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Myostatin mutant heterozygote sheep need good nutrition

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SUMMARY

The myostatin mutation, +g6723G>A, is associated with a high yield of high quality lamb meat (Kijas *et al*. 2007). Myostatin negatively regulates skeletal muscle growth. The +g6723G>A mutation reduces the production of myostatin, increasing carcass muscle content and decreasing carcass fat content. We investigated whether nutrient supply (feed intake) affects the expression of muscle and fat traits in wether lambs with one or no copy of the myostatin +g6723G>A mutation.

Seventy-eight wether lambs with one (n = 38, MSTN A/G) or no copies (n = 40, MSTN G/G) of the causative allele were housed in individual pens and fed a diet at a high or a low level (1.8 or 1.1 × maintenance allowance, respectively) for 47 days. The lambs were subjected to computed tomography scanning at the beginning and completion of the experiment. The non-carcass components in each image were removed and the weight of lean tissue (muscle), fat and bone were estimated using Autocat software, as described by Haynes *et al.* (2010). The data were analysed using a linear regression model using R (R development core team, Vienna, Austria) to test the effects of myostatin genotype and nutritional level and their interaction, with initial composition as a covariate.

All lambs had a greater rate of fat deposition than muscle deposition (Table 1). The heterozygous lambs had a greater (P < 0.05) daily carcass growth rate and a tendency (P < 0.10) to deposit more lean tissue than the homozygous normal lambs when fed *ad libitum*. In contrast, heterozygous lambs had the slowest carcass and muscle (P < 0.10) growth when feed was restricted. Accretion of bone differed (P < 0.05) only between feed levels not genotype.

Table 1. Average daily growth (g/day) of muscle, fat, bone and the total carcass of lambs heterozygous or homozygous for the MSTN A/G mutation when fed *ad libitum* or at a low level

Variable (g/d)	High feed intake		Low feed intake	
	MSTN A/G	MSTN G/G	MSTN A/G	MSTN G/G
n	19	19	20	20
Fat	99.2 ± 2.5^{a}	96.3 ± 2.5^{a}	25.5 ± 2.4^{b}	26.4 ± 2.4^{b}
Muscle	81.0 ± 5.0^{a}	70.0 ± 5.0^{b}	2.6 ± 4.8^{c}	8.4 ± 4.9^{c}
Bone	9.0 ± 0.8^{a}	7.7 ± 0.8^{a}	1.4 ± 0.8^{b}	1.9 ± 0.8^{b}
Total	189.2 ± 5.6^{a}	174.0 ± 5.6^{b}	29.5 ± 5.4^{c}	36.7 ± 5.4^{d}

Row means with different superscript letters differ (P < 0.05) or tend to differ (P < 0.10, italics).

A high plane of nutrition improved the growth rate of the heterozygous MSTN A/G lambs more than that of the homozygous normal lambs; however, nutritional restriction adversely affected the heterozygous lambs more than the homozygous normal lambs. Hence, sheep heterozygous for the myostatin mutation require a high level of nutrition to maximise the genetic benefits of this mutation.

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