Proc. Assoc. Advmt. Anim. Breed. Genet: 23: xxx-xxx

GROWTH AND SLAUGHTER TRAITS OF DORMER AND SOUTH AFRICAN MUTTON MERINO LAMBS

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SUMMARY

The Dormer and South African Mutton Merino (SAMM) are respectively the most important terminal sire and dual-purpose breeds in South Africa. This study compared these breeds for birth weight, weaning weight, yearling weight and slaughter traits. Dormers were lighter at birth but heavier subsequently than their SAMM contemporaries. Dormer carcasses had greater fat depths than those of the SAMM breed. SAMM meat was lighter with a slightly higher cooking loss than Dormers. Most of the observed breed differences probably stems from the roles the respective breeds play in the South African sheep industry.

INTRODUCTION

In South Africa there is a diversity of sheep breeds and crosses (Hoffman *et al*. 2003). The Dormer is the most prominent terminal sire breed, while the South African Mutton Merino (SAMM) is the dominant dual-purpose breed (Cloete *et al*. 2014). The Dormer was developed at the Elsenburg Agricultural College in the 1940's, when Dorset Horn rams were crossed with German Merino ewes to establish a new composite breed (Van Wyk *et al*. 2003). The Dormer plays an important role as a terminal sire breed for crossbreeding with wool breeds. The Dormer is regarded as an early-maturing breed suggesting that they reach their maximum fat growth potential at a younger age and lower live weight (Lawrie 1998). They are thus more likely to put on fat at an earlier age than their contemporaries (Cloete *et al*. 2004a). The SAMM originated from the German Merino, which was imported to South Africa in 1932 (Cloete *et al*. 2004c). The foundation flock was kept at Elsenburg, from where it spread throughout South Africa. The breed was used to develop composite breeds, including the Dohne Merino, Dormer and Afrino. The SAMM has been exported as seedstock to countries aboard, including Australia (Cloete *et al*. 2001). The SAMM has a high growth rate and produces suitable slaughter lambs with ideal meat traits (Neser *et al*. 2000) and is regarded as a late-maturing breed. This means that they may have less sub-cutaneous fat at the same age as contemporaries from other breeds (Cloete *et al*. 2012).

Studies on lamb and mutton indicate that there is variation between breeds (Sink & Caporaso 1977). Hoffman *et al*. (2003) also found that breed affects meat quality. Limited research has been done to verify the effect of breed on the eating quality of lamb (Fisher et al. 1999: Safari *et al*. 2001).

Both the Dormer and SAMM exhibit favourable growth and meat production traits. These attributes promotes the role of these breeds to contribute to the local small stock industry. The aim of this study was to evaluate these breeds in terms of quantitative growth and slaughter traits when maintained in a single flock.

MATERIALS AND METHODS

Data were collected from the Dormer and SAMM resource flocks at Elsenburg research farm, Western Cape, South Africa. Both breeds remained in the same flock except when mated within breeds in single-sire groups to rams of the same breed. They utilised either dryland lucern or oat fodder crop paddocks during winter and spring or irrigated pastures that mainly consisted of kikuyu for the rest of the year. Data collection for this study took place from 2007 to 2018. The breed, sex, birth type, age of dam and year of birth of the lambs were recorded. Lamb birth weights of 3043 lambs were recorded within 24 hours of birth, at weaning (at roughly 100 days; n = 2765) and again as yearlings (n = 2155). A total of 201 Dormers and SAMM yearlings born in 2015 and 2016 were slaughtered to assess meat traits. Lambs were weighed 24 hours prior to slaughter to record the slaughter weight. The sheep were slaughtered at a commercial South African abattoir using the techniques previously described by Cloete *et al*. (2004a). The *ante mortem* treatment was similar for all the sheep within contemporary groups and sheep were slaughtered at random after electrical stunning at 200 V for 4 seconds. The sheep were exsanguinated and carcasses allowed to bleed out before dressing and no electrical stimulation was applied. The pH and carcass temperature were measured 45 minutes *post mortem* and the dressed carcasses were hung in a chiller at 2^{0}C for 48 hours (McGeehin *et al*. 2011). The carcass weight, temperature and pH were determined after 48 hours and the dressing percentage was calculated as carcass weight divided by slaughter weight. Loin samples were excised out on the left side of the *M. Longgissimus lumborum* between the 13th rib and 3rd and 4th lumbar vertebrae. Two 1.5cm thick steaks were cut from these samples and used to derive cooking loss, drip loss, colour and meat tenderness (Honikel 1998). Back-fat depth was measured 25mm off the midline at the 13th rib and the fat rump was measured between the 3rd and 4th lumbar vertebrae as described by Cloete *et al*. (2004a). The colour of subsamples from these samples was measured in triplicate by using a colour-guide $45^{0}/0^{0}$ colorimeter (BYK-Gardner, USA) to determine L* (lightness), a* (red-green range) and b* (blue-yellow range). To determine drip loss, other subsamples were needed. Individual samples were weighed, attached to a string and suspended in an inflated plastic bag. The sample was left at 4^{0}C for 24 hours and weighed again to determine the drip loss, expressed as a percentage of the original sample weight (Honikel, 1998). Another set of samples were used for cooking loss. Individual samples were weighed, placed in thin-walled plastics bags and put in a water-bath at 80^{0}C for 1 hour. Cooked samples were removed from the water-bath, cooled in cold water, blotted dry and weighed again. Cooking loss was also calculated as the difference in sample weight before and after cooking and expressed as a percentage of initial weight. Shear-force was determined on the same samples used for cooking loss using an Instron machine equipped with a Warner-Bratzler shear head (Honikel 1998). Subsamples with a diameter of 1 cm were removed from the core of each cooled (4^{0}C) sample. Maximum shear force values (N) were recorded for each sample and the mean was calculated. Shear force and tenderness is inversely correlated.

Data from the study were analysed for fixed and random effects, using ASREML (Gilmour *et al*. 2016). Fixed effects included in the models for all traits were breed (SAMM or Dormer), year of birth (as described above), age of dam (2-5 years), sex (male or female) and birth type (single or multiple), interactions as well as age at measurement as linear covariates. The random effect of animal was included throughout for the variation if controlled. Since the objective of the study was to report breed differences, genetic variation as well as other fixed effects were not reported.

RESULTS AND DISCUSSION

Least square means depicting the effect of breed on quantitative growth and slaughter traits are shown in Table 1**.** SAMM lambs were 6.3% heavier at birth than Dormers ($P < 0.05$). A previous study by Brand *et al*. (1985) also reported that Dormers were smaller than SAMM lambs at birth. In contrast, Dormers were heavier than SAMM contemporaries at weaning (10.3%) and yearling (15.0%) ages ($P<0.05$). Slaughter and carcass weights of Dormers tended ($P<0.10$) to be heavier than those of SAMM contemporaries, bearing in mind that this was based on much fewer records compared to the other weight traits. Dressing percentage did not differ between the breeds. A previous study by Cloete *et al*. (2004a) on these breeds suggested no significant difference between the two breeds for slaughter weight, although carcass weight and dressing percentage differed significantly in favour of the Dormers.

Table 1. Least square means (± SE) depicting the effect of breed (Dormer or SAMM) on quantitative growth and slaughter traits.

Trait	Breed		Significance
	Dormer	SAMM	
Birth weight (kg)	4.59 ± 0.08	4.88 ± 0.10	*
Weaning weight (kg)	30.1 ± 0.52	27.3 ± 0.64	**
Yearling weight (kg)	53.0 ± 0.66	46.1 ± 0.82	**
Slaughter weight (kg)	49.3 ± 0.80	44.9 ± 1.30	0.062
Carcass weight (kg)	22.7 ± 0.40	20.3 ± 0.60	0.059
Dressing percentage (%)	45.6 ±0.30	45.1 ± 0.05	0.429

* P < 0.05; ** P < 0.01; actual significance for P > 0.05

The pH recorded at 45 min and 48 h post slaughter did not differ between the breeds (Table 2). An ultimate pH greater than 5.8 is considered as undesirable (Devine *et al*. 1993) and the ultimate pH of both breeds was within this range. Fat depth differed significantly between breeds at both sites, with Dormers being fatter than SAMM contemporaries. It could be argued that Dormers have more fat cover due to being an early maturing breed which means that they were physiologically more developed than the SAMM breed at the same stage (Cloete *et al*., 2004b). Carcasses with subcutaneous fat depth of 1-4 mm fat that is measured between the 3rd and 4th lumbar vertebrae and 25mm from the midline at the 13^{th} rib are considered as the optimum fat level in South Africa (GG 14060, 1992).

Table 2. Least square means (± SE) depicting the effect of breed (Dormer or SAMM) on qualitative meat traits.

Trait	Breed		Significance
	Dormer	SAMM	
pH45 min	6.6 ± 0.06	6.4 ± 0.08	0.17
pH48 hr	5.6 ± 0.01	5.58 ± 0.03	0.31
Fat 13^{th} rib (mm)	2.1 ± 0.12^a	1.2 ± 0.22^b	*
Fat rump (mm)	5.3 ± 0.24^a	3.2 ± 0.40^b	**
Cooking loss (%)	29.6 ± 0.50^a	32.0 ± 0.70^b	*
Drip loss (%)	1.6 ± 0.11	1.4 ± 0.16	0.83
Colour L*	34.7 ± 0.30^a	36.4 ± 0.40^b	**
Colour a*	13.3 ± 0.10	12.8 ± 0.20	0.07
Colour b*	9.9 ± 0.10	10.2 ± 0.20	0.21
Shearing value (N)	47.3 ± 1.60	57.0 ± 2.60	0.15

* P < 0.05; ** P < 0.01; actual significance for P > 0.05

The mean cooking loss of SAMM meat was higher than that of Dormer meat (P<0.05; Table 2). Drip loss was not affected by breed (P>0.05). Hoffman *et al*. (2003) and Cloete *et al*. (2012)

found that cooking loss and drip loss did not differ significantly between different breeds. From Table 2 it is evident that drip loss is inversely correlated with cooking loss. A low drip loss (%) results in more water available to be lost during cooking and a higher cooking loss (%) is expected (Thomas *et al*., 2004).

According to Hedrick *et al*. (1983), muscles with a high intramuscular fat content have higher muscular brightness values as fats have high light reflection properties. This could explain the slightly lighter meat for SAMM compared to Dormer meat ($P<0.01$). Although Dormer meat may be darker than that of SAMM, the values differ by such a small margin that a consumer might not be able to visually perceive the differences (Cloete *et al*. 2012). There was no significant difference between Dormer and SAMM for meat tenderness.

CONCLUSIONS

This study showed that, although SAMM lambs were heavier at birth, Dormers had higher subsequent weights. The observed breed differences could be related to the respective roles of the two breeds within the South African sheep industry. The thicker fat cover of Dormers compared to their SAMM contemporaries probably indicate that the focus of selection for growth in this breed was not for lean growth, as in other sheep-producing countries. This result probably reflects a smaller emphasis on meat quality in South Africa as compared to other sheep-producing countries.

REFERENCES

Brand A.A., Cloete S.W.P. and De Villiers T.T. (1985) *S. Afr. J. Anim. Sci.* **15**: 155.

Cloete, J.J.E., Hoffman, L.C., Cloete, S.W.P. and Fourie, J.E. (2004a) *S. Afr. J. Anim. Sci.* **34**: 44.

Cloete, J.J.E., Hoffman, L.C., Cloete, S.W.P. and Fourie, J.E. (2004b) *S. Afr. J. Anim. Sci*. **34**: 189.

Cloete, J.J.E., Hoffman, L.C. and Cloete, S.W.P. (2012) *Meat Sci*. **91**: 318.

Cloete S.W.P., Olivier J.J., Sandenbergh L. and Snyman M.A. (2014) *S. Afr. J. Anim. Sci*. **44**: 308.

Cloete, S.W.P., Schoeman, S.J., Coetzee, J. and Morris, J.deV. (2001) *Austr. J. Exp. Agric.* **41**: 145.

Cloete S.W.P., Van Wyk J.B. and Neser F.W.C. (2004c) *S. Afr. J. Anim. Sci*. **34**: 37.

Devine C.E., Graafhuis P.H., Muir P.D. and Chrystall B.B. (1993) *Meat Sci.* **35**: 63.

Fisher A.V., Enser M., Richardson R.I., Wood J.D., Nute G.R., Kurt E., Sinclair L.A. and Wilkonson R.G. (1999) *Meat Sci*. **55**: 141.

Gilmour, A.R., Gogel, B.J., Cullis, B.R., Welham, S.J., and Thompson, R. (2016) ASREML-user Guide Release 4.0 VSN International Ltd, Hemel Hempstead, UK.

Government Gazette (GG) (1992). Regulations regarding the classification and marking of meat. No. R. 1748. Agricultural Products Standards Act, 1990 (Act No. 119 of 1990). In: Government Gazette, 324 (14060), 4.

Hedrick H.B. (1983) *J. Anim. Sci.* **57**: 1316.

Hoffman L.C., Muller M., Cloete S.W.P. and Schmidt D. (2003) *Meat Sci.* **65**: 1265.

Honikel K.O. (1998) *Meat Sci.* **49**: 447.

Lawrie R.A. (1998) *Lawrie's meat science* (6th ed) Cambridge, England: Woodland Publ. Ltd.

McGeehin B., Sheridan J.J. and Butler F. (2001) *Meat Sci*. **58**: 79.

Neser F.W.C., Erasmus G.J. and Van Wyk J.B. (2000) *S. Afr. J. Anim. Sci.* **30**: 172.

Safari E., Forgarty N.M., Ferrier G.R., Hopkins L.D. and Gilmour A. (2001) *Meat Sci.* **57**: 153.

Sink J.D. and Caporaso F. (1977) *Meat Sci.* **1**: 119.

Thomas A.R., Gondoza H., Hoffman L.C., Oosthuizen V. and Naude R.J. (2004) *Meat Sci* **67**: 113.

Van Wyk J.B., Fair M.D. & Cloete S.W.P. (2003) *S. Afr. J. Anim. Sci.* **33**: 213.