

Effect of the Texel muscling quantitative trait locus (TM-QTL) and sex on meat quality parameters of the semimembranosus muscle of purebred Texel lambs

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Introduction The TM-QTL located on chromosome 18 (Walling *et al.*, 2004) increases loin muscle dimensions and weights (by ~4 to 14%) in purebred and crossbred carrier Texel lambs but other muscles seem to be unaffected (Macfarlane *et al.*, 2009). Lambe *et al.* (2010) reported that TM-QTL had no detrimental effects on tenderness of *Longissimus lumborum* and *vastus lateralis* muscles of purebred Texel lambs, but before the TM-QTL can be recommended to industry it is important to assess its effects on other meat quality (MQ) traits. Therefore results are reported here for the *semimembranosus* muscle including additional MQ traits.

Material and methods Purebred Texel lambs born in 2009 and reared with their dams on pasture (n = 197) on two farms or indoors (n = 12) were slaughtered at mean age of 144d (range 126 to 155d) and mean hot carcass weight of 15.2 kg (range 8 to 25 kg). After electrical stimulation and kept at ~2°C for either 7 or 9 days, the topside cut (containing the *semimembranosus* (SM), *adductor* and *gracilis* muscles) was taken from the right side of each carcass. A cut surface of SM was allowed to bloom for 1 hour before colour measurements (Minolta CR-410) and pH (Testo 205) were recorded. Samples were stored in sealed plastic bags and frozen (-30°C), were later defrosted in 17 batches for 24 hours at 3°C. A ~150g cut of the SM was weighed prior to cooking in a polythene bag in a 70°C water bath for 90 minutes. After cooking, fluid was drained off and samples stored overnight at 3°C. The next day, samples were weighed after drying with a paper towel, to determine cooking loss as a percentage of uncooked weight. Twelve shears, perpendicular to the fibre axis were performed on six 13mm by 13mm by 25 mm cores using a modified Warner-Bratzler protocol, as described by Purchas & Aungsupakorn (1993). Median peak force (PF) and median work done (WD) were determined for the 12 shear force values. Colour parameters L*, a* and b* were measured and used to calculate hue angle ($\arctan[a^*/b^*]$, increased brownness). WD and PF were transformed (\log_{10}) to ensure a normal distribution. Data were analysed using the MIXED procedure of SAS (SAS Inst. Inc., Cary, NC). Sex, farm, rearing rank, genotype and the interaction sex by genotype were included in the model as fixed effects. Hot carcass weight and aging time were included as covariates. Sire (n = 7) was fitted as a random effect and defrosting batch was included for the PF and WD traits only. No significant (P≤0.05) higher order interactions were found between terms, and non-significant (P>0.05) fixed effects and covariates were excluded from the models. Only samples from lambs with known TM-QTL genotypes were included in the analysis (n = 143; Table 1). Pair-wise comparisons of least-squares (LS) means of the MQ traits for the four TM-QTL genotypes and two sexes (see below) were estimated using t-tests (Bonferroni-adjusted for multiple comparisons).

Results LS means are reported for MQ traits where S (sire) and D (dam) superscripts denote allele origin, while “TM” and “+” represent the TM-QTL and wildtype allele, respectively. PF and WD in +^S/TM^D males was significantly greater than +^S/+^D females and TM^S/+^D females for WD only (P≤0.05). L* values were significantly higher in TM^S/+^D males than females. No further differences were observed between sexes or genotype for other MQ traits, including a*, b* and pH (data not shown). No significant differences were found between genotypes within sex, however there were significant sex differences irrespective of genotype (P≤0.05).

Table 1 Sex by TM-QTL genotype LS means and average standard errors of difference (Ave. s.e.d.) for meat quality traits

Trait	Number		PF (log ₁₀ N)		WD (log ₁₀ N)		CL (%)		L*		Hue angle	
	M	F	M	F	M	F	M	F	M	F	M	F
Genotype												
+ ^S /+ ^D	14	26	3.79 ^{ab}	3.69 ^b	2.25 ^{ab}	2.17 ^b	32.53 ^{ab}	30.47 ^b	44.23 ^{ab}	43.06 ^b	0.38 ^a	0.37 ^a
+ ^S /TM ^D	8	9	3.95 ^a	3.73 ^{ab}	2.45 ^a	2.22 ^{ab}	33.51 ^a	30.94 ^{ab}	44.57 ^a	43.50 ^{ab}	0.40 ^a	0.37 ^a
TM ^S /+ ^D	23	30	3.78 ^{ab}	3.72 ^{ab}	2.29 ^{ab}	2.20 ^b	33.38 ^a	31.24 ^b	45.53 ^a	43.40 ^b	0.40 ^a	0.38 ^a
TM ^S /TM ^D	14	19	3.77 ^{ab}	3.74 ^{ab}	2.27 ^{ab}	2.22 ^{ab}	32.79 ^{ab}	30.75 ^b	45.47 ^{ab}	42.52 ^b	0.40 ^a	0.37 ^a
Ave s.e.d.			0.051		0.047		0.601		0.528		0.010	
Adj. means (sex effects)			3.82 ^x	3.72 ^y	2.31 ^x	2.20 ^y	33.05 ^x	30.85 ^y	44.95 ^x	43.12 ^y	0.40 ^x	0.37 ^y

M = Male (entire), F = Female. Means within trait sharing a common superscript are not significantly different (P>0.05)

Conclusions Effects of the TM-QTL on MQ traits for the *semimembranosus* muscle in purebred Texel lamb are negligible when lamb has been aged for 7 or more days. All MQ traits were however significantly affected by sex with females having better MQ.

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