BRIEF COMMUNICATION: Effect of birth weight on survival of lambs born to ewe lambs

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Keywords: sheep; survival; ewe; lamb; hogget; birth weight.

INTRODUCTION

Benefits of ewe lamb mating (at 8 to 9 months of age) include improved lifetime production, increased rates of genetic gain and higher net profits (Kenyon *et al.*, 2008 and references therein). These benefits of ewe lamb mating are only achieved if the ewe lamb successfully rears its offspring to weaning. For mature ewes, a reduction of mortality before weaning by 1% is equivalent to an extra $10 gross margin per hectare (Morel & Kenyon 2006). To maximise farm profits it is necessary to understand the factors that influence pre-weaning mortality of lambs born to ewe lambs so that appropriate management strategies can be implemented.

In studies investigating the survivability of lambs from mixed-age ewes, it was found that the lamb's birth weight is a strong driver of lamb survival (Yapi *et al.*, 1990; Morel *et al.*, 2008). With multiple births, survival of the lamb is also dependant on its birth weight relative to the birth weight of littermates (Morel *et al.*, 2008; 2009). Although lamb survival from mixed age ewes has been investigated (Everett-Hincks & Dodds 2008; Morel *et al.*, 2008; 2009), similar studies have not been undertaken with ewe lambs. The role that variation in birth weight has on survival of lambs born to ewe lambs is not known. The objective of this study was to investigate the effects of birth weight on survival of both single and twin lambs born to ewe lambs and in twins the effect of the percentage of total birth weight.

MATERIALS AND METHODS

Data was collected from eight experiments where the live weight of lambs born to ewe lambs (also termed hoggets) had been recorded within 24 hours of birth and also at weaning. The final data set had observations from 1,620 ewe lambs which gave birth to either single (n = 1,392) or twin (n = 456) lambs. For a lamb where a birth weight but no weaning weight was recorded, it was assumed the lamb had died before weaning. There was no record of the age at which the lambs had died. The twins were further classified according to their birth weight as the lighter twin or the heavier twin to give three birth ranks: single, heavier twin and lighter twin. For the lambs born as twins the total birth weight (TBWT) was calculated by adding together the birth weights of each lamb within the set. The percentage of the total birth weight (PBWT) for the individual lamb was calculated by dividing the birth weight of the lamb by the total birth weight of the litter (PBWT = Birth weight/TBWT) and then multiplying by 100 to calculate a percentage.

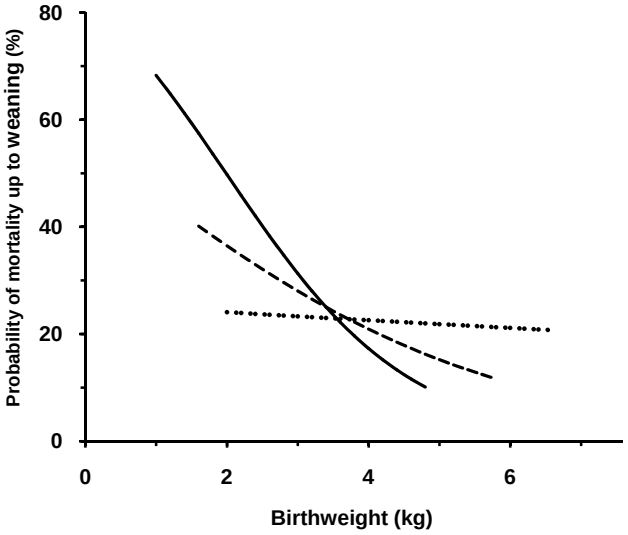
The effect of a lamb's birth weight and the PBWT in twins on mortality to weaning was assessed with a logistic model (PROC GENMOD, (SAS 2003)) which included birth weight or percentage of total birth weight as the covariate, birth rank as the fixed effect and also their interaction. The effect of the experiment from which data was obtained was accounted for by specifying the experiments as subpopulations using the AGGREGATE option in the model statement.

RESULTS AND DISCUSSION

The overall mortality rate before weaning for lambs born from ewe lambs as either a single, heavier twin or the lighter twin was 22.0%, 22.4% and 28.5%, respectively. Therefore, there were more deaths before weaning with the lighter twin in the eight experiments investigated. These values are lower than the 24% for singletons and 38% for twins, in the experiment with ewe lambs by Morris *et al.* (2005).

Birth weight is considered to be the main contributor to lamb deaths before weaning (Huffman *et al.*, 1985; Yapi *et al.*, 1990). The relationship between lamb birth weight and mortality for the different birth ranks is presented in Figure 1. It has been reported that the survival rates of lambs born to ewe lambs were highest when lamb birth weight is 3.3 to 4.1 kg (McMillan & McDonald, 1983). The results from this meta-analysis suggest that, for ewe lambs, further reductions in mortality could be obtained when birth

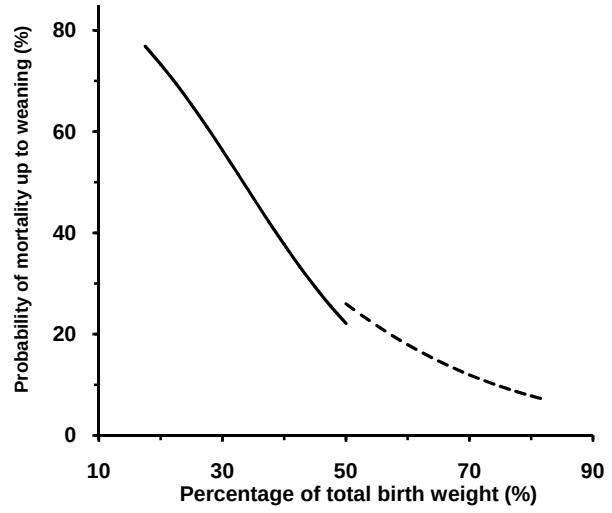
FIGURE 1: Relationship between lamb birth weight and mortality for lambs born from ewe lambs as a single (dotted line), the heavier twin (dashed line) or the lighter twin (solid line).



weights are greater than 4.1 kg especially, when twins are born.

For twin lambs, as birth weight increased the mortality decreased. The decrease in mortality was greater for the lighter twin (logistic regression: Mortality = 1.543 - 0.776*x;* P = 0.001 for slope being different from zero) compared to the heavier twin (logistic regression: Mortality = 0.219 - 0.387*x:* P = 0.09 for slope being different from zero). Birth weight did not influence the mortality in lambs born as a single (logistic regression: Mortality = -1.065 -0.042*x:* P = 0.90 for slope being different from zero). This is consistent with the relationship between birth weight and mortality following a quadratic pattern where mortality decreases as birth weight increases and then is constant before an increase in mortality at very heavy birth weights (Kenyon *et al.*, 2002; Everett-Hincks & Dodds 2008; Morel *et al.*, 2009). For mixed-age ewes having lambs with birth weights greater than 6 kg the mortality rate is considered to increase (Dalton *et al.*, 1980). In the current data set there was insufficient number of lambs born with a live weight above 6 kg to be able to conclude if this was also the case with lambs born to ewe lambs.

FIGURE 2: Relationship between percentage of total birth weight and mortality for twin lambs born from ewe lamb as the heavier twin (dashed line) or the lighter twin (solid line) in the twin set.



In a similar manner to the results of Morel *et al.* (2009), the decrease in mortality rate with increasing birth weight was greater in the lighter twin compared to the heavier twin. The reason for the greater response in the lighter twin is not well understood however, Morel *et al*. (2009) speculated that it may be a consequence of the lighter lamb having an increased ability to compete with its litter mate. Lighter lambs have a greater increase in heat production with increasing body weight compared to their heavier cohorts (Kerslake *et al.*, 2009) and it maybe this mechanism which gives greater reductions in the mortality rate with increased birth weight in the lighter twin lamb compared to the heavier twin and single lamb.

For the lighter twin an increase in its PBWT was associated with a decrease in mortality (logistic regression: Mortality = -0.0756 + 2.521*x;* P = 0.08 for slope being different from zero). Although the heavier twin appears to have a decreasing mortality with increased PBWT, the slope of the regression is not significantly different to zero (logistic regression: Mortality = -0.0475 + 1.3281*x:* P = 0.36 for slope being different from zero). This implies that there is no effect of PBWT on mortality for the heavier twin (Figure 2).

This study did not record the age of the lamb when it died which limits the ability to fully ascribe lamb mortality to birth weight however, clear relationships between mortality before weaning and birth weight were established. The results from the regressions with both birth weight and PBWT on lamb survival suggest that an increased weaning percentage could be achieved in lambs born to ewe lambs by increasing the birth weight of the smaller twin or reducing the difference in birth weight between the lambs in the twin set. Although this may increase the mortality of the heavier twin, the overall mortality is likely to decrease as there are smaller changes in mortality for the heavier twin with increases in BWT and PBWT.

Increasing the level of nutrition of mature ewes during pregnancy increases lamb birth weights and survival rates (Rattray, 1986). Ewe lambs with a very poor diet during pregnancy will produce lambs with lower birth weights (Mulvaney *et al.*, 2008) but, improving the nutritional regime of ewe lambs during pregnancy has resulted in no effect on lamb birth weights and lamb survival to weaning (Morris

et al., 2005; Kenyon *et al.*, 2008). This implies that a longer term improvement of ewe lamb live weight prior to mating may be needed to influence lamb birth weights and lamb survival to weaning. Further research needs to consider what management strategies for ewe lambs prior to and during pregnancy are likely to increase birth weights in their lambs and what other factors are likely to be important for improving the weaning percentage. There also needs to be a comparison of mortality of lambs born to ewe lambs and mixed-aged or mature ewes to establish if different management schemes are necessary for ewes of different ages.

ACKNOWLEDGEMENTS

The authors acknowledge the providers of funding for the experiments: Meat and Wool New Zealand, C. Alma Baker Trust and Massey University. Authors are also grateful to Fraser Mulvaney for the collection and provision of data.

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