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**SOME COMPOSITION CHARACTERISTICS OF YOUNG  
MALE SOUTHDOWN SHEEP FROM LINES SELECTED  
FOR HIGH AND LOW BACKFAT DEPTH**

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of the requirements for the degree  
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**Abdullah Yousef Abdullah**  
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## ABSTRACT

Thirty-six 6-8 month Southdown ram lambs, 18 each from the high and low-backfat selection lines established at Massey University in 1976, were used in this study to evaluate some carcass composition characteristics.

Animals were randomly allocated within lines within sire groups into three lots of 12 rams each and were housed in metabolism crates on a lucerne chaff diet (1.3 maintenance). After a 10-day adjustment period, an intravenous urea challenge was administered to the animals (120 mg/kg LW) and blood samples were collected before and after the infusion. Rams were slaughtered within 5-7 days of the urea challenge and half-carcasses were separated into soft-tissue and bone.

Differences in body composition between the selection lines were greatest for measures of fatness. They were found to a lesser extent in some other characteristics, especially those that have been reported previously to have positive or negative genetic correlations with backfat depth. Thus, carcasses from the high-backfat line, when compared at the same carcass weights had significantly greater fat depths at C. J, GR, S2 and L3, by 56.7%, 37.1%, 26.1%, 33.3% and 51%, respectively. The high-backfat line group also had significantly greater amounts of kidney fat, higher chemically analysed fat percentage in the carcass soft-tissue, larger intermuscular fat cell diameter, shorter carcasses, lighter heart and liver weights, deeper (B) and narrower (A) cross sections of *M. longissimus*, and slightly higher ( $P < 0.10$ ) dressing-out percentages.

Moreover, at the same carcass weight, the results of the current study agree well with previous studies in showing that fatter lambs had a higher proportion of the fatter cuts (rack cuts) and a lower proportion of the leaner cuts (shoulder cuts). The high-backfat line animals also had lighter total side bone weight, and shorter lengths and smaller circumferences of the humerus, radius & ulna, femur and tibia bones in the carcasses, which agrees with the negative genetic or phenotypic correlations reported elsewhere between backfat thickness and bone weight, bone percentage or bone length in sheep.

At the same total side bone weight, line effects on bone distribution in the current study were less marked than the previous work with 17-month-old rams, with significantly higher weights of bone in the rack cut, lower weights of bone in the leg cut and lighter humerus and femur bone weights for the carcasses of the high-backfat line. Shoulder cut bone weight in the present study did not differ between selection lines and the difference was in the opposite direction for the total leg bone cut compared with older rams in the previous study.

At the same carcass weight, similar total weight of four muscle in the carcasses of both lines was found, but at the same fat-free soft tissue weight in the side there are few effect on the distribution of muscle. The ratio of muscle to bone weight and muscularity are higher in the high-backfat line when adjusted to the same fat-free soft tissue and total side fat-free soft tissue weight plus bone respectively. These results are consistent with previous studies in showing that the reduction in backfat thickness have little or no effect on total muscle weight, little effect on muscle distribution and lower ratio of muscle to bone weight and lower muscularity.

Line differences in muscle fibre type, proportion and area in the M. semitendinosus were not found in the present study. This result which differs from previous which showed higher proportions of ( $\beta$ R) red fibres for the high-backfat line.

In general, all moisture measurements showed a slightly higher weight and percentage in the low-backfat line.

The prediction of empty body water percentage from the response to a urea challenge by measuring the rate of urea dilution in the plasma was not very successful. The best extrapolation estimates of zero-time were obtained using a simple exponential model after linear adjustments were made for increasing baseline values.

It is concluded that divergent selection for and against fatness on the basis of weight-adjusted ultrasonically-measured fat depth C in the present lines has led to line differences in 14 kg carcasses such that the fat line carcasses have more fat, less bone and a similar weight of muscle. The urea dilution method as used in this study was found to be unsatisfactory for the prediction of carcass composition.

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## TABLE OF CONTENTS

Abstract .....	i
Acknowledgements .....	iii
Table of Contents .....	iv
List of Tables .....	vii
List of Figures .....	ix
List of Abbreviations .....	xi
Chapter 1    Introduction .....	1
Chapter 2    Literature Review .....	3
2.1    Introduction .....	3
2.2    Genetic variability in the composition of sheep .....	3
2.2.1    Introduction .....	3
2.2.2    Variables involved in sheep body and carcass composition .....	4
2.2.2.1    Dressing percentage .....	4
2.2.2.2    Fatness - percentage, partitioning and distribution .....	5
2.2.2.3    Muscle - distribution and muscle to bone ratio .....	11
2.2.2.4    Bone - percentage and distribution .....	15
2.3    Genetic effects on muscle fibre characteristics .....	16
2.3.1    Introduction .....	16
2.3.2    Changes with growth .....	17
2.3.3    Genetic influence .....	18
2.4    Genetic effects on fat cellularity .....	22
2.4.1    Introduction .....	22
2.4.2    Changes with growth .....	22
2.4.3    Genetic influence on fat cellularity characteristics .....	25
2.5    Measurement of body water by dilution methods .....	28
2.5.1    Introduction .....	28
2.5.2    Dilution methods, other those those involving urea .....	28
2.5.3    Urea dilution as a method of estimating body water .....	30

Chapter 3	Materials and Methods .....	35
3.1	Animals and experimental design .....	35
3.1.1	Animals .....	35
3.1.2	Experimental procedure .....	35
3.2	Urea space measurements .....	36
3.3	Slaughter procedures .....	37
3.4	Body components measured at slaughter .....	37
3.4.1	Blood collection .....	37
3.4.2	Non-carcass components measurements .....	37
3.4.3	Skin and wool sampling .....	38
3.5	Carcass measurements .....	44
3.6	Dissection procedures and measurements .....	44
3.7	Adipose tissue measurements .....	46
3.8	Muscle fibre-type measurements .....	47
3.9	Chemical analysis .....	48
3.9.1	Water determination .....	48
3.9.2	Fat determination .....	49
3.10	Statistical methods .....	50
3.10.1	Body and carcass composition .....	50
3.10.2	Urea dilution .....	51
Chapter 4	Results .....	54
4.1	Introduction .....	54
4.2	Body and carcass composition characteristics .....	54
4.2.1	Final liveweight, carcass weight and dressing-out percentage ....	54
4.2.2	Non-carcass body components .....	54
4.2.3	Linear and area measurements .....	56
4.2.4	Carcass composition .....	56
4.2.4.1	Weights of individual cuts .....	56
4.2.4.2	Bone distribution and dimension .....	59
4.2.4.3	Partitioning of fat among the depots .....	59
4.2.4.4	Adipose cell diameter and volume .....	63
4.2.4.5	Muscle weight and distribution .....	63
4.2.4.6	Muscularity .....	67
4.2.4.7	Muscle fibre type - area and proportion .....	67

	4.2.5	Carcass and non-carcass empty-body water .....	67
	4.3	Measurements of body water by dilution methods .....	74
Chapter	5	Discussion .....	80
	5.1	Introduction .....	80
	5.2	Body and carcass composition .....	80
	5.2.1	Dressing-out percentage .....	80
	5.2.2	Non-carcass components .....	81
	5.2.3	Linear and area measurements .....	81
	4.2.4	Weights of individual cuts .....	82
	5.2.5	Weights, distribution and dimensions of bones .....	83
	5.2.6	Fatness .....	83
	5.2.6.1	Level of fatness and fat distribution .....	83
	5.2.6.2	The relationship between carcass water and fat .....	85
	5.2.6.3	Adipose cellularity .....	85
	5.2.7	Muscle .....	86
	5.2.7.1	Muscle weight and distribution .....	86
	5.2.7.2	Muscle to bone ratio .....	87
	5.2.7.3	Muscularity .....	87
	5.2.7.4	Muscle fibre type and size .....	88
	5.3	Measurements of body water by dilution methods .....	89
Chapter	6	Conclusions .....	93
References		.....	96

## LIST OF TABLES

<u>Table</u>	<u>Page</u>
2.1 The cellular characteristics of adipose tissue from mice or rats in a sample of studies involving groups with genetically different fatness levels .....	27
3.1 Layout of the experimental design .....	36
3.2 Definitions of the carcass linear measurements .....	40
4.1 Least-squares means of age at slaughter, fasted liveweight, empty liveweight, percentage gut contents, carcass weight, dressing-out percentage, and non-carcass component weights of Southdown rams within two sire groups from each of the high and low backfat lines. ....	55
4.2 Least-squares means for carcass linear dimensions of Southdown rams within two sire groups from each of the high and low backfat lines .....	57
4.3 Least squares means for cut weights and dissected tissue weights of Southdown rams within two sire groups from each of the high and low backfat lines .....	58
4.4 Least square means for bone weight distribution within total side bone of Southdown rams within two sire groups from each of the high and low backfat lines .....	60
4.5 Least squares means for internal body fat depots, two intermuscular fat depots and fat percentage in M. Longissimus, soft tissue and bone of Southdown rams within two sire groups from each of the high and low backfat lines .....	62
4.6 Least squares means for fat cellularity characteristics of two adipose tissue depots of Southdown rams within two sire groups from each of the high and low backfat lines .....	64

4.7	Least squares means for muscle weight distribution and ratios of muscles to bones adjusted to a constant total fat-free soft tissue weight of Southdown rams within two sire groups from each of the high and low backfat lines .....	65
4.8	Least squares means for ratios of muscle weights relative to bone lengths of Southdown rams within two sire groups from each of the high and low backfat lines .....	68
4.9	Least squares means for muscle fibre area and proportions of the three muscle fibre types (red, intermediate and white) from <i>M. semitendinosus</i> of Southdown rams within two sire groups from each of the high and low backfat lines .....	69
4.10	Mean squares with degrees of freedom from the nested analyses of variance for muscle fibre areas and proportions of the three muscle fibre types (red, intermediate and white) from four bundles within <i>M. semitendinosus</i> of Southdown rams within two sire groups from each of the high and low backfat lines .....	70
4.11	Least squares means for moisture weight and percentage of all non-carcass components of Southdown rams within two sire groups from each of the high and low backfat lines .....	71
4.12	Least squares means for moisture weight and percentage of water in carcass components and total empty liveweight of Southdown rams within two sire groups from each of the high and low backfat lines .....	72
4.13	Means and standard errors of the actual and estimated empty body water percentages calculated by four different methods and relationships between actual and estimated values .....	78
4.14	Least squares means for baseline urea concentration, urea clearance rates, and actual and estimated empty body water percentage calculated by different methods of Southdown rams within two sire groups from each of the high and low backfat lines .....	79

## LIST OF FIGURES

<u>Figure</u>	<u>Page</u>
3.1 Sampling position on the pelt .....	39
3.2 A diagram indicating where measurements were taken on the hanging carcass .....	41
3.3 A side of carcass showing the positions of the standardised cuts using dotted lines. The locations of the two intermuscular fat depots used in this study are also shown .....	42
3.4 Diagrams indicating where measurements were taken on some cut surfaces of the carcasses. The shoulder cut was made between ribs 7 and 8, the loin cut was between the 12th and 13th ribs, and the leg cut was between the last and second to last lumber .....	43
3.5 Diagrams indicating where measurements were made for four bones .....	45
4.1 Bone dimensions adjusted to a constant carcass weight for high (H) and low (L) backfat lines of Southdown rams .....	61
4.2 Double-log regression lines relating the weight of three leg muscles to femur length separately for high- (solid line) and low-backfat (dashed line) lines of Southdown rams .....	66
4.3 The amount of moisture in carcass and non-carcass components expressed as percentages of the total moisture weight in the empty body for Southdown rams of both lines .....	73
4.4 Changes in mean plasma urea concentration with time after an intravenous urea challenge for Southdown rams of high- and low-backfat selection lines. Pre-challenge baseline values (Mean = 10.9 mmol/l) have been subtracted from all values (* = $P < 0.05$ for line effect) .....	76

4.5 Actual and estimated empty body water percentages for Southdown rams from high (H) and low (L) backfat lines. Estimation methods (designated C15, C30, C45, Cav, D1 and D2) are described in the text ..... 77

## LIST OF ABBREVIATIONS

KKCF	=	Kidney knob and chanal fat
SCF	=	Subcutaneous fat
IMF	=	Intermuscular fat
IMFD	=	Intermuscular fat depot
$\beta$ R	=	Red muscle fibres
$\alpha$ R	=	Intermediate muscle fibres
$\alpha$ W	=	White muscle fibres
D <sub>2</sub> O	=	Deuterium oxide
TOH	=	Tritiated water
LW	=	Liveweight
EBWT or EBW	=	Empty body weight
EBH <sub>2</sub> O	=	Empty body water weight
US	=	Urea space
EUCC	=	Estimated urea concentration change
RRW	=	Reticulo-ruminal water
H	=	High-backfat line of Southdown sheep
L	=	Low-backfat line of Southdown sheep
S <sub>1</sub> , S <sub>2</sub> , S <sub>3</sub> , S <sub>4</sub>	=	Sires one, two, three and four
S	=	Standard deviation
d	=	diameter
v	=	volume
A	=	Area
RSD	=	Residual standard deviation
r	=	correlation coefficient between x and y
R <sup>2</sup>	=	coefficient of determination
NS	=	Not significant
S	=	P < 0.10
*	=	P < 0.05
**	=	P < 0.01
***	=	P < 0.001