

THE GLUCOSE TEST AND NUTRITION OF EWES IN LATE PREGNANCY

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SUMMARY

A flock of mature Border Leicester x Merino ewes was divided into low or high blood glucose groups at 90 ± 3 days after joining. Each group was subdivided into low, medium or high nutrition groups and were fed accordingly from day 100 of pregnancy until 3 weeks after lambing. Ewes were condition scored and blood sampled for plasma glucose concentration throughout the experiment. Ewe fleece weights were recorded three months after lambing. Ewe condition and plasma glucose concentration changed according to glucose and nutrition groups. Lambing percentage was higher in the low glucose group (136%) than in the high glucose group (89%). Lamb mortality was reduced in low glucose ewes with improved nutrition which increased ewe productivity by 0.9 kg of lamb liveweight per ewe joined. The incidence of CNS injury was higher in lambs born to high glucose ewes than those born to low glucose ewes (44% vs 28% of post-mortems; $P < 0.05$). Sub-dural brain haemorrhages were more prevalent ($P < 0.05$) in high glucose group lambs (58%) than in low glucose group lambs (30%). Low glucose ewes fed high rations produced significantly higher fleece weights than those fed medium or low rations. This result was not observed in high glucose ewes. (Keywords: glucose, nutrition, pregnancy, lamb survival)

INTRODUCTION

Peri-natal lamb mortality is a major problem limiting the productivity of many Australian sheep flocks (Alexander 1984). If ewes likely to lose lambs because of poor nourishment could be identified and given improved nutrition, then this problem could be reduced. Feeding the whole flock at the level required by the most needy is economically wasteful and could result in birth difficulties in some ewes. Using X-ray (Rizzoli et al. 1976), video fluoroscopy (Beach 1980) or ultrasound (Fowler and Wilkins 1982) the number of fetuses carried by each ewe can be accurately determined. These techniques allow division of the flock and feed to be apportioned according to foetal number. Recently we proposed an alternative approach to the identification of ewes requiring improved nutrition in late pregnancy (Parr et al. 1982). This method requires a single measurement of plasma glucose from each ewe in mid-pregnancy. It does not aim at diagnosis of multiple pregnancy but identifies those ewes with relatively low blood glucose concentrations. The aim of the present study is to determine the importance of differential feeding of ewes in late pregnancy according to their plasma glucose concentration.

MATERIALS AND METHODS

Mature Border Leicester X Merino ewes ($n=396$) were joined at the second oestrus after synchronization with progestagen sponges. Upon reaching 90 ± 3 days after joining all ewes were yarded overnight. The following morning a jugular blood sample (8-10 ml) was collected with a minimum of disturbance into a heparinized syringe. Whole blood samples were then immediately placed in ice water before centrifugation. All ewes were again blood sampled in the same manner 28, 14 and 2 days prior to the commencement of lambing. Plasma samples were analysed for glucose concentration using an automated glucose oxidase-phenyl amino phenazone method (Trinder 1969). The within assay co-efficient of variation of 133 sets of standards measured during the assay was 1.5%. Using the glucose measurements taken at day 90 ewes were designated 'High'(H) or 'Low'

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(L) depending on whether their plasma glucose concentration was above or below the median value for the flock. The ewes were also randomly allotted on live weight to 3 nutrition groups (low, medium and high) and all groups were replicated to produce 12 treatment groups each containing 33 ewes. Each group was placed in a 1 ha enclosure which provided negligible pasture and was offered the respective ration from day 100 after joining until 21 days after lambing had finished. The ration consisted of 75% oats and 25% lupins calculated to provide a mean metabolizable energy level of 8.5, 11.2 and 14.0 MJ/kg DM for the low, medium and high nutrition groups respectively. This was offered in increments according to ARC (1980) recommendations. Body condition scores (Jefferies 1961) of each ewe were estimated on four occasions at fortnightly intervals before lambing and at the conclusion of the nutritional treatment period. At lambing, lambs were identified and weighed. Lambs dying in the peri-natal period underwent post-mortem examination. At shearing, three months after lambing fleece weights of all ewes were recorded.

RESULTS

Changes in condition score during the treatment period (Table 1) reflected both glucose group and ration offered. Plasma glucose changes were also influenced by glucose group and feed level (Table 2).

Table 1 Condition score (mean $\pm$ s.e.) at start (A) and conclusion (B) of treatment period

Glucose group	Nutrition group	Condition score (1-5)		Change in cond. score
		A	B	
L	Low	2.7 $\pm$ 0.04	2.3 $\pm$ 0.08	-0.4
	Med	2.7 $\pm$ 0.04	2.5 $\pm$ 0.08	-0.2
	High	2.8 $\pm$ 0.06	2.9 $\pm$ 0.07	+0.1
H	Low	2.9 $\pm$ 0.05	2.9 $\pm$ 0.07	Nil
	Med	2.9 $\pm$ 0.06	2.9 $\pm$ 0.09	Nil
	High	2.9 $\pm$ 0.05	3.3 $\pm$ 0.07	+0.4

Table 2 Plasma glucose concentrations (mean $\pm$ s.e.) at start of treatment period (A) and just prior to lambing (B)

Glucose group	Nutrition group	Plasma glucose (mmol/l)		Change in Glucose
		A	B	
L	Low	2.8 $\pm$ 0.04	3.0 $\pm$ 0.07	+0.2
	Med	2.9 $\pm$ 0.04	3.2 $\pm$ 0.06	+0.3
	High	2.9 $\pm$ 0.04	3.4 $\pm$ 0.08	+0.5
H	Low	3.6 $\pm$ 0.04	3.2 $\pm$ 0.07	-0.4
	Med	3.5 $\pm$ 0.04	3.4 $\pm$ 0.06	-0.1
	High	3.5 $\pm$ 0.03	3.7 $\pm$ 0.08	+0.2

The lambing percentage per ewes joined was higher in the L glucose group (136%) than in the H glucose group (89%). In L glucose lambs, peri-natal mortality decreased with increasing ration (Table 3).

Table 3 Lamb mortality (%), ewe productivity and fleece weights of ewes

Glucose group	Nutrition group	NP*	T*	Lamb mortality (%)	Ewe productivity ⁺ (kg)	Fleece weight [#] (kg)
L	Low	4	33	25/76(33)	2.6	5.1 ^a ± 0.07
	Med	7	28	23/93(25)	3.3	5.1 ^a ± 0.09
	High	6	34	22/94(23)	3.5	5.4 ^b ± 0.08
H	Low	30	19	15/56(27)	2.1	5.3 ^{ab} ± 0.08
	Med	21	23	26/64(41)	2.1	5.5 ^b ± 0.09
	High	19	20	12/56(21)	2.0	5.5 ^b ± 0.10

* NP, T ; Number of non-pregnant ewes and ewes with twins.

+ Ewe productivity; live lamb weight at birth per ewe joined.

Means with different superscripts differ significantly ($P < 0.05$).

The incidence of CNS injury was higher in lambs born to H glucose ewes than in those born to L glucose ewes (44% vs. 28% of post mortems; $P < 0.05$). Sub-dural brain haemorrhages were more prevalent ($P < 0.05$) in H glucose lambs (58%) than in L glucose lambs (30%) whereas cervical spinal cord bruising was the more common CNS injury in L group lambs. Birthweight of lambs was not influenced by glucose group or nutrition treatment. Productivity, expressed as live lamb weight at birth per ewe joined was increased by 0.9 kg per ewe joined with increasing rations fed to L glucose ewes (Table 3). This response was not observed in the H glucose groups. Fleece weight was significantly reduced in L glucose ewes receiving low and medium rations (Table 3). This effect was not seen in H glucose ewes receiving these rations.

DISCUSSION

Increasing feed during late pregnancy reduced lamb mortality in low glucose ewes resulting in an increase in productivity. This demonstrates the value and more efficient use of extra feed when given to low glucose ewes during late pregnancy and in the peri-natal period. Productivity from high glucose ewes remained constant indicating that extra feed was of little value in these groups. Estimations of condition score and plasma glucose concentrations indicated that nutritional stresses were not excessive compared with responses measured in early pregnancy (Parr and Williams 1982).

The majority of lamb deaths in low glucose groups were associated with cold exposure, mismothering and starvation. Conditions during lambing (August 1984) were cold and wet. Birth injury, particularly brain haemorrhages were associated with the high lamb mortality in the low and medium nutrition groups of H glucose ewes. Spinal cord bruising was more commonly found in twin lambs of the L glucose ewes. Haughey (1973) also found this condition was more common in twin lambs.

Corbett (1979) estimated that the reduction in annual fleece weight due to pregnancy and lactation was 10-14%. In our study, improved nutrition was of more value in terms of wool growth in low glucose ewes than in high glucose ewes.

In conclusion, ewes given improved nutrition at mid-pregnancy onwards on the basis of low blood glucose concentrations have an increased lamb survival, increased productivity and improved wool growth. The incidence and type of CNS injury seen in lambs born to high glucose ewes could enable future focus on this group to reduce this problem.

ACKNOWLEDGEMENTS .

We thank Messrs. C. Toohey, T. Squires, W. Leach and D. Kerton for their assistance, Drs. L. Cahill, R. Fairclough and Mr. I. Davis are thanked for their comments on the manuscript, This work was supported by funds provided by the Australian Wool Corporation.

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