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Ewe maternal behaviour score and lamb survival

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ABSTRACT

The relationship between maternal behaviour and ewe productivity was determined by least squares analyses of records for 1 year on 1050 ewes of 6 genotypes and 3 age groups. A 1 to 5 score was assigned to each ewe based on observations during tagging of lambs within 24 h of birth.

Maternal behaviour was better (by 0.26 score) in 6-tooth (6th) than 4th ewes which had a score 0.27 units higher than 2th ewes. Maternal behaviour score increased by 0.18 for each unit increase in litter size (range 1 to 4). When the effect of litter size on maternal behaviour was removed, ewe genotype differences in maternal behaviour score were small.

Lambs weaned/lambs born, corrected for litter size, age and genotype of ewe, increased by 0.06 for each unit increase in ewe behaviour score. The rate of increase was greater within higher litter sizes. Weight of lamb weaned/ewe lambing was higher for ewes with higher scores for maternal behaviour.

Keywords Ewe behaviour; lamb survival; litter size; ewe age; breed; weaning weight.

INTRODUCTION

Lamb survival and weaning weight are major determinants of the weight of lamb weaned/ewe present at lambing.

Many variables influence lamb survival. Extensive studies have determined the relative importance of sex of lamb, age of dam, genotype of sire and dam, and birth weight on lamb survival in New Zealand ewe flocks (Dalton *et al.*, 1980; Hight and Jury, 1970 and Hinch *et al.*, 1983). Another factor which may influence lamb survival is behaviour of the ewe, but few studies have been made on this relationship. Aspects of maternal behaviour, particularly behavioural traits of the lambing ewe have been described (Arnold and Morgan, 1975), but the factors which influence this behaviour and any consequences maternal behaviour may have for ewe productivity have seldom been considered. This paper reports on a preliminary analysis of the influence of maternal behaviour on lamb survival and weaning weight and discusses the influence of age of ewe, genotype of ewe and litter size on maternal behaviour.

MATERIALS AND METHODS

Experimental Design

As part of an ongoing comparison of ewe genotypes, behaviour data were collected on 1146 ewes during 1983. Six ewe genotypes were represented; Corriedale (Cr), Border-Corriedale (BdCr), Coopworth (Cp), Booroola Merino cross Coopworth (F1 BrCp), Booroola Merino-Coopworth x Booroola Merino-Coopworth (F2 BrCp) and Booroola Merino-Coopworth x Coopworth (¼Br ¾Cp). Coopworth and Booroola Merino X ewes were bred at Lincoln College but Corriedale and Border Corriedale ewe lambs were bought in from 4 different farms. All ewes were mated to Dorset Down rams and run together. Ewes were set stocked at lambing at approximately 20 ewes/ha, then grouped in mobs of 550 after lambing and rotationally grazed until weaning.

Measurements

Within 24 h of birth lambs were tagged and date, litter size and individual birth weight (to the nearest 0.25 kg) were recorded. Maternal behaviour score (MBS) was recorded on a 5-point scale based on the response of the ewe to the handling and tagging of her lamb(s) by the shepherd. Definitions of the MBS scores are;

1. Ewe flees at the approach of the shepherd, shows no interest in the lamb(s) and does not return.
2. Ewe retreats further than 10 m but comes back to her lamb(s) as the shepherd leaves them.
3. Ewe retreats to such a distance that tag identification is difficult (5 to 10 m).
4. Ewe retreats but stays within 5 m.
5. Ewe stays close to the shepherd during handling of her lambs.

A similar scoring system was used by Alexander *et al.*, (1983).

Number of lambs weaned/ewe and lamb weaning weight (measured to the nearest 0.1 kg) were recorded at weaning in late November. Ewe winter weight to the nearest 0.1 kg was measured in mid July, off pasture.

Analysis

Of the 1146 ewe records 96 were excluded as incomplete. Three measures of survival were calculated: survival from birth to weaning (LW/LB) and 2 components of this; survival from birth to tagging within 24 h (LT/LB) and survival from tagging to weaning (LW/LT). Weaning weight was recorded on 1355 lambs.

Relationships between MBS, lamb survival, lamb weaning weight, birth weight, litter size, ewe winter weight and genotype were established. These are referred to as 'uncorrected' data. Because of unequal sized groups of ewes in most classes, a least squares analysis of variance was used to determine factors which were contributing to lamb survival, weaning weight and MBS. Initially all main effects, age of ewe, genotype, litter size and MBS, all 2-factor interactions and 2 partial regressions (birth weight within litter size and ewe winter weight within genotype), were included in the model. Non-significant effects were then excluded progressively until a final model of significant effects only was obtained. These are referred to as 'corrected' results.

RESULTS

Ewe records at lambing were reasonably evenly distributed throughout ewe age and genotype but unequally distributed in respect to maternal MBS and litter size groups (Table 1).

The range in birth weight was 1.0 to 4.9 kg. There was a progressive reduction in average birth weight from 4.39 kg in single born lambs to 1.6 kg in quintruplets. LW/LB increased by 0.04, 0.10, 0.15 and 0.09 for each kg increase in birth weight for singles, twins, triplets and quadruplets, respectively.

Within litter size, LW/LB generally increased as MBS increased both in uncorrected data (Fig. 1) and in corrected data (Table 1), with LW/LB being significantly lower in MBS 1 than in higher MBS scores. LW/LB also tended to be lower in higher litter sizes (Fig. 1) so that birth rank remained as a significant influence on LW/LB through all but the final stage of the model (Table 1). Age and genotype of ewe had been excluded from the model at earlier stages.

LT/LB showed relationships with MBS and litter size similar to those shown by LW/LB but with values 15% higher on average. LW/LT showed no significant relationships with any of the factors investigated.

Weaning weight was significantly influenced by ewe genotype, litter size and MBS although for the latter, no pair of means was significantly different (Table 1). The partial regression on birth weight within litter size was significant and showed that

TABLE 1 Least squares means for significant effects on LW/LB, lamb weaning weight and maternal behaviour score.

Model variable	MBS	LW/LB	Weaning weight (kg)
MBS			
1	—	(63) 0.33^{a}	(33) 20.5
2	—	(133) 0.75^{b}	(156) 20.1
3	—	(418) 0.78^{b}	(510) 20.5
4	—	(346) 0.83^{b}	(508) 20.8
5	—	(90) 0.85^{b}	(148) 21.3
Litter size			
1	(455) 2.97^{a}	—	(403) 23.0^{a}
2	(486) 3.16^{b}	—	(756) 21.4^{b}
3	(84) 3.35^{c}	—	(158) 20.5^{b}
4	(25) 3.52^{d}	—	(38) 17.7^{c}
Ewe age (y)			
2	(301) 2.99^{a}	—	—
3	(415) 3.25^{b}	—	—
4	(334) 3.52^{c}	—	—
Ewe breed			
Cr	(209) 3.04^{b}	—	(243) 20.4^{ab}
BCr	(206) 3.43^{a}	—	(259) 21.9^{a}
Cp	(186) 3.38^{a}	—	(252) 21.6^{a}
F_1 BrCp	(169) 3.23^{a}	—	(231) 20.5^{ab}
F_2 BrCp	(87) 3.03^{b}	—	(98) 19.1^{b}
¼Br¾Cp	(193) 3.39^{a}	—	(272) 20.6^{ab}

( ) = number of observations
Means not followed by the same letter differ significantly ($P<0.01$)

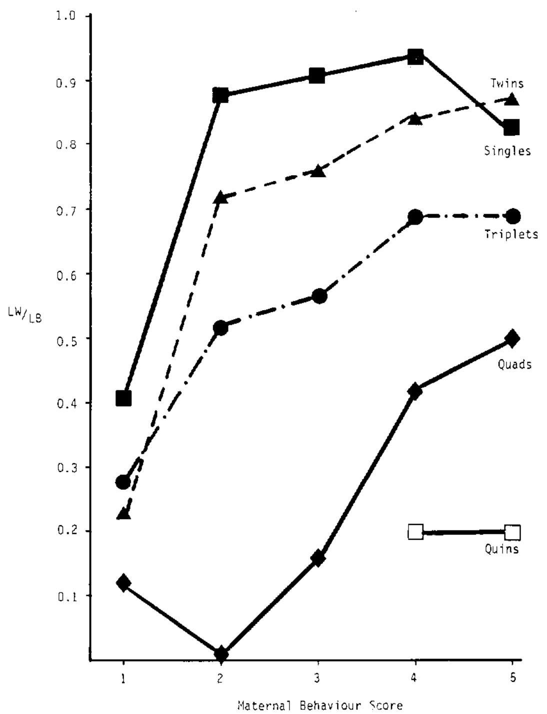

FIG. 1 Relationship between maternal behaviour score and LW/LB within birthrank (raw data).

weaning weight increased by 1.45 kg for each kg increase in birth weight. LW/LB within litter size also significantly influenced weaning weight of individual lambs. Within singles, weaning weight declined by 0.10 kg for each 0.10 increase in LW/LB. Equivalent figures for birth ranks 2, 3 and 4 were −0.62, −0.76 and −0.86 kg respectively. The ranking of ewe genotype for individual lamb weaning weight was the same as for MBS.

The 3 main effects, (ewe age, ewe genotype and litter size) significantly influenced MBS (Table 1). MBS increased by 0.26 units for each year increase in ewe age and by 0.18 unit for each unit increase in litter size. In the initial model, ewe genotype effect was not significant but in later models became significant as some of the effects, especially litter size x genotype and ewe winter weight within genotype were eliminated.

DISCUSSION

The increase in LW/LB per kg increase in birth weight within litter size (0.04 to 0.15) in these data is very similar to that shown by other workers. Dalton *et al.* (1980) and Hinch *et al.* (1983) recorded, in multiple births, increases of 0.16 and 0.17 in LW/LB for an increase of 1 kg in birth weight. Hinch *et al.* (1983) have presented lamb survival-birth weight relationships as curvilinear. The range of birth weight in the present study tended to be within the linear phase of the relationship and justifies the use of linear models. The decline in LW/LB of 0.22 on average for each unit increase in litter size is also similar to that shown by Hinch *et al.* (1983). Unlike the findings of other workers (Dalton *et al.*, 1980; Hight and Jury, 1970), the present study showed no age-of-dam effect on LW/LB. This may be due to MBS explaining some of the age effect on survival because ewe age was found to influence MBS.

The obvious trend (Fig. 1) of an increase in LW/LB with improved MBS has not to our knowledge been identified before. The trend was greater at larger litter sizes. For example, LW/LB increased by 0.18, 0.06 and 0.05 for quads, triplets and twins respectively for each unit increase in MBS from 2 to 5. There was no obvious trend for singles.

From the least squares analysis a major factor influencing LW/LB was shown to be MBS. Behavioural score 1 was the only score which was statistically different from any other score. A number of ewes which had a single dead lamb which they subsequently deserted contributed to the very low survival for this MBS and because of this, score 1 has been left out of some of the subsequent discussion. Although the difference in LW/LB between MBS 2 and 5 is not statistically significant, the increase of 0.10 in LW/LB is likely to be of practical importance.

A further approach to confirm the maternal behaviour effect on LW/LB was made by adjusting lamb losses for the differences in litter size attributable to MBS. This was done for each MBS by calculating the *expected* mean lamb losses from the *observed* mean litter size, using the relationships between litter size and LW/LB published by Rohloff *et al.* (1982) and Kelly (1980). Predicted and actual lamb losses are shown for each MBS, relative to score 2, in Fig. 2. For a change in litter size from 1.60 at MBS 2 to 2.01 at MBS 5, lamb losses would have been expected to increase by 24% (Kelly, 1980) or 61% (Rohloff *et al.,* 1982) whereas they actually declined by 19%.

Weaning weight corrected for age of dam, ewe genotype and litter size increased by 5% from MBS 1 to 5. The effect of MBS on weaning weight is not large but is additive to the effect of MBS on LW/LB.

For each year increase in ewe age, MBS increased by 0.27 units. This appears to be the first time a definitive value has been given to the commonly held view that older ewes are better mothers. The improvement in MBS by 0.18 units for each increase in litter size may represent a stimulation of maternal behaviour by additional lambs. However, some concern exists over the possibility that a larger number of lambs present at tagging may subjectively influence the shepherd to give the ewe a

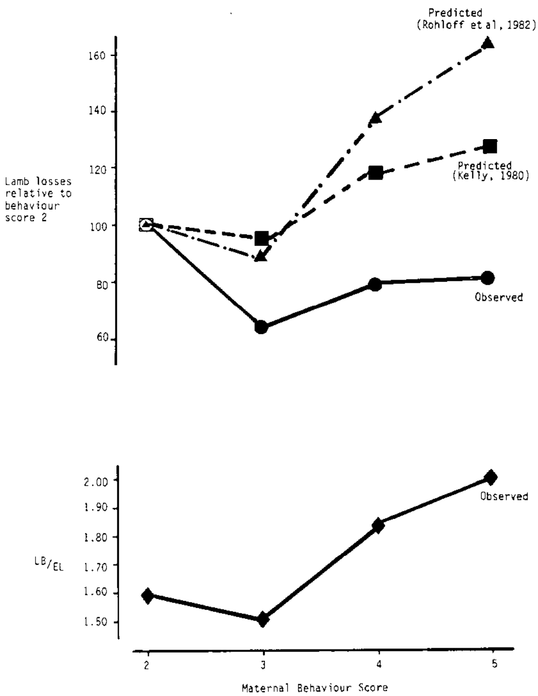

FIG. 2 Comparison of observed lamb deaths within behaviour score with lamb loss predicted from LB/EL. (See text for explanation of calculated values).

higher MBS. If the improved MBS at greater litter size was only an effect of a greater number of lambs, the improvement in LW/LB with increase in MBS would not have been expected. Furthermore, weaning weight which is recorded completely independently of MBS also shows an increase with increasing MBS confirming that MBS has an effect on ewe productivity independent of litter size. In general the ewe genotype effect on MBS was small with the range between the genotypes only representing 0.016 of a change in LW/LB. Whateley *et al.* (1974) observed much larger differences in MBS between genotypes than in the present work but no correction was made for litter size. Part of the genotype difference in maternal behaviour often commented on by others (Whateley *et al.*, 1974 and Dalton *et al.*, 1980) may be attributable to an effect of litter size on maternal behaviour.

The productivity (kg lamb weaned/ewe lambing) was calculated for each MBS from a common litter size of 1.67 (the overall mean for these data) and the appropriate LW/LB and weaning weight from Table 1. Productivity increased from 11.2 kg lamb weaned/ewe lambing for MBS 1 to 25.0, 26.8, 29.0 and 30.4 kg for MBS of 2, 3, 4 and 5 respectively. This represented a 20% increase in ewe productivity with an increase in MBS from 2 to 5.

This study has shown that a calibrated observation on the behaviour of ewes while their lambs are handled within 24 h of birth is related to LW/LB, lamb weaning weight and thus ewe productivity. Further study on the repeatability, heritability and potential for manipulation of MBS is now required before definitive statements can be made on the importance of MBS in animal production systems.

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REFERENCES

Alexander G.; Stevens D.; Kilgour R.; de Langen H.; Mottershead B.E.; Lynch J.J. 1983. Separation of ewes from twin lambs: Incidence in several sheep breeds. *Applied animal ethology* **10:** 301-317.

Arnold G.W.; Morgan P.D. 1975. Behaviour of the ewe and lamb at lambing and its relationship to lamb mortality. *Applied animal ethology* **2:** 25-46.

Dalton D.C.; Knight T.W.; Johnson D.L. 1980. Lamb survival in sheep breeds in New Zealand hill country. *New Zealand journal of agricultural research* **23:** 167-173.

Hight G.K.; Jury K.E. 1970. Hill country sheep production. II Lamb mortality and birth weights in Romney and Border Leicester x Romney flocks. *New Zealand journal of agricultural research* **13:** 735-752.

Hinch G.N.; Kelly R.W.; Owens R.W.; Crosbie S.F. 1983. Patterns of lamb survival in high fecundity Booroola Merino flocks. *Proceedings of the New Zealand Society of Animal Production* **43:** 29-32.

Kelly R.W. 1980. Components of reproductive wastage in sheep. *Proceedings of the tenth seminar of the Sheep and Beef Cattle Society of the New Zealand Veterinary Association:* 78-93.

Rohloff R.M.; Davis G.H.; Hinch G.N. 1982. Characteristics of high performance flocks in Otago and Southland. *Proceedings of the New Zealand Society of Animal Production* **42:** 19.

Whateley J.; Kilgour R.; Dalton D.C. 1974. Behaviour of hill country sheep during farming routines. *Proceedings of the New Zealand Society of Animal Production* **34:** 28-36.