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Ewe maternal behaviour score and lamb growth: Ten years on

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ABSTRACT

Maternal Behaviour Score (MBS) has previously been positively associated with lamb weaning weight. This study further investigated the effects of MBS and other ewe behaviours on the growth rate of 111 Scottish Blackface lambs to weaning. Four variables which had a significant effect on growth rate in a stepwise regression analysis were: birthweight ($p < 0.05$), pre-lambing and early post-lambing ewe liveweights ($p < 0.001$) and MBS ($p < 0.05$). The relationship between MBS and lamb growth rate was not linear. An increase in MBS from 2 to 3 was associated with the greatest increase (10%) in growth rate. MBS was correlated to the frequency of ewe calling ($p < 0.01$) and ewe head up, alert posture ($p < 0.01$) observed during undisturbed field interactions. These behaviours are used to maintain contact between the ewe and lamb, and are indicators of ewe awareness. Therefore, MBS is a good indicator not only of lamb growth but also of the strength of the pre-weaning ewe-lamb relationship.

Keyword: ewe behaviours; lamb growth; maternal behaviour score; birthweight; liveweight.

INTRODUCTION

The most common measure of growth in any farm animal is change in liveweight (McDonald *et al.*, 1981). Growth comparisons between animals based on a single weight measure are however fraught with errors from unpredictable changes in gut contents and other sources (e.g. fleece weight). An alternative is to take a series of weights over time and then mathematically describe this curve (e.g. the Gompertz equation).

Many factors have been shown to influence lamb growth. Most studies have been concerned with the effect of nutrition on growth (e.g. Robinson *et al.*, 1974), the effect of breed on growth and carcass composition changes as the lamb develops (e.g. Croston and Pollot, 1985), or have been genetic studies designed to determine predictors of breeding values for growth (e.g. Coop and Hayman 1962). The only study, to date, to consider the influence of ewe behaviour on lamb growth was that of O'Connor *et al.* (1985). That study found, that a calibrated observation of ewe flight response, when her lamb(s) were handled within 24 hours of birth, was related to lamb survival, weaning weight and thus ewe productivity. Corrected weaning weight increased by 5% with an increase in Maternal Behaviour Score (MBS) from 1 to 5.

It has been shown in sheep that ewe maternal behaviour influences lamb behaviour (O'Connor, 1990) and this paper will discuss the further implications of maternal behaviour on lamb growth. The aim of the present study was to investigate several ewe behaviours, including MBS, and their association with lamb growth.

MATERIALS AND METHODS

Animals

Scottish Blackface ewes (73) and their lambs (111) were continuously grazed in a 6.5 ha drained field on

Castlelaw Farm in the Pentland hills, Scotland for the 18 weeks of the study. Lamb liveweight (35 singles and 76 twins) was recorded fortnightly until weaning. Ewe liveweight was recorded one month before lambing and at three times post-lambing at 6 weekly intervals.

Behaviour Observations

Focal animal observations, which included all interactions with her lamb(s), were taken on all ewes. Each ewe was observed for fifteen minutes on three separate days within each of weeks 1, 3, 6 and 14 after parturition. All observations were tape-recorded in the field and later transcribed (in real time) using 'Key Behaviour' (Deag, 1988), a computerised behaviour data collection package.

The behaviour frequencies (all per 15 minutes) analysed were; ewe approaches to within 1m of her lamb(s), ewe leaves (moving more than 1m from lamb(s)), refusal to allow suckling following an attempt by a lamb, suckling, calling (vocalising) and headup (head held up above shoulder height). The proportion of time the ewe spent within 1 m of her lamb(s) was also considered. All these behavioural variables changed over time and therefore a mean value, taken over all weeks, for each ewe was used in these analyses. This approach avoids the problem of repeated measures and the differing week effect between variables.

Maternal Behaviour Score (MBS) was a modified version of that described by O'Connor *et al.* (1985). The MBS was recorded on a 6-point scale based on the flight response of the ewe to handling and tagging of her lamb(s) by the observer on the day after birth. The scores were defined as:

1. Ewe flees at approach of the observer, shows no interest in her lamb(s) and does not return when the observer leaves
2. Ewe retreats further than 10 metres but maintains an interest in her lamb(s) and comes back to them as the observer leaves them

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3. Ewe retreats to 5-10 metres
4. Ewe retreats but stays within 5 metres
5. Ewe stays close, within 1 metre, to the observer during handling of her lamb(s)
6. Ewe makes physical contact with her lamb(s) while they are being held by the observer

Analysis

A growth coefficient (B value) was derived from the 9 lamb liveweight estimates (including birthweight) using the Gompertz equation (see Kyriazakis, 1989 for derivations). In addition to the behavioural variables described above, the effects due to sex of lamb, parity, litter size, birthweight, ewe liveweights and condition scores on lamb growth were analysed. Male lambs were castrated at one month of age, on average, and so the sex comparison is in fact between ewe and wether lambs.

Data were analysed by using correlation and linear regression to determine those parameters which had a significant effect on lamb growth. Initially a best-fit regression, using a maximum R² improvement technique, identified the variables resulting in the highest R² and the lowest standard deviation. This analysis then indicated the optimal subset of eleven variables on which a complete stepwise regression was completed. Variables giving rise to non-significant effects (based on T-values) were progressively excluded until a final model of only significant effects was obtained.

RESULTS

The eleven variables found by the 'best-fit' technique to influence B value were: birthweight, MBS, pre-lambing ewe liveweight, early post-lambing ewe liveweight, mid-lactation ewe liveweight, litter size, sex of lamb, ewe approach frequency, ewe leave frequency, proportion of time ewe spent with lamb and headup frequency. The final regression model included only four significant variables; birthweight, pre-lambing and early post-lambing ewe liveweights and MBS (Table 1). Pre-lambing ewe liveweight had a negative effect and the other three showed positive effects on B value. This means that an increase in their value was related to an increase in lamb growth.

The effect of MBS was not uniform across the range of values. Table 2 shows that the greatest increase in B value occurred with an improvement in MBS from score 2 to 3. This is equivalent to an increase in lamb growth of 189 to 204 g/d.

TABLE 1: Results of regression analysis on B value

Independent Variables	Coefficient	F value (df=1,95)	Significance
MBS	0.00018	5.11	*
Birthweight	0.00019	6.00	*
Pre-lambing ewe liveweight	-0.00012	13.93	***
Early post-lambing ewe liveweight	0.00012	26.08	***

TABLE 2: Mean (\pm s.e.m.) lamb growth (B value) relative to MBS values.

MBS	n	Mean B value \pm s.e.m.
2	10	0.0070 \pm 0.0003
3	23	0.0078 \pm 0.0002
4	52	0.0080 \pm 0.0001
5	14	0.0080 \pm 0.0002
6	9	0.0078 \pm 0.0003

A subset of the correlation matrix of MBS and lamb growth with significant variables only is shown in Table 3. Lamb growth was significantly negatively correlated with litter size ($p < 0.01$), proportion of time spent with lamb ($p < 0.05$) and pre-lambing ewe weight ($p < 0.01$) and positively correlated to birthweight ($p < 0.05$). MBS was significantly positively correlated with parity, the frequency of ewe call and the frequency of ewe headup.

TABLE 3: Correlation coefficients between lamb growth or MBS and significant variables.

Variable	Lamb Growth	MBS
Litter size	-0.28**	0.11
Parity	-0.18	0.26**
MBS	0.09	-
Birthweight	0.19*	-0.03
Pre-lambing ewe liveweight	-0.30**	0.07
Early post-lambing ewe liveweight	0.05	0.07
Ewe Call	0.09	0.27**
Ewe Headup	0.15	0.26**
Time with Lamb	-0.23*	-0.04

DISCUSSION

This study found that several variables, including aspects of ewe behaviour, influenced lamb growth. The use of a single growth coefficient, B value, gives a unitary measure for the whole growth period and as such is not confounded by individual 'day' anomalies. Birthweight showed a significant effect on lamb growth. This indicates that not only does lamb birthweight have an important influence on lamb survival (Dalton *et al.*, 1980) but also affects the growth of the lamb in the longer term. Both pre-lambing and an early post-lambing ewe liveweight had significant effects on lamb growth. Although litter size did not have a significant effect on lamb growth within the regression it was significantly negatively correlated to lamb growth. The negative association of pre-lambing ewe liveweight with lamb growth is a reflection not only of ewe liveweight at this time but also of litter size and foetus weight. It appears that the influence of pre-lambing ewe liveweight on lamb growth was explaining some of the potential negative effects of litter size on lamb growth.

The only behaviour variable to show a significant negative relationship with lamb growth was the proportion of time the ewe and lamb(s) spent within 1m of each other. Counterintuitively, this may indicate that for animals which maintain close contact the ewe-lamb relationship is weaker.

Alternatively lambs may stay closer to ewes with lower levels of milk production. Although this behavioural strategy might appear to enable the lamb to take every advantage of any suckling opportunity, the ewe ultimately controls access to the udder (O'Connor, 1990). Therefore, in practice there is likely to be little or no benefit to the lamb of staying close to the ewe, in terms of increased suckling or increased growth rate.

The major behaviour parameter to have a significant positive effect on lamb growth was MBS. The present result confirms the previous findings of O'Connor *et al.*, (1985) ten years ago and demonstrates the strength of the relationship between MBS and lamb growth with it being consistent across several breeds and in different farming environments. This indicates that a simple measurement (MBS) taken near birth can help predict long term production performance. O'Connor *et al.*, (1985) found that both parity and litter size significantly influenced MBS. In the present study, MBS was found to be significantly correlated to parity but not litter size. However, in the present study, there were only comparisons between singles and twins compared to litter sizes including triplets and quads in the New Zealand study.

MBS was however, strongly correlated to the frequency of ewe headup and ewe call. It may be that MBS, which seems to measure ewe attentiveness towards her lamb(s) early in the lambs life, is a good indicator of later ewe attentiveness (ewe headup and calling). Parker and Nicol (1993) suggested that differences in ewe attention, in this case grooming behaviour, at birth may contribute to the improved lamb survival and growth associated with high MBS ewes. Ewe headup and call have been shown to be critical in the ewe's control of her lamb(s) movements in the field and particularly in allowing access of the lamb(s) to the udder (O'Connor, 1990). The lamb has to learn that it will only be allowed to suckle when the ewe gives the appropriate "signal". Once learnt, the ewe also uses this signal to get the lamb to approach under other circumstances, particularly if disturbed or to generally maintain contact with her lambs within the flock (O'Connor, 1990).

This communicative behaviour does not however, appear to influence growth though a relationship with suckling frequency. Suckling frequency was not related to lamb growth to weaning in this study probably because it only influences very early lamb growth whilst the lamb is solely dependant on ewe's milk (Treacher, 1983). These two communication variables may be good indicators of

the strength of the ewe-lamb relationship and indicate an association between ewe attentiveness or awareness of her lambs and lamb growth. How ewe behaviour affects lamb growth requires further investigation. One suggestion is that better mothers graze the superior areas of pasture and, by grazing as a family unit (Lawrence, 1984), they provide their lambs with higher quality feed.

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