

ELEVATED MUSCLE PROTEIN BREAKDOWN IN
GROWTH HORMONE TRANSGENIC SHEEP

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Sheep with multiple copies of a metallothionein growth hormone (GH) fusion gene (Nancarrow et al. 1988) had a greater energy expenditure than normal sheep at similar feed intakes (Graham and Margan 1988) and markedly elevated plasma GH concentration (>3000ng/ml). Protein synthesis is thought to account for a significant fraction of energy expenditure, and chronic GH administration increases muscle protein synthesis rate in sheep. The present study was carried out to determine if there were alterations in muscle protein metabolism sufficient to account for the increased energy expenditure of GH transgenic ewes.

Four Merino ewes, approximately 10 months old, were used. Two were transgenics (liveweight 28,37 kg) kindly provided by Drs J.D. Murray, C.D. Nancarrow and K.A. Ward, CSIRO Division of Animal Production. The other two ewes were normal siblings (liveweight 43,46 kg). They each ate approximately 800 g/d of lucerne chaff/oats pellets prior to and during the experiment. The animal preparation and experimental plan to measure hind limb muscle protein kinetics was similar to that used previously (Oddy and Lindsay 1986) except that here L-(2,6-³H)phenylalanine was the marker amino acid, and analyses were of blood rather than plasma. Protein degradation, gain and synthesis in muscle were calculated as described by Barrett et al. (1987).

Transgenic sheep had greater rates of protein degradation and appeared to synthesise more protein in hind limb muscle than the normal sheep. Their muscles used more oxygen, despite there being no significant difference in blood flow between transgenic and normal sheep.

		Transgenic	Normal	
muscle protein degradation	umol Phe/kg/min	1.12	0.44	P<0.05
protein gain	"	0.08	0.13	NS
protein synthesis	"	1.2	0.57	NS
blood flow	ml/kg/min	94	117	NS
oxygen uptake	umol/kg/min	358	240	P<0.05
oxygen used by protein synthesis	%	10.1	7.2	NS

We estimated the contribution of protein synthesis to muscle oxygen uptake on the basis that the formation of each peptide bond required the expenditure of 5 molecules of ATP, 1 mole oxygen produced 6 moles ATP and muscle phenylalanine content was 4.16 g Phe/100g protein. As this contribution was <10%, variation in protein synthesis could not account for the difference in oxygen uptake between the normal and transgenic sheep.

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