Hogget lamb mortality

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ABSTRACT

Hogget lamb mortality in the Waihora sheep improvement programme from 1970/80 has ranged from 18 to 35% (mean = 24%). Hogget lambs born during the 1981 and 1982 lambings were used to study the timing, magnitude and causes of lamb mortality.

Mean mortality rates to weaning were 33% and 28% in each year. The distribution of deaths was similar in each of the periods: at birth, born alive but died by day 3 and died between day 4 and docking. Dystocia was the single largest cause of deaths to day 3 accounting for about 13 lambs/100 lambs born. Birth weight was an important factor in lamb deaths with an optimum range of 3.3 to 4.1 kg for minimum mortality.

Keywords Lamb mortality; dystocia; birth weight; hoggets; ewe lambs; Waihora; Romney

INTRODUCTION

Hogget lamb mortality in the Waihora sheep improvement programme from 1970/80 has ranged from 18 to 35% (mean = 24%) (Hight *et al.*, 1975; R. L. Craig, unpublished). These high mortality rates are surprising since twinning rates were low (mean = 4%) and weather conditions during lambing in October were generally settled. High mortality rates have also been reported in other hogget flocks (Lewis, 1959; Baker *et al.*, 1981). Unlike the situation with lambs born to adult ewes the factors associated with high hogget lamb mortality are not understood.

The aim of this study was to examine factors associated with the timing, extent and causes of hogget lamb mortality.

MATERIALS AND METHODS

Romney hoggets in the Waihora sheep improvement scheme at Waihora and Otutira (Hight *et al.*, 1975) were joined with entire rams for 25 days from early May in 1981 and 1982. In early September each year pregnant hoggets were weighed, vaccinated and grazed as one mob on each farm until the start of lambing. All lambs born in 1981 (n = 952) but only those born during 6 to 14 October 1982 (n = 468) were included in the study.

New-born lambs were tagged and birth weights recorded following a daily shedding system. Each lambing paddock was then carefully checked daily for 3 days to collect dead lambs. These were examined using post-mortem procedures described by McFarlane (1965) and modified by Haughey (1973 a) to include central nervous system examination. Cause of death classifications included: congenital malformation, prenatal infection, dystocia, exposure, starvation, misadventure and undiagnosed.

All lambs were assumed to be new-born at tagging and age of lamb at death was determined from lambing, post-mortem, docking and weaning lists. Lambs were classified as dead: at birth, by days 1 to 3; by docking and by weaning. Docking and weaning took place in late October (mean age = 3 weeks), and mid-December (mean age = 9 weeks) respectively.

Statistical analyses were carried out using the Genstat package. Logit transformations were applied to binomial data. Data collected in 1982 are included for comparative purposes but have not been statistically analysed.

RESULTS

Hogget Pre-lambing Live Weight and Lambing Day

Least-squares mean live weight and lambing day were 37.7 kg and day 283.1 respectively (Table 1).

TABLE 1 Hogget live weight and lambing day.

	Hogget live weight (kg)†	Hogget lambing day (day 283 = Oct 10)
Overall least squares mean	37.7	283.1
Flock		
Waihora	40.6	284.1
Otutira	34.9	282.1
	***	***
Birth rank		
single	37.5	283.6
multiple	38.0	282.6
		*
Litter size		
single	36.9	283.0
twin	38.6	283.1
	***	

† At day 243.

Pre-lambing live weight was significantly affected by age of hogget at weighing (0.04 ± 0.01 kg/day mean ± S.E.) and interval from weighing to lambing (−0.10 ± 0.02) kg/day). The mean interval from weighing to lambing was 40 days.

Waihora hoggets were heavier and lambed later than Otutira hoggets ($P < 0.001$); single-born hoggets were of similar live weight to multiple-born hoggets but lambed later ($P < 0.05$) and twin-bearing hoggets were heavier ($P < 0.001$) than single-bearing hoggets but had similar mean lambing dates.

Lamb Birth Weight and Time of Death

Birth weights were heavier in later-born lambs (0.03 ± 0.01 kg/day) and lambs born to heavier hoggets (0.02 ± 0.01 kg/day). Single-born lambs were about 1 kg heavier ($P < 0.001$) than twin-born lambs (Table 2) but flock and sex differences were not significant.

The relationship between birth weight and lamb deaths to weaning was curvilinear (Fig. 1) and the optimum birth weight range for minimum mortality was 3.3 to 4.1 kg. Almost one-third of lambs born were dead by weaning (Table 2). More twins than singles died by weaning (39.2% *v* 33.0% $P < 0.01$) but only because they were lighter at birth.

The proportion of lambs born dead or born alive but dying by day 3 was also curvilinearly ($P < 0.001$) related to birth weight (Fig. 1). Minimum mortality over these periods occurred in birth weight ranges of 2.5 to 4.0 kg and 3.0 to 5.0 kg respectively. Lamb deaths from day 4 to docking showed a decrease ($P < 0.01$) with increasing birth weight (approximately 5%/kg over the 2.0 to 5.0 kg birth weight range) and was negligible above 4.5 kg. There was no relationship between birth weight and post docking deaths.

The pattern of lamb deaths between birth and weaning after adjusting for birth weight (Table 2) shows approximately equal proportions of lambs dying at birth, between birth and day 3 and from day 4 to weaning. More twins than singles died between day 4 and docking (10.3% *v* 4.4%, $P < 0.01$) but only because they were lighter at birth. Some lambs (3.7%) were dead by day 3 but the precise time of

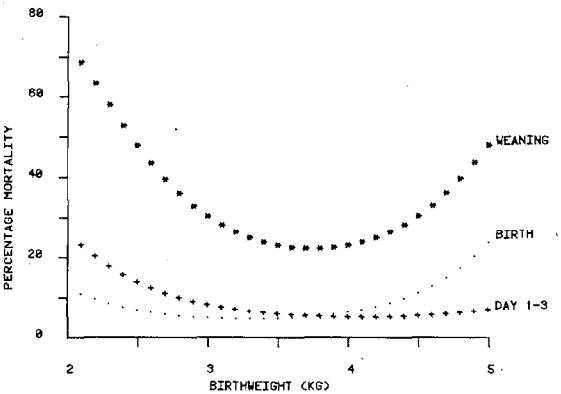

FIG. 1 The relationship between birth weight (BT) and % lambs dead/lambs born at:

birth —ln (P/1-P) = 3.524 − 3.850 BT + 0.585 BT²
± 0.759 ± 0.100

1 to 3 days —ln (P/1-P) = 4.243 − 3.477 BT + 0.424 BT²
± 0.697 ± 0.093

weaning —ln (P/1-P) = 9.269 − 5.607 BT + 0.748 BT²
± 0.672 ± 0.091

where P = lambs dead/lambs born.

TABLE 2 Lamb birth weight and time of death.

		% lambs dead/lamb born (adjusted for birth wt)				
	Birth weight (kg)	Birth-weaning	Born dead†	1 to 3 days†	4 days-docking	Docking-weaning
Overall mean	3.55	32.5	9.8	9.0	4.6	5.4
Flock						
Waihora	3.6	32.8	9.5	10.7	4.2	4.6
Otutira	3.5	32.2	10.0	7.5	5.0	6.3
Birth rank						
single	4.0	33.0	9.8	9.0	4.3	6.0
twin	3.1 ***	32.0	9.8	9.0	4.9	4.8
Sex						
female	3.5	30.3	9.0	8.6	4.5	4.9
male	3.6	34.6	10.6	9.4	4.7	5.9

† An additional 3.7% lambs were dead by day 3 but exact time unknown.

death could not be determined. Of lambs born alive but dying by day 3, 76.7% (66/86) were dead within 24 hours of birth.

The pattern of lamb deaths in 1982 confirmed that found in 1981 except that only 1.5% of lambs died post docking. The overall mortality to weaning was 28.0%.

Diagnosed Cause of Lamb Mortality

The proportion of lambs that died as a result of dystocia (Fig. 2) or starvation was curvilinearly related to birth weight ($P < 0.001$). Prenatal deaths showed a decline ($P < 0.01$) with increasing birth weight.

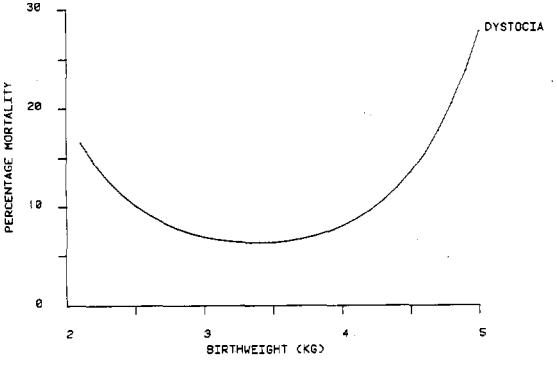

FIG. 2 The relationship between birth weight (BT) and % lambs dead of dystocia/lambs born:

$$\ln (P/1\text{-}P) = 4.815 - 4.444\ BT + 0.658\ BT^2$$
$$\pm\ 0.724 \quad \pm\ 0.097$$

where P = lambs dead of dystocia/lambs born.

Dystocia, starvation and prenatal deaths were the major causes of mortality (Table 3). More twins than singles were classified as starvation (5.3% *v* 1.8%, $P < 0.05$) and prenatal (5.0% *v* 1.5%, $P < 0.05$) but only because they were lighter at birth.

The mean proportion of all deaths by weaning diagnosed as dystocia, starvation and prenatal were 42.9%, 9.2% and 6.2% respectively. In 1982 the respective proportions were 43.5%, 6.9% and 5.3%. In 1981, a further 17.3% of dead lambs were found but not examined compared to 3.1% in 1982. Congenital abnormalities, infection, and exposure accounted for only 6.2% and 1.5% of deaths in 1981 and 1982 respectively.

Of the dystocia deaths: 25% were classified as prolonged births (hypoxia lesions, no subcutaneous oedema, no liver rupture); 28% as foeto-pelvic disproportion (correct presentation—subcutaneous oedema in both forelegs and head); and 47% as incorrect presentation (oedema with or without liver rupture). Subcutaneous oedema due to dystocia was evident in 54% (14/26) of starvation deaths. These findings on causes of mortality were consistent in both years.

Hoggets Assisted

Overall, 4.5% of hoggets were assisted to lamb in 1981 (3.8% in 1982). Flock, hogget birth rank and litter size differences were not significant. Assisted lambs were 1.0 kg heavier ($P < 0.001$) at birth than unassisted lambs.

Central Nervous System Injury (Dystocia and Starvation Deaths)

Of the lambs dying because of dystocia 60.8% (73/120) had no cranial haemorrhages, and severe congestion contributed to only 11% (4/36) of cases where cranial lesions were present. In contrast only 7.5% (9/120) of spinal cords were considered normal. The most frequent lesions were mild epidural (64%) and subdural (23%) haemorrhages at the cervical site.

Cranial haemorrhages occurred in only 7.7% (2/26) of lambs dying of starvation. However, all lambs dying from starvation exhibited epidural lesions at the allanto-occipital and cervical sites with 73% and 56% of cases respectively classed as severe. Similar proportions (50%) of suckled and unsuckled starvation lambs had severe cervical haemorrhaging.

DISCUSSION

The high levels of mortality to weaning recorded during the 2 years studied confirm this as an important problem in the 2 flocks. The results highlight the neonatal period as one of highest risk with about one-third of deaths occurring at birth and a similar proportion within 24 hours of a live birth. It is clear that an additional 5% or so of hogget lambs die in each of the periods: birth, 1 to 3 days and 4 days to weaning compared to singles born to adult ewes (Hight and Jury, 1970; Dalton *et al.*, 1980). Furthermore, the timing and magnitude of deaths in this study are comparable to those recorded for triplet lambs born to elite ewes at Waihora in 1980 (Kilgour, 1982).

TABLE 3 Diagnosed causes of lamb mortality.

	% lambs dead/lambs born (adjusted for birth wt)		
	Dystocia	Starvation	Prenatal
Overall mean	12.3	2.7	1.8
Flock			
Waihora	12.9	3.0	2.1
Otutira	11.7	2.4	1.5
Birth rank			
single	14.7	1.8	1.5
twin	10.3	4.1	2.1
Sex			
female	12.3	2.2	1.9
male	12.3	2.3	1.7

Dystocia was the single most important cause of lamb deaths accounting for about 12 deaths per 100 lambs born. Birth weight was an important feature of these deaths with both light and heavy lambs at increased risk. Dystocia is also an important cause of death in single lambs born to older ewes (Hight and Jury, 1970; Meyer and Clarke, 1978) and the optimum birth weight range for minimal dystocia deaths (3.0 to 4.0 kg) in this study is similar to that reported for singles from adult ewes (Dalton *et al.*, 1980). However, an additional 5% of hogget lambs died of dystocia in this study at any given birth weight over this range. This indicates a lower ability of hogget lambs to withstand the trauma of birth, possibly because of a more intense and/or prolonged labour.

Although malpresentation at birth was a feature of dystocia deaths, the assistance rate was moderate and compares favourably with the 3% (Gibson and Craig, 1980) and 7% (R. Kilgour, pers. comm.) reported for older ewes of similar genetic background.

It is clear that lambs with birth weights around 3.7 kg would have the least chance of dying by weaning. The suggested optimum for lambs born to older ewes was 1 kg heavier than found in this study (Dalton *et al.*, 1980). Manipulation of mean birth weight appears to offer little scope for reducing hogget lamb mortality to weaning since the suggested optimum and the actual mean birth weights were similar in both years in this study. This contrasts with the situation in older ewes where mean birth weights can be 1 to 2 kg below the suggested optimum (Dalton *et al.*, 1980). However, twins born to hoggets could benefit from higher mean birth weights if excessive twin mortality rates are to be avoided. A reduction in the range of hogget lamb birth weights to between 3.3 and 4.1 kg would be expected to reduce mortality to weaning by 7%. At birth weights less than 3.5 kg the relationship with mortality to weaning was similar to that for lambs born to older ewes (Dalton *et al.*, 1980). This suggests that common physiological factors are associated with the deaths of light lambs born to immature as well as adult ewes. However, at birth weights between 4.0 and 5.5 the additional mortality rate to weaning of hogget lambs increased from 6% to 55%. It is likely that hogget foeto-pelvic disproportion accounts for a large proportion of these additional deaths.

Starvation was not a major cause of diagnosed deaths, accounting for about 3 deaths/100 lambs born. Furthermore, dystocia and not exposure appeared to be the major complicating factor in starvation deaths. This may explain why starvation deaths began increasing above the optimum birth weight of 4.1 kg. Other studies show decreasing starvation deaths with higher birth weights (Dalton *et al.*, 1980).

The high incidence of central nervous system injury in dystocia deaths confirms other findings (Haughey, 1973 a,b; Duff *et al.*, 1982). Similarly, the high incidence of spinal lesions found in starvation deaths supports evidence in lambs from adult ewes (Haughey, 1973 b). Spinal haemorrhages in starvation deaths in this study had no effect on whether lambs suckled. Duff *et al.* (1982) reported a similar finding.

CONCLUSIONS

High lamb mortality, mainly as a result of dystocia, can be a major problem with hoggets. The neonatal period is clearly one of high risk accounting for about two-thirds of lamb deaths. Birth weight and lamb mortality to weaning were closely related and the suggested optimum birth weight range for twin and single lambs was 3.3 to 4.1 kg. Birth weight manipulation appears to offer little scope for improving hogget lamb survival and further studies are required to determine the causes of dystocia.

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