b>Appendix 1</b>	
<b>TABLE A1.1</b> Definitions of carcass linear measurements .....	239
<b>Appendix 1</b>	
<b>FIGURE A1.1</b> A diagram indicating where measurements were taken on the hanging carcass .....	240
<b>Appendix 1</b>	
<b>FIGURE A1.2</b> A carcass showing positions of the standardised cuts (dotted lines). The locations of the two intermuscular fat depots (IMF) used in this study are also shown .....	241
<b>Appendix 1</b>	
<b>FIGURE A1.3</b> Diagrams indicating where measurements were taken on three cut surfaces of the carcass. The shoulder cut was made between ribs 7 and 8, the loin cut was made between the 12th and 13th ribs, and the leg cut was between the last and second to last lumbar vertebra .....	242
<b>Appendix 1</b>	
<b>FIGURE A1.4</b> Diagrams indicating where measurements were made for three bones .....	243
<b>Appendix 1</b>	
<b>FIGURE A1.5</b> A diagram indicating where measurements were made for the scapula bone .....	244
<b>Appendix 1</b>	
<b>FIGURE A1.6</b> A diagram indicating where measurements were made for the pelvic bone .....	245



**Appendix 1**

<b>FIGURE A1.7</b> A diagram indicating where measurements were made for the eighth rib .....	246
---	-----

**Appendix 2**

<b>Table A2.1</b> Definitions for carcass muscularity, M:B ratio, B:A ratio, EMA ratio and carcass weight to length ratio .....	247
---	-----

**Appendix 3**

<b>TABLE A3.1</b> Means for liveweights, carcass weights, and the weights of non-carcass components of Southdown rams from both the high- and low-backfat lines within the 7 weight groups. All weights are as grams except live and carcass weights, which are in kilograms .....	248
--	-----

**Appendix 3**

<b>TABLE A3.2</b> Means for carcass linear dimensions (mm) of Southdown rams from both the high- and low-backfat lines within the 7 weight groups .....	249
---	-----

**Appendix 3**

<b>TABLE A3.3</b> Means for cut weights (g) and water and fat percentage in <i>M.longissimus</i> of Southdown rams from both the high- and low-backfat lines within the 7 weight groups .....	250
---	-----

**Appendix 3**

<b>TABLE A3.4</b> Means for muscle fibre number in a cross-sectional area of $0.36 \mu\text{m}^2$ for the three muscle fibre types (red, intermediate and white) for a middle subsample of <i>M.semitendinosus</i> that was frozen within 2 to 3 hours of slaughter. The second part of the table gives mean areas, fibre numbers, and sizes for the other <i>M.semitendinosus</i> that was sampled post rigor for Southdown rams from the high- and low-backfat lines within the 7 weight groups .....	251
---	-----

**Appendix 3**

**TABLE A3.5 Means for leg characteristics and dissected tissue weights (g) of Southdown rams from both the high- and low-backfat lines within the 7 weight groups ..... 252**

**Appendix 3**

**TABLE A3.6 Means for rack and shoulder characteristics and dissected tissue weights (g) of Southdown rams from both the high- and low-backfat lines within the 7 weight groups ..... 253**

**Appendix 3**

**TABLE A3.7 Means for bone weights and dimensions of Southdown rams from both the high- and low-backfat lines within the 7 weight groups. All weights and dimensions are as grams and millimetre, respectively, except bone area, which are in square centimetres ..... 254**

**Appendix 3**

**TABLE A3.8 Means for muscularity values and M:B ratios for several parts of the leg and the shoulder together with some other shape ratios of Southdown rams from both the high- and low-backfat lines within the 7 weight groups ..... 256**

**Appendix 4: A description of the step-by-step procedures followed to prepare boneless leg cuts ..... 257**