Comparison of carcase and meat quality traits of crossbred lambs sired by rams selected for high and low muscle density

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Objective

To assess carcase and meat quality traits with a sample of crossbred lambs sired by rams selected for high and low muscle density.

Introduction

Muscle density as assessed by computer tomography (CT) has previously been found to be genetically and phenotypically negatively correlated with intramuscular fat (Karamichou *et al*., 2006). It may be used as an *in-vivo* tool to aid selection in a genetic programme for lamb meat for improved meat quality.

Methods

120 Innovis Abermax™ (F1 Charollais x Texel) ram lambs had pedigree and growth performance traits measured and CT scanned. The 5 highest and 5 lowest muscle density ram lambs (45.06 Hounsfield Units (HU) and 38.28HU respectively) were selected for AI with 230 North Country Mule ewes.

405 lambs were pedigree and performance recorded. 268 were slaughtered. An average of 20 lambs per sire were selected (in 4 slaughter batches) for further carcase and meat quality assessments.

Loin (LV4) was recorded for pH at 48 hours. Shear force tested (after 7 days maturation). Colour measurements were taken under oxygen permeable state after blooming for 1 hour. Intramuscular fat (IMF) content was analysed using bimethylation technique (Lee *et al.,* 2012). Sensory traits were analysed at Bristol University via a trained sensory panel.

Data were firstly analysed by unbalanced nested ANOVA model (sire nested within muscle density). With the fixed effects, sex, dam age (2yr v.older), birth/rear type (single/twin/artificial reared), MyoMax™ status and slaughter batch fitted where appropriate. As slaughter weight was used as a covariate.

Residual maximum likelihood (REML) analysis was carried out with fixed effects (P<0.02) and sire as the random term.

Results

Table 1. Effect of muscle density on carcase quality measurements in crossbred progeny lambs (adjusted to a uniform slaughter weight: 42.8 kg).

		Sire muscle density group			
		Low	High		
Trait	n	Mean	Mean	SED	P-Value
Log, US fat depth (mm)	264	0.42 (†2.6)	0.39(†2.4)	0.027	0.290
US muscle depth (mm)	252	25.7	26.4	0.42	0.173
Hot carcase weight (kg)	252	19.8	20.2	0.15	**0.023**
48hr cold carcase weight (kg)	246	19.2	19.7	0.17	**0.031**
Killing out %	252	45	46	0.34	**0.019**
Log conformation	252	0.48 (R)	0.50 (R+)	0.009	**0.040**
Log fat class	252	0.97(3L-)	0.96(3L-)	0.01	0.583
Ultimate pH (LV4)	205	5.71	5.69	0.011	0.162
Shear Force (N)	200	29.6	32.0	1.1	0.067
Colour saturation (Log C)	184	1.24(†17.5)	1.23(†17.0)	0.005	**0.013**
Colour lightness (Log L*)	184	1.64(†43.5)	1.63(†43.2)	0.003	0.290
Colour redness (Log a*)	184	1.21(†16.2)	1.20(†15.7)	0.005	**0.012**
Log Total IMF (mg/g)	197	3.41(†2546)	3.36(†2312)	0.028	0.161

† Geomean

Table 1. Effect of muscle density on meat quality measurements in crossbred progeny lambs (adjusted to a uniform slaughter weight: 42.8 kg).

		Sire muscle density group			
		Low Mean	High Mean		
Trait	n	Units 1-8	Units 1-8	SED	P-Value
Texture	184	5.68	5.56	0.108	0.314
Juiciness	184	5.11	5.01	0.080	0.237
Flavour liking	184	5.61	5.59	0.054	0.753
Overall Liking	184	5.32	5.27	0.091	0.620

Conclusion

High muscle density progeny have increased lean tissue that is expressed as higher carcase weight, killing out % and conformation (P <0.05; Table 1). Low muscle density progeny had improved colour saturation and redness (P<0.05; Table 1). Although not significant, low muscle density progeny predicted means were higher in IMF content, lower with the trait shear force and consistently higher in meat eating quality traits.

This establishes that selection for high muscle density results in increased carcase lean and selection for low muscle density results in improved meat quality traits.

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References

Karamichou, E., Richardson, R.I., Nute, G.R., Mclean, K.A. and Bishop S.C. 2006. Genetic analyses of carcass composition as assessed by X-ray computer tomography, and meat quality traits in Scottish Blackface sheep. Animal Science 82:151-162.
Lee, M. R. F., Tweed, J. K. S., Kim, E. J. and Scollan, N. D. 2012. Beef, chicken and lamb fatty acid analysis a simplified direct bimethylation procedure using freeze-dried material. Meat Sci. 92:863-866.