Observations on neonatal progress of Dormer and South African Mutton Merino lambs

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Data of Dormer (n = 290) and SA Mutton Merino (n = 306) lambs, born by ewes which were observed continuously during lambing in 1989—1991, formed the basis of this investigation. Progeny of SA Mutton Merino ewes were heavier at birth ($P \leq 0.05$) than progeny of Dormers in 1989 and 1990, but no difference was observed in 1991. Lambs given birth to by maiden ewes (2 years) were slower ($P \leq 0.01$) to stand than progeny of adult (3—6 years) and old (≥ 7 years) ewes. A significant interaction between dam age and birth type was observed with regard to progress from standing to first suckling. Single lambs born to maiden ewes responded slower ($P \leq 0.05$) than multiples. Amongst the progeny of mature ewes, singles progressed faster ($P \leq 0.05$) than multiples, and a similar tendency was observed in progeny of old ewes. Time-lapses from birth to standing and from standing to apparently suckling declined ($P \leq 0.01$) with an increase in birth mass. Halfsib analysis of variance heritability estimates were 0.46 ± 0.16 for the interval from birth to standing and 0.22 ± 0.12 for the interval from standing to suckling. Lambs which died subsequently were slower ($P \leq 0.01$) to stand, and tended ($P = 0.07$) to progress more slowly from standing to suckling than their contemporaries which survived. It is doubtful whether these results will find application in practice, since such observations are very labour-intensive. From a scientific viewpoint it is important to take cognisance of the possibility of genetic variation in neonatal progress, suggesting that selection may have a role to play in the reduction of lamb mortality. Live-mass gain to *ca.* 3 days of age was found to be a reliable indicator of subsequent lamb mortality in twin and triplet lambs. An increase of 1 kg was associated with decreases of 22% in twin mortality and 43% in triplet mortality.

Data van Dormer- (n = 290) en SA Vleismerino-lammers (n = 306) van ooie wat deurlopend onder observasie was tydens lam in 1989—1991, is in die ondersoek gebruik. Nageslag van SA Vleismerino-ooie was swaarder by geboorte ($P \leq 0.05$) as die nageslag van Dormers in 1989 en 1990, maar geen verskil is in 1991 waargeneem nie. Lammers van jong ooie (2 jaar) was stadiger ($P \leq 0.01$) om te staan as lammers van volwasse (3—6 jaar) en ou (≥ 7 jaar) ooie. Vordering van staan-tot-suip is ooreenstemmend deur moederouderdom beïnvloed, sowel as deur 'n betekenisvolle ($P \leq 0.01$) interaksie tussen moederouderdom en geboortestatus. Enkelinglammers gebaar deur jong ooie het stadiger ($P \leq 0.05$) gevorder as meerlinge. By die nageslag van volwasse ooie het enkelinge egter vinniger ($P \leq 0.05$) gevorder as meerlinge, en 'n ooreenstemmende neiging is by die nageslag van ou ooie waargeneem. Die tydsverloop van geboorte-tot-staan en van staan-tot-suip is verkort ($P \leq 0.01$) met 'n toename in geboortemassa. Oorerflikhede met halfsibmetodes beraam, was 0.46 ± 0.16 vir die tydperk van geboorte-tot-staan en 0.22 ± 0.12 vir die tydperk van staan-tot-suip. Lammers wat later dood is, was stadiger ($P \leq 0.01$) om te staan, en het geneig ($P = 0.07$) om stadiger te vorder van staan-tot-suip as hulle tydgenote wat oorleef het. Daar is egter twyfel oor die praktiese toepaslikheid van die resultate, aangesien sulke observasies baie arbeids-intensief is. Uit 'n wetenskaplike oogpunt is dit egter belangrik om kennis te neem van die moontlikheid van genetiese variasie, wat op 'n moontlike rol vir seleksie in die verlaging van lamvrektes dui. Liggaamsmassatoename tot ongeveer 3 dae was 'n betroubare indikasie van latere vrektes by tweeling- en drielinglammers. 'n Toename van 1 kg het tot onderskeie afnames van 22 en 43% in tweeling- en drielingvrektes gelei.

Keywords: Birth mass, neonatal lamb progress, survival.

Introduction

Hofmeyr & Boyazoglu (1965) estimated the overall lamb mortality in the Western Cape to be 16%. In a more recent investigation, Haughey (1989) estimated perinatal lamb mortality in the Western and Southern Cape to be 15.1% (8 to 45%). Fourie & Cloete (1990) similarly reported that 12% of 12 374 commercial Merino ewes which lambed in the Bredasdorp district in 1988—89 failed to rear any lamb to marking at *ca.* 6 weeks of age. It thus seems that lamb mortality still remains at unacceptably high levels, despite considerable effort in the care and management of lambing flocks in this area.

When levels of lamb mortality exceed *ca.* 15%, it is usually possible to identify one or more major causes of death, whereas it is often not as well defined in flocks with lower mortality levels (Alexander, 1984). Aberrant behaviour by ewes and lambs is a factor implicated in lamb mortality (Alexander, 1984; 1988). Behavioural traits with survival value in lambs include standing soon after birth, suckling soon after standing, close following of the mother, and absence of separation from the mother (Alexander, 1988). Some of these traits may be determined genetically, as suggested by the fact that crossbred lambs were less likely to be separated from their Merino dams than purebreds (Stevens *et al.*, 1984). Crossbred lambs were similarly better at recognizing their dams than purebred Merino lambs (Nowak *et al.*, 1987).

Against this background, birth mass and behavioural traits with possible survival value were investigated in the offspring of fecund Dormer and SA Mutton Merino ewes which were observed continuously during lambing.

Material and Methods

The 596 lambs (306 SA Mutton Merino and 290 Dormer lambs) born during the investigation described by Cloete (1992) formed the basis of this report. The previous paper (Cloete, 1992) can be consulted for details regarding the experimental site, flocks observed and procedure.

Data recorded

Complete information regarding parentage (identity of sire and dam), birth year, breed, sex, age of dam, and birth type was available for all lambs. Birth mass was recorded within 12 h of birth. Lamb progress, reflected by the time-lapse between birth and first standing, first seeking teats, reaching the udder and apparently suckling was also investigated. Maternal co-operation during attempts to suckle was scored by the allocation of points for desirable behaviour (standing still, back slightly arched, nuzzling the lamb into correct position) and the absence of undesirable behaviour (backing, circling, butting). Points thus ranged from a maximum of 6 for a combination of all the desirable behaviour patterns, to 1 when a ewe rejected her lamb(s) with aggression. By the end of the observation period (at an age of *ca.* 3 days) lambs were weighed again before being joined in larger groups with other lambed ewes and their lambs.

Statistical analysis

The data were unbalanced, and standard least squares procedures were used in most analyses (Harvey, 1977; 1982). A general fixed model was fitted, including the effects of breed (SA Mutton Merino or Dormer), birth year (1989—1991), sex (ram or ewe), age of dam (2 years, 3—6 years or ≥ 7 years, designated as maiden, mature or old respectively) and birth type (single, twin, triplet). In subsequent analyses, birth mass or maternal co-operation score was included as covariate, to adjust neonatal progress data for differences in these traits. The distribution of data recorded as time intervals (lamb progress) was skew, and these data were analysed after a standard $\log_{10}$ transformation to normalize the distribution. The effects of the respective main effects were tabulated for ease of presentation. Significant two-factor interactions were discussed in the text where they occurred.

Data of 514 lambs sired by 42 rams contributing > 3 progeny to the data set (k = 10.4), for which information regarding time intervals between birth and standing, birth and apparently suckling as well as standing and apparently suckling were available, were used to obtain heritability estimates for these traits by standard halfsib analysis of variance procedures (Harvey, 1977). The general mixed model applied contained the random effect of sires within contemporary groups (consisting of breed and birth year) and the other fixed effects mentioned earlier, with or without the inclusion of birth mass as covariate. Heritability estimates and standard errors were calculated from the between-sire and error variance components, using formulaes given by Harvey (1977) and Swiger *et al.* (1964).

Results

Birth mass

Birth mass results were complicated by a significant ($P \leq 0.01$) interaction between breed and year of birth. In 1989 and 1990, SA Mutton Merino lambs were heavier ($P \leq 0.05$) than Dormers (1989 – 4.3 ± 0.1 vs. 4.0 ± 0.1 kg; 1990 – 4.1 ± 0.1 vs. 3.7 ± 0.1 kg), while no difference was observed between the breeds in 1991 (4.3 ± 0.1 vs. 4.3 ± 0.1 kg). Overall, SA Mutton Merino and ram lambs were heavier ($P \leq 0.01$) than Dormers and ewes respectively (Table 1). Lambs given birth to by mature and old dams were heavier ($P \leq 0.01$) than lambs borne by maidens. Birth type was closely related to birth mass with 1 kg separating singles from twins ($P \leq 0.01$) and a further 0.7 kg separating twins from triplets ($P \leq 0.01$).

Neonatal lamb progress

The interval between birth and first standing was correlated with the time-lapse between birth and teat seeking (r = 0.87), birth and reaching the udder (r = 0.69) and birth and apparently suckling (r = 0.54), due to the period from birth to standing it had in common. The time-lapses from birth to standing and from standing to apparently suckling, were however, uncorrelated (r = –0.01). These measures of lamb progress are presented in Table 1. The interval from birth to standing was largely unaffected by the main effects included in the analysis, except for quicker ($P \leq 0.01$) progress in lambs given birth to by mature and old ewes in comparison with progeny of maidens. Multiple lambs correspondingly tended ($P \leq 0.23$) to be slower to stand than singles.

The interval between standing and apparently suckling was largely independent of the known sources of variation, with the exception of dam age (Table 1). There was, however, also a significant ($P \leq 0.05$) interaction between dam age and birth type. Single lambs given birth to by maiden ewes were found to be slower ($P \leq 0.05$) to progress from standing to apparently suckling than twins and triplets (54.9 vs. 27.5 and 25.7 min respectively; $\log_{10}$ transformed means ± *SE*s – 1.74 ± 0.13 vs. 1.44 ± 0.06 and 1.41 ± 0.16). Amongst the progeny of mature ewes, singles progressed ($P \leq 0.05$) faster than multiples (14.5 vs. 21.3 and 20.6 min respectively; $\log_{10}$ transformed means ± *SE*s – 1.16 ± 0.07 vs. 1.33 ± 0.03 and 1.31 ± 0.07). A similar tendency was observed in lambs borne by old ewes (16.9 vs. 30.9 and 30.2 min respectively; $\log_{10}$ transformed means 1.23 ± 0.22 vs. 1.49 ± 0.08 and 1.48 ± 0.14).

The interval between birth and first standing declined ($P \leq 0.01$) with an increase in birth mass (b ± *SE* = –0.145 ± 0.039; antilog = 1.4 min/kg birth mass). Individual class regressions for Dormer and SA Mutton Merino lambs tended ($P = 0.06$) to differ (–0.194 ± 0.048 vs. –0.096 ± 0.046 for the respective breeds). The interval between standing and apparently suckling also declined ($P \leq 0.01$) as birth mass increased (b ± *SE* = –0.139 ± 0.053; antilog = 1.38 min/kg birth mass). The inclusion of birth mass as covariate reduced the effect of dam age on neonatal lamb progress, but it remained significant ($P \leq 0.05$). As would have been expected, higher scores for maternal co-operation with attempts to suckle were associated ($P \leq 0.01$) with shorter intervals between standing and apparently suckling (b ± *SE* = –0.082 ± 0.023; antilog = 1.21 min/unit increase in maternal co-operation score).

It was furthermore attempted to relate early postnatal progress of lambs to subsequent lamb mortality. Lambs which died prior to weaning (n = 101) were slower ($P \leq 0.01$) to

Table 1 The effects of breed, year, sex, dam age and birth type on birth mass and time to stand and to suckle in Dormer and SA Mutton Merino lambs observed continuously during 1989—1991

Effect	Number of lambs	Birth mass (kg)	Number of lambs	Time to stand (min)		Standing to suckling (min)	
				Mean ± *SE*	Antilog	Mean ± *SE*	Antilog
Overall mean	596	4.1 ± 0.05	516	1.30 ± 0.03	19.9	1.40 ± 0.04	25.1
Breed		**		NS		NS	
Dormer	290	4.0^{1} ± 0.1	260	1.31 ± 0.04	20.4	1.42 ± 0.05	26.3
SA Mutton Merino	306	4.2^{2} ± 0.1	256	1.30 ± 0.04	19.9	1.38 ± 0.05	24.0
Year		**		NS		NS	
1989	214	4.2^{2} ± 0.1	173	1.39 ± 0.06	24.5	1.31 ± 0.08	20.4
1990	180	3.9^{1} ± 0.1	161	1.30 ± 0.04	19.9	1.41 ± 0.05	25.7
1991	202	4.3^{2} ± 0.1	182	1.22 ± 0.06	16.6	1.47 ± 0.08	29.5
Sex		**		NS		NS	
Ram	312	4.2^{1} ± 0.1	256	1.32 ± 0.04	20.9	1.41 ± 0.05	25.7
Ewe	284	4.0^{2} ± 0.1	260	1.29 ± 0.04	19.5	1.39 ± 0.05	24.5
Dam age		**		**		**	
2 years	103	3.9^{1} ± 0.1	92	1.46^{2} ± 0.05	28.8	1.53^{2} ± 0.07	33.9
3—6 years	416	4.2^{2} ± 0.1	360	1.27^{1} ± 0.03	18.6	1.26^{1} ± 0.04	18.2
7+ years	77	4.3^{2} ± 0.1	64	1.18^{1} ± 0.07	15.1	$1.40^{1,2}$ ± 0.09	25.1
Birth type		**		NS		NS	
Single	77	5.0^{3} ± 0.1	71	1.21 ± 0.07	16.2	1.38 ± 0.10	24.0
Twin	375	4.0^{2} ± 0.1	340	1.33 ± 0.03	21.4	1.42 ± 0.03	26.3
Triplet	144	3.3^{1} ± 0.1	105	1.36 ± 0.06	22.9	1.40 ± 0.08	25.1

NS = Not significant ($P > 0.05$); ** significant ($P \leq 0.01$).
^{1,2} Denote significance ($P \leq 0.01$).

stand than their contemporaries which survived to weaning (n = 415; 27.2 vs. 19.4 min; $\log_{10}$ transformed means ± *SE*s – 1.435 ± 0.041 vs. 1.287 ± 0.023 respectively). Similar differences were found with regard to the intervals between birth and first seeking teats, reaching the udder and apparently suckling. Lambs which died prior to weaning correspondingly tended (P = 0.07) to progress slower from standing to apparently suckling than their contemporaries which survived to weaning (32.3 vs. 25.5 min, $\log_{10}$ transformed means ± *SE*s 1.510 ± 0.056 vs. 1.406 ± 0.031 respectively).

Between-sire variance components were significant ($P \leq 0.05$) for birth mass and the various measures of lamb progress in the postnatal period. Heritability estimates (± *SE*s) were 0.194 ± 0.117 for birth mass, 0.458 ± 0.156 for the time interval between birth and standing, and 0.218 ± 0.121 for the interval between standing and apparently suckling. The inclusion of birth mass as covariate resulted in little change in the heritability estimates for the latter two traits, which were 0.561 ± 0.170 and 0.225 ± 0.123 respectively. The variance between sires was therefore not associated with birth mass differences.

Live mass at the end of the observation period and gain to *ca.* 3 days

Live mass at *ca.* 3 days of age was recorded for 518 lambs which survived to the end of the observation period. Except for the absence of significant ($P \geq 0.05$) breed and year effects, live mass at *ca.* 3 days was influenced similarly as birth mass by sex, dam age and birth type (Table 2).

Gain to the end of the observation period (at *ca.* 3 days) was largely independent of breed, sex and dam age (Table 2).

Table 2 The effects of breed, year, sex, dam age and birth type on lamb mass at the end of the observation period (*ca.* 3 days), and gain from birth to the end of the observation period in Dormer and SA Mutton Merino lambs

Effect	Number of lambs	Live mass at *ca.* 3 days (kg)	Gain: birth to *ca.* 3 days (kg)
Overall mean	518	5.0 ± 0.1	0.81 ± 0.04
Breed		NS	NS
Dormer	263	4.9 ± 0.1	0.85 ± 0.06
SA Mutton Merino	255	5.0 ± 0.1	0.77 ± 0.05
Year		NS	**
1989	171	5.0 ± 0.1	0.78^{1} ± 0.08
1990	159	4.9 ± 0.1	1.05^{2} ± 0.06
1991	188	5.0 ± 0.1	0.60^{1} ± 0.08
Sex		**	NS
Ram	268	5.1^{2} ± 0.1	0.83 ± 0.05
Ewe	250	4.8^{1} ± 0.1	0.79 ± 0.05
Dam age		**	NS
2 years	91	4.7^{1} ± 0.1	0.76 ± 0.08
3—6 years	362	5.1^{2} ± 0.1	0.84 ± 0.04
7+ years	65	5.2^{2} ± 0.1	0.83 ± 0.09
Birth type		**	**
Single	70	6.2^{3} ± 0.2	1.08^{3} ± 0.10
Twin	347	4.8^{2} ± 0.1	0.82^{2} ± 0.03
Triplet	101	4.0^{1} ± 0.1	0.53^{1} ± 0.08

NS = Not significant ($P > 0.05$); ** significant ($P \leq 0.01$).
$^{1-3}$ Denote significance ($P \leq 0.01$).

The significant effects of birth year and birth type were complicated further by a significant ($P \leq 0.05$) interaction between these factors. In 1989, gain of single lambs (0.91 ± 0.20 kg; n = 9) was similar to that of twins (0.83 ± 0.06 kg; n = 99), with triplets gaining only slightly less (0.58 ± 0.09 kg; n = 63). In 1990, gain of triplets and twins was similar (0.94 ± 0.12 kg vs. 0.87 ± 0.06 kg, n = 25 and 94 respectively). In 1991, triplets gained markedly slower ($P \leq 0.05$) than twins or singles (0.13 ± 0.15 kg, n = 13 vs. 0.67 ± 0.06 kg, n = 154 and 0.98 ± 0.13 kg, n = 21 respectively). These effects could be related to sampling, as the number of singles in 1989 and triplets in 1991 were relatively few.

The gain to *ca.* 3 days of four single lambs which died between the end of the observation period and weaning was similar to that of 66 survivors (1.04 ± 0.10 vs. 0.83 ± 0.26 kg). In larger litters, the gain of lambs which subsequently died was lower ($P \leq 0.05$) than that of survivors in twins (0.894 ± 0.034 vs. 0.496 ± 0.069 kg; n = 301 and 46 respectively) and in triplets (0.721 ± 0.082 vs. 0.308 ± 0.097 kg; n = 64 and 37 respectively). On the basis of these results, lamb deaths in the post-observation period were regressed on gain to *ca.* 3 days. The overall regression coefficient suggested that lamb deaths declined by 0.23 (SE_b = 0.04) lambs died/lambs born for an increase of 1 kg in gain to *ca.* 3 days. Individual class regressions for breeds and birth years were similar, but it differed for the respective birth type classes. In singles, post-observational deaths were largely independent of gain to *ca.* 3 days (b ± *SE* = –0.03 ± 0.04), while lamb deaths and gain to *ca.* 3 days were related in twins (b ± *SE* = –0.22 ± 0.04) and triplets (b ± *SE* = –0.43 ± 0.08). The lack of a significant regression in the case of singles could probably be ascribed to the low level of deaths amongst singles in the post-observation period.

Discussion and Conclusions

Birth mass

Van der Merwe (1976) and Brand *et al.* (1985) reported that Dormer lambs weighed less ($P \leq 0.01$) at birth than SA Mutton Merinos. The interaction of breed and birth year, and the lack of a significant difference between the two breeds in 1991 should perhaps be seen as coincidental against this background. According to De Villiers & Cloete (1984), one of the intentions with the formation of the Dormer breed was to provide a sire breed suitable for terminal crossbreeding with Merino ewes. The comparatively small size of Dormer lambs at birth was seen as an advantage in this regard (Van der Merwe, 1976). The effects of sex and dam age on birth mass accorded with results in the literature (Hight & Jury, 1970; Dalton *et al.*, 1980; Scales *et al.*, 1986). Birth type effects corresponded to those reported by Maund *et al.* (1980), Hinch *et al.* (1985), Owens *et al.* (1985), and Scales *et al.* (1986).

Neonatal lamb progress

In this study we found that progeny of maiden ewes were slower to stand than those lambs given birth to by adult and old ewes. Owens *et al.* (1985) reported that the first-born of multiple lambs of maidens took longer before they attempted to stand than first-born lambs of adult ewes. No effect of ewe age was observed in the investigation of Arnold & Morgan (1975).

Alexander *et al.* (1990) similarly found no parity effect in their study, but reported that lamb progress was affected by birth type. In this study we found that single lambs, given birth to by mature ewes, progressed faster from standing to suckling and a similar tendency was observed in the progeny of old ewes, but in lambs borne by maiden ewes, singles were at a disadvantage compared to multiples. It seems reasonable to assume that progress in higher-order births should be slower than in singles (Owens *et al.*, 1985; Alexander *et al.*, 1990), although the effect may largely be related to birth mass differences (Slee & Springbett, 1986).

In the present study, heavier lambs were quicker to stand and to progress from standing to suckling as was reported by Owens *et al.* (1985) and Slee & Springbett (1986). The inclusion of birth mass as a covariate did not eliminate the effect of dam age, although it was somewhat reduced.

It is acknowledged that the present set of data was too small for a comprehensive genetic analysis. The heritability of lamb progress from standing to apparently suckling was furthermore smaller than twice its standard error, and thus not significant in conventional terms. The significant between-sire variance for lamb progress after birth does, however, warrant further attention. Although no significant breed variation occurred in the present investigation, Slee & Springbett (1986) and Alexander *et al.* (1990) reported significant differences between breeds. These differences suggest that these traits are, to an extent, determined genetically. The independence of the estimated heritability values from birth mass must also be seen against the observation that birth mass significantly influenced early lamb progress within, but not necessarily across, breeds (Slee & Springbett, 1986). It was furthermore clear that postnatal lamb progress was at least phenotypically related to subsequent lamb survival, as lambs which died later were slower to stand, and tended to be slower to progress from standing to suckling than their contemporaries which survived. Owens *et al.* (1985) correspondingly reported that an increase in time to standing and commencement in seeking the udder was associated with a concomitant decrease in survival. At this stage it was not even attempted to estimate a genetic correlation between subsequent lamb mortality and early postnatal progress, as it is generally known that between-sire variance for lamb survival is low (Smith, 1977; Cundiff *et al.*, 1982; Gama *et al.*, 1991) and the results are highly unpredictable. The practical application of these results in the industry is also doubtful, since it is evidently not practical to use it on a large scale in commercial flocks as a selection criterion. From a scientific viewpoint it is important to take cognisance of the possibility that neonatal lamb progress is heritable, which suggests that at least one component related to lamb mortality is controlled genetically. These results support the contention of Fogarty (1984) and Lindsay *et al.* (1990) that a measure of lamb survival should be included in selection programmes for increased fecundity. Neonatal progress may also be studied as a correlated response in selection programmes aimed at the improvement of ewe rearing ability and lamb survival (Atkins, 1980; Donnelly, 1982; Haughey, 1983) in order to understand the complex interrelationships between lamb survival and other traits.

Live-mass gain to *ca.* 3 days

Live-mass gain to *ca.* 3 days of age was found to be quite a reliable indicator of subsequent lamb mortality in twin and triplet lambs, as lambs which subsequently died gained less up to *ca.* 3 days than survivors. An increase of 1 kg in live-mass gain to *ca.* 3 days was associated with respective decreases of

22 and 43% in twin and triplet mortality. It is reasonable to assume that gain to *ca.* 3 days is mainly dependent on the maternal environment and milk supply. The present results thus support the conclusion of Haughey (1989) that a major part of deaths after 1 week of age was associated with symptoms of mismothering. The weighing of lambs at *ca.* 3 days may be of value for the identification of multiple lambs for handrearing in very intensive systems aimed at maximum output of lamb per ewe available, but needs to be refined further in order to fulfill this purpose. The possibility that lamb mortality may actually be increased in large flocks by human interference during such a practice must also be considered.

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