A STUDY OF SOME FACTORS AFFECTING THE RESISTANCE OF NEWBORN LAMBS TO COLD-STRESS WITH PARTICULAR REFERENCE TO STARVATION AND EXPOSURE MORTALITY

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ABSTRACT

Newborn lambs (less than 48 hours old) were exposed to a range of environments and their responses to cold-stress examined. The study centred on Romney lambs, with Merinos and Drysdale-Romney crosses used for comparative purposes. Experiments were conducted in a climate chamber, the design of which is described. Environmental components examined were ambient temperature (5 to 30^{o}C), airspeed (0.0 to 1.9 m sec^{-1}) and wetness. The two main indices of resistance to cold-stress, together with their repeatabilities, were heat production (r = 0.53 to 0.59) and rate of decline in rectal temperature (r = 0.62 to 0.84).

The summit metabolic rate of Romney lambs was 18.03 ± 0.63 W kg^{-1}. Wet lambs became hypothermic at ambient temperatures as high as 15^{o}C but dry lambs did not approach the limit of their ability to control body temperature. Air movement increased heat production by 7 to 20% over conditions of still air.

Twin lambs exhibited a lower resistance to cold-stress than singles, this being a function of their lower bodyweight, poorer birthcoat insulation and possibly lower summit metabolic rate. Female lambs were less resistant to cold-stress than males in only one experiment. This effect could not be accounted for solely by between-sex differences in body weight.

Age effects were small and were mainly related to drying of the birthcoat. Unfed lambs less than 1 hour old had a similar thermoregulatory ability to older fed lambs. Summit metabolism appeared

not to be affected by age or feeding.

Dry Romney and Drysdale-Romney cross lambs frequently failed to constrict blood vessels of the hind limb immediately upon entering the cold zone and had higher skin temperatures than Merino lambs. Wet lambs exhibited low skin temperatures consistent with the constriction of peripheral blood vessels having occurred. Skin temperature declined rapidly with age in lambs less than 1 hour old.

Genotype for face cover did not affect the lamb's resistance to cold-stress, skin temperature, bodyweight or coat characteristics (hip coat depth, midside coat depth, midside wool weight per unit area of skin).

Bodyweight was an important determinant of resistance to cold-stress. Heat production in cold conditions was proportional to bodyweight raised to the power 0.78 to 0.85.

Drysdale-cross lambs had greater coat depths and midside wool weight (per unit area of skin) than Romneys, and a superior resistance to cold-stress. Coat depth was moderately repeatable ($r = 0.43$ to 0.73) and was reduced by wetting only in the Drysdale-cross lambs. Sire of the lamb appeared to influence coat depth but not midside wool weight.

Heat production was negatively related to each of the coat characters, the relationships being curvilinear in one experiment. Midside wool weight and coat depth were largely independent in their control of metabolic rate. Coat insulation per unit of depth or midside wool weight was not influenced by wetting or air movement

(within the range available).

High coat depths and midside wool weight in the birthcoat were (phenotypically) associated with high greasy fleeceweight and staple length, slightly poorer colour, and a possible increase in fibre diameter and medullation, in the hogget fleece.

Application of the results is discussed with respect to available methods of selecting or managing lambs for an improved resistance to cold-stress and a reduced incidence of starvation-exposure mortality.

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TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

LIST OF TABLES

LIST OF TABLES (continued)

LIST OF TABLES (continued)

LIST OF TABLES (continued)

LIST OF TABLES (continued)

LIST OF TABLES (continued)

LIST OF TABLES (continued)

LIST OF TABLES (continued)

LIST OF TABLES (continued)

LIST OF FIGURES

LIST OF ABBREVIATIONS

LENGTH	mm	millimetre
	cm	centimetre
	m	metre
	km	kilometre
VOLUME	ℓ	litre
MASS	mg	milligram
	g	gram
	kg	kilogram
ENERGY	J	joule
	kJ	kilojoule
	cal	calorie
	kcal	kilocalorie
POWER	W	Watt
TEMPERATURE	^{o}C	degree Celcius
	^{o}F	degree Fahrenheit
TIME	sec	second
	min	minute
	hr	hour
STATISTICAL TERMS	S.E.	Standard error of the mean
	d.f.	degrees of freedom

All other abbreviations are defined at appropriate points in the text.

LIST OF APPENDICES