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The effect of nutrition during pregnancy on the behaviour of adolescent ewes and their lamb(s) within 12 hrs of birth.

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ABSTRACT

Hogget mating has become more common in recent times as a management strategy to produce additional lambs. The productivity of hogget mating is limited by low lamb birth weights and poor lamb survival. A study has shown that maternal nutrition during pregnancy in hoggets had no effect on the birth weight or survival of lambs. This study investigated the effect of nutrition during pregnancy on the post-parturient behaviour of hogget ewes and their lambs.

On day 13 after the mid-point of breeding hogget ewes were stratified by breed and live weight and randomly allocated to one of three feeding regimes: Low (gained 10kg of live weight by parturition), Medium (20kg) and High (30kg). Within 12 hours of birth lambs were ear tagged and the maternal behaviour of hogget ewes was recorded using a maternal behaviour score (MBS) a five point measure of a ewe's response to the handling of her lambs. Behavioural observations of the hogget and her lamb(s) were made for 5 minutes after the completion of tagging the lamb.

Singleton-bearing hogget ewes fed on the high plane of nutrition had significantly ($P < 0.05$) greater maternal behaviour scores than singleton-bearing hoggets fed on low or medium planes. In the low fed group, significantly ($P < 0.05$) fewer hoggets bleated in response to their lamb (60%) compared with medium (73%) and high (85%) fed hoggets. Of the lambs that bleated, those born to hoggets in the medium fed group bleated significantly ($P < 0.05$) more than lambs born to hoggets in the low or high fed groups.

Feeding hogget ewes on a high level of nutrition had a positive impact on hogget and lamb behaviour within 12 hours of birth. A high level of nutrition during pregnancy may result in behaviours that increase survival of lambs born to hogget ewes.

Keywords: Hogget; behaviour; lamb; maternal nutrition.

INTRODUCTION

The practice of mating ewes at approximately 8 months of age (hoggets) has increased such that in New Zealand in the 2004 breeding season 2.7 million hogget ewes were mated, an increase of 17% from 2003 (Anonymous, 2004). However, hogget mating often results in lambs with relatively light birth weights (Dyrmundsson, 1973; McMillan, 1983), low survival rates (Tyrrell, 1976; McCall & Hight, 1981; McMillan, 1983; McMillan & McDonald, 1983) and less than 5% of ewes bearing multiple fetuses (McCall & Hight, 1981; McMillan & McDonald, 1983; Moore *et al.*, 1983). An increase in lamb birth weight and survival would result in increased profitability for a hogget lambing system.

Underfeeding of mature ewes during pregnancy results in their lambs having lower energy reserves (Mellor & Murray, 1985), reduced vigour (Moore *et al.*, 1986; Dwyer *et al.*, 2003) and lower birth weight (Mellor & Murray, 1985; Dwyer *et al.*, 2003) which can reduce lamb survival. To these authors knowledge there is only one study

that has examined the effect of hogget nutrition during pregnancy under New Zealand pastoral farming conditions (Morris *et al.*, 2005). However in the United Kingdom hogget ewes fed on concentrates and in the high feeding group are growing rapidly at a rate of 234 g/day which resulted in reduced lamb birth weights and survival compared to ewes in the normal growth treatment (Wallace *et al.*, 1996).

In mature ewes undernutrition affects the expression of both maternal and neonatal behaviours associated with ewe-lamb bonding (Dwyer *et al.*, 2003). Ewe bleats are believed to be an indicator of the ewe/lamb bond. Low pitched bleats are made exclusively to the lamb in a "care-giver" role which aid in the formation of the ewe-lamb bond and high pitched bleats are a "protest" or alarm bleat (Dwyer *et al.*, 1998). To date little work has been published on the behaviour of hogget dams and their lambs 12 - 24 hours after birth. However, a higher plane of nutrition has been reported to increase the time a ewe spent at the birth site (Lindsay *et al.*, 1990).

This study investigated the effect of three levels of maternal nutrition during pregnancy on the post-parturient behaviour of hogget ewes and their lambs.

METHODS AND MATERIALS

One hundred and forty-eight hoggets and their lambs were observed within 12 - 24 hours of lambing. The hoggets in this study were also involved in the study by Morris *et al.* (2005) in which they examined the effects of the three feeding regimes: Low (gained approximately 10kg of total live weight by parturition), Medium (20kg) and High (30kg) on their lambs birth weight and survival to weaning.

Maternal behaviour of the hogget was quantified using a maternal behaviour score (MBS) which was a five point measure of a hogget's response to her lambs being handled, whereby a hogget that fled and did not return after 5 minutes was scored 1 and a hogget that stayed within 5 meters of the shepherd and made contact with the shepherd or lamb during tagging was scored 5 (O'Connor *et al.*, 1985). The maternal behaviour of hoggets was observed while their lambs were ear tagged.

Additional behavioural observations of the hogget and her lamb(s) were made for five minutes after the completion of tagging. All lambs were tagged and handled in a similar manner by experienced shepherds and records were made of hoggets that required assistance during parturition.

After ear-tagging the lamb(s) was placed on its side and then released, during the subsequent 5 minute period the lambs' latency to bleat, stand, make contact with the hogget, feed successfully and follow the hogget were recorded. In addition the number of low and high pitched hogget bleats and lamb bleats were counted during this period.

Statistical analysis

The comparison of the presence or absence of particular behaviours by hogget treatment and pregnancy (birth) rank was conducted using chi square tests (Proc Freq, SAS, 2005). Count data of the number of hogget high and low pitched bleats and lamb bleats were not normally distributed and transformations failed to normalise the data. Therefore non-parametric tests were used to determine the effect of hogget treatment and pregnancy (birth) rank on the frequency of bleats. Maternal behaviour scores were analysed using the mixed model procedure (SAS, 2005).

Count data of number of bleats and time required to exhibit a particular behaviour are given

as medians for each group. Maternal behaviour scores are given as means (\pm standard error of the mean).

RESULTS

Hogget live weights in late gestation were significantly influenced by their nutritional treatments (low 48.5 kg, medium 57.2kg and high 67.1kg). Lamb birth weight showed a significant ($P < 0.05$) interaction of birth rank and hogget treatment such that significant differences in birth weight were observed only within singleton lambs (low 4.2 kg, medium 4.1 kg and high 4.5 kg).

Hoggets fed on the high plane of nutrition had significantly ($P < 0.05$) greater maternal behaviour scores than hoggets fed on low or medium planes of nutrition (Table 1). Singleton-bearing hoggets had a significantly ($P < 0.05$) greater maternal behaviour score compared to twin-bearing hoggets. In the low fed group, significantly ($P < 0.05$) fewer ewes bleated in response to their lamb compared to hoggets on a medium or high level of nutrition (Table 1). Of hoggets that bleated in a low pitch in response to their lamb, low fed hoggets bleated significantly ($P < 0.05$) less frequently. Singleton bearing hoggets that bleated in a low pitch did so significantly ($P < 0.05$) more frequently than their twin-born counterparts. A comparison of the nutritional treatment of singleton-bearing hoggets showed that hoggets in the high fed treatment bleated in a low pitch less frequently ($P < 0.05$).

There was little variation in the percentage of hoggets that bleated in a high pitch between pregnancy ranks and hogget treatments (Table 1). However, twin bearing hoggets in the medium nutrition treatment that bleated in a high pitch did so significantly ($P < 0.05$) more than their low and high nutrition counterparts.

There was a trend ($P = 0.09$) for a smaller proportion of lambs born to hoggets fed on the high nutritional level to bleat in response to their dam compared with the low and medium nutritional levels (Table 2). Interestingly, of the lambs that bleated those born to hoggets in the low fed group tended to take longer to bleat ($P = 0.07$) and bleat significantly ($P < 0.05$) less frequently than lambs born to hoggets in the medium or high fed groups. Twin lambs born to hoggets on a medium level of nutrition took significantly ($P < 0.05$) longer to bleat, bleated significantly ($P < 0.05$) more often and took longer to stand compared to twin lambs born to hoggets fed on a low or high level of nutrition.

TABLE 1: The percentage of hoggets that bleated in a low and high pitch plus the median number of bleats, the percentage of hoggets that moved more than 5 meters from the tagging site after returning to her lamb(s) and the least squares means (\pm S.E.) of maternal behaviour scores (MBS).

	Hogget behaviours						
	Hogget (n)	Low bleat ² (%)	No. low bleats ¹ (n)	High bleat ² (%)	No. high bleats ¹ (n)	Hogget left lambs ² (%)	MBS ³
Pregnancy rank							
1	126	80.6	4.0	97.0	9.0	41.3 ^b	3.3 ^b \pm 0.1
2	22	66.0	2.0	100.0	6.5	19.4 ^a	2.9 ^a \pm 0.2
			**		ns		
Hogget treatment							
Low	55	60.3 ^a	2.0	100.0	7.0	31.4	2.9 ^a \pm 0.1
Medium	39	72.9 ^{ab}	4.5	100.0	10.0	32.9	3.0 ^a \pm 0.2
High	54	84.8 ^b	4.0	100.0	11.0	23.7	3.4 ^b \pm 0.1
			**		ns		
Treatment x Pregnancy rank							
1 x Low	47		5.0		7.0		
1 x Medium	34		5.0		9.0		
1 x High	45		2.0		12.0		
			**		ns		
2 x Low	7		2.0		4.0		
2 x Medium	5		1.0		13.0		
2 x High	10		2.5		4.5		
			ns		*		

1= Kruskal-Wallis test showing median.

2 = P-values were based on logit transformation of percentage of hoggets that exhibited each behaviour (back transformed percentage)

3 = Mixed model procedure showing means. Means within columns with different superscripts are significantly different (P<0.05)

ns = no significant difference (P<0.05), * = significant differences at the P>0.1 level, ** = significant differences at the P<0.05 level

TABLE 2: The percentage of lambs that bleated, stood or made contact with their dam and the median time taken to exhibit these behaviours (seconds) during the 5 minute observation period.

	Lamb behaviours								
	Lamb (n)	Bwt	Bleat ² (%)	Time to bleat ¹ (sec)	No. bleats ¹ (n)	Stand ² (%)	Time to stand ¹ (sec)	Contact hogget ² (%)	Time to contact ¹ (sec)
Birth rank									
1	126	4.3 ^b \pm 0.1	95.4	5.0	6.0	89.9	12.0	92.5 ^a	20.0
2	39	3.5 ^a \pm 0.1	89.9	3.5	4.0	92.6	13.0	100.0 ^b	15.0
				ns	ns		ns		ns
Hogget									
Low	62	3.7 \pm 0.1	94.7	8.0	4.0	91.7	16.5	86.5 ^a	20.0
Medium	59	4.0 \pm 0.1	95.9	4.0	6.0	92.4	10.0	91.4 ^a	20.0
High	44	4.0 \pm 0.1	85.5	5.0	6.0	89.6	10.0	100.0 ^b	18.0
				*	**		ns		ns
Birth rank x Treatment									
1 x Low	47	4.2 ^{ab} \pm 0.1		8.0	6.0		16.0	91.2 ^a	20.0
1 x Medium	34	4.1 ^b \pm 0.1		5.0	6.0		9.0	95.7 ^a	17.5
1 x High	45	4.5 ^a \pm 0.1		2.0	5.0		2.0	88.9 ^a	12.5
				ns	ns		ns		ns
2 x Low	12	3.3 ^c \pm 0.2		5.0	4.5		12.0	80.0 ^a	20.0
2 x Medium	10	3.8 ^{bc} \pm 0.2		9.0	12.5		24.0	83.3 ^a	17.0
2 x High	17	3.5 ^a \pm 0.2		4.5	2.0		16.0	100.0 ^b	20.0
				**	**		*		ns

1= Kruskal-Wallis test showing medians

2 = P-values were based on logit transformation of percentage of lambs that exhibited each behaviour (back transformed percentage) ns = no significant difference (P<0.05), * = significant differences at the P>0.1 level, ** = significant differences at the P<0.05 level

DISCUSSION

Hoggets fed on the high plane of nutrition had significantly greater maternal behaviour scores than hoggets fed on low or medium planes. In addition more twin lambs born to hoggets maintained on a high plane of nutrition made physical contact with their dam during the 5 minute observation period than their counterparts born to hoggets maintained on low or medium levels of nutrition. The reuniting of hogget and lamb is strongly linked with the maternal behaviour score as hoggets that do not return to their lamb(s) do not allow the opportunity to make contact. Maternal behaviour has been linked with litter survival such that as maternal behaviour scores increase litter survival also increase (Everett-Hincks *et al.*, 2005). Therefore there is an advantage in terms of behaviour to feeding twin-bearing hoggets on a high level of nutrition during pregnancy.

During the observation period a greater percentage of hoggets maintained on a high level of nutrition during pregnancy bleated in a low pitch compared with hoggets maintained on a low plane of nutrition. In addition hoggets maintained on a low level of nutrition that bleated in a low pitch did so less often than hoggets maintained on medium or high planes of nutrition. Low pitched bleats aid in formation of the ewe-lamb bond (Dwyer *et al.*, 1998). Therefore a high level of feeding of hoggets during pregnancy may enhance maternal behaviour resulting in increased lamb survival.

Of the lambs that bleated, twin lambs born to hoggets in the medium fed group bleated more but had a longer latency to bleat than lambs born to hoggets in the low or high fed groups. No differences were seen between singleton lambs born to hoggets in each feeding level. It is unclear why differences in behaviour resulting from hogget feeding levels are seen only in twin lambs.

CONCLUSION

Feeding hogget ewes on a high level of nutrition had a positive impact on ewe and lamb behaviour within 12 hours of birth. A high level of nutrition during pregnancy may result in behaviours that could result in increased survival of lambs born to hogget ewes.

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