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GROWTH, CARCASS AND MEAT QUALITY TRAITS OF DORMER AND SOUTH AFRICAN MUTTON MERINO LAMBS

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SUMMARY

This study compared animals from the Dormer and South African Mutton Merino (SAMM) breeds for birth weight, weaning weight, yearling weight, carcass and meat quality traits. Dormers were lighter at birth but heavier subsequently than their SAMM contemporaries. Dormer carcasses had greater fat depths than SAMM's. SAMM meat was lighter with a slightly higher cooking loss than Dormers. The observed breed differences reflect the roles the breeds play in the South African sheep industry.

INTRODUCTION

In South Africa, 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 1940s when Dorset Horn rams were crossed with German Merino ewes to establish the composite breed (Van Wyk *et al*. 2003). The Dormer plays an important role as a terminal sire breed for crossbreeding with wool breeds. 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 and to other countries such as Australia (Brown and Asadi Fozi 2005). The traits recorded in both breeds in the National Small Stock Evaluation Scheme include birth weight, weaning weight, postweaning weight and reproduction (Schoeman *et al*. 2010). No emphasis is thus directed to wool traits in either breed. Both breeds have a high growth rate and grow out to a high mature weight compared to other South African ovine genetic resources (Van der Merwe *et al*. 2019). Previous studies comparing these breeds for meat traits were based on small sample sizes and animals slaughtered at an age of 18 to 20 months (Cloete *et al*. 2004a; 2012). There is a need to update the earlier results on slaughter traits with information of animals slaughtered at a more reasonable age.

This study therefore aims to evaluate these breeds in terms of growth, as well as carcass and meat traits at an age aligned with industry practice. This aim excluded discussion of other fixed effects or genetic parameters.

MATERIALS AND METHODS

Data were collected from the Dormer and SAMM resource flocks at Elsenburg research farm, Western Cape, South Africa. The background of flocks was reported by respectively van Wyk *et al*. (2003) and Cloete *et al*. (2004c). Selection in both breeds was mostly based on early growth and conformation. Expressed relative to the overall means for weaning weight, mediocre annual genetic gains of 0.2% in Dormers (Van Wyk *et al*. 1993) and 0.1% in SAMM's (Zemuy 2002) were realised. No direct selection pressure was applied to any meat trait. Both breeds remained in the same flock during the study, except when mated within breeds in single-sire groups to rams of the same breed. Both breeds utilised either dryland lucerne or oat fodder crop paddocks during winter and spring, and irrigated pastures that mainly consisted of kikuyu for the rest of the year. Data collection for the weight traits 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 3,043 lambs were recorded within 24 hours of birth, at weaning (at 103 ± 14 days; n = 2,765) and again as yearlings (at 356 ± 0.44 days; n = 2,155). A total of 201 Dormers and SAMM yearlings, born in 2015 and 2016, were slaughtered at an average age of 392 ± 51 days to assess meat traits. Lambs were weighed 24 hours prior to slaughter (slaughter weight). The sheep were slaughtered at a commercial abattoir, using the techniques previously described by Cloete *et al*. (2004a). The *ante mortem* treatment was similar for all the sheep within year-sex contemporary groups and sheep were slaughtered at random after electrical stunning at 200 V for 4 seconds. The sheep were exsanguinated, 0and carcasses allowed to bleed out before dressing. No electrical stimulation was applied. The dressed carcasses were hung in a chiller at 2^0C 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. At this stage, fat depth 25mm off the midline at the 13th rib and at the rump between the 3rd and 4th lumbar vertebrae was measured as described by Cloete *et al*. (2004a). Loin samples of 8 cm were excised from the left side of the *M. Longgissimus lumborum* between the 13th rib and 3rd and 4th lumbar vertebrae. Two 1.5cm thick slices were cut from these steaks and used to measure cooking loss and shear force on one and meat colour and drip loss on the other (Honikel 1998**).** Individual 20 to 30g meat portions from the first slice were used to determine cooking loss. Samples were placed in thin-walled plastics bags and put in a water-bath at 80^0C for 1 hour. Cooked samples were removed from the water-bath, cooled in cold water, blotted dry and weighed again. Cooking loss was calculated as the difference in sample weight before and after cooking and expressed as a percentage of initial weight. Shear force was determined on these cooked samples using an Instron machine equipped with a Warner-Bratzler shear head (Honikel 1998). Three subsamples with a diameter of 1 cm were removed from the core of each cooled (4°C) sample. Maximum shear force values (N) were recorded for each sample and the mean was calculated. Shear force and tenderness is inversely correlated. The second slice was used to first measure colour 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). Drip loss was then determined by attaching a 20 to 50g meat sample to a string and suspending it in an inflated plastic bag. These bags were left at 4^0C for 24 hours and weighed again to derive drip loss as explained for cooking loss (Honikel 1998).

Data were analysed using ASREML (Gilmour *et al*. 2015). Fixed effects included in the models for all traits were breed (SAMM or Dormer), year of birth (2007-2018 for body weights, 2015-2016 for carcass and meat quality traits), age of dam (2-5 years), sex (male or female) and birth type (single or multiple), two-factor interactions between birth year and sex as well as between birth year and breed as well as age at measurement as linear covariates. The random effects of sire and dam were included throughout for the variation it controlled.

RESULTS AND DISCUSSION

SAMM lambs were 7.3% heavier at birth than Dormers ($P < 0.05$; Table 1). A previous study by Brand *et al*. (1985) also reported that Dormers were significantly smaller than SAMM lambs at birth. In contrast, Dormers were heavier than SAMM contemporaries at weaning (6.8%) and yearling (13.9%) ages ($P<0.05$). Slaughter weight of Dormers tended ($P=0.054$) 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. Carcass weight was increased by 10.1% in Dormers compared to SAMM contemporaries. Dressing percentage did not differ between the breeds. Previous studies by Cloete *et al*. (2004a; 2012) on these breeds suggested no significant difference between the two breeds for slaughter weight. However, carcass weight and dressing percentage differed significantly in favour of Dormers in the former study. The present results thus concur with those of Cloete *et al*. (2004a) for carcass weight.

Table 1. Predicted means (± SE) for the effect of breed (Dormer or SAMM) on growth and carcass traits

Trait	Breed		
	Dormer	SAMM	Significance
Birth weight (kg)	4.59 ± 0.06	4.95 ± 0.07	**
Weaning weight (kg)	29.7 ± 0.4	27.8 ± 0.4	**
Yearling weight (kg)	52.5 ± 0.4	46.1 ± 0.5	**
Slaughter weight (kg)	49.3 ± 1.6	44.9 ± 2.4	0.054
Carcass weight (kg)	22.8 ± 0.8	20.7 ± 1.1	*
Dressing percentage (%)	45.8 ± 0.7	45.5 ± 1.1	0.443

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

The ultimate pH recorded 48 h post slaughter did not differ between the breeds (Table 2). An ultimate pH between 5.8-6.0 is considered as undesirable (Devine *et al*. 1993) and the ultimate pH of both breeds was below this range. The tenderness and texture deceases at an ultimate pH of 5.8-6.0. An ultimate pH above 5.8 also influences the flavour, juiciness and aroma of the meat. The proportion of high pH carcasses amounted to 0.075 in Dormers and 0.101 in SAMM's (Chi^2=0.98; degrees of freedom=1; P=0.45). Undesirable high pH carcasses were thus quite infrequent in both breeds. Ultimate pH was heritable in South African sheep (Naudé *et al*. 2018), allowing opportunities for selective breeding.

Table 2. Predicted means (± SE) for the effect of breed (Dormer or SAMM) on meat quality traits

Trait	Breed		Significance
	Dormer	SAMM	
pH48 hr	5.60 ± 0.01	5.58 ± 0.03	0.31
Fat 13th rib (mm)	2.04 ± 0.22	1.21 ± 0.34	*
Fat rump (mm)	5.31 ± 0.49	3.02 ± 0.66	**
Cooking loss (%)	29.1 ± 0.9	31.8 ± 1.4	*
Drip loss (%)	1.91 ± 0.21	1.82 ± 0.27	0.96
Colour L*	34.1 ± 0.5	35.8 ± 0.8	**
Colour a*	13.4 ± 0.3	13.9 ± 0.4	0.09
Colour b*	9.65 ± 0.21	9.87 ± 0.29	0.12
Shear force (N)	50.4 ± 3.2	56.2 ± 4.3	0.14

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

Fat depth differed significantly between breeds at both sites, with Dormers being fatter than SAMM contemporaries. Fat depth at 20 months was independent of breed in a previous study on Dormer and SAMM sheep (Cloete *et al*. 2012). In contrast, Cloete *et al*. (2004a) also reported that Dormers were fatter (P<0.05) than SAMM contemporaries at 18 months. The present analyses use a substantially larger data set that any of the previous studies, while the animals were also slaughtered younger. Age and maturity type possibly combined to give the results that were obtained. Carcasses with subcutaneous fat depth of 1-4 mm fat measured 25mm from the midline at the 13th rib are considered as acceptable in South Africa (Government Gazette 14060 1992). The frequency of carcasses of each breed conforming to this desired fat distribution did not differ (Dormer=0.644 vs. SAMM=0.522, Chi^2=2.33; P=0.13). However, SAMM carcasses were more likely to be leaner (Dormer=0.197 vs. SAMM=0.478, Chi^2=16.0; P<0.01) and Dormer carcasses fatter (Dormer=0.159 vs. SAMM=0.000, Chi^2=10.6; P=0.01) than the desired range. 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). Cloete *et al*. (2004a; 2012) found no differences for cooking loss between Dormers and SAMM's (P>0.05). This study involved younger sheep and a larger sample size, both of which could be causative in the result obtained. Further research is therefore needed. Although Dormer meat may be slightly 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). The a* and L* values for Domers and SAMM are regarded as acceptable for the average consumer at respectively 9.5 and 34.0 or higher (Khliji *et al*. 2010). 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 reflect the different 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 many other sheep-producing countries. This result stems from the absence of meat quality as a selection trait in South Africa's formal recording scheme (Schoeman *et al*. 2010). Clearly this state of affairs is undesirable and requires further effort to align sheep recording in South Africa with international benchmarks.

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