

Differences in triiodothyronine and thyroxine are influenced by sire and diet and are associated with dry matter intake and body composition in adult Merino wethers

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Triiodothyronine (T3) and thyroxine (T4) play a role in the physiological regulation of growth, dry matter intake (DMI) and metabolism. These important production traits are maintained by the influence of thyroid hormone on increasing the basal metabolic rate, increasing glucose availability, stimulating protein synthesis and lipid metabolism (Todini *et al.*, 2007). The aim of this study was to examine the usefulness of T3, T4 and their ratio as a biomarker of DMI and body composition change in Merino wethers from divergent sires. We hypothesized that thyroid hormone concentrations would increase as a result of greater tissue mobilization, driven by an increase or decrease in plane of nutrition.

Two cohorts of 160 wethers, from 15 sires, were blocked by sire, randomly allocated to individual pens and fed a chaff diet at 100% of recommended maintenance from days 0-35 and either *ad libitum* or 60% of maintenance from days 35-70 with DMI measured daily. Blood samples were collected, and body composition assessed by dual energy x-ray absorptiometry scanning on days 0, 35 and 70. Twenty-four wethers from four sires with divergent DMI and body composition change were selected and their T3 and T4 concentrations were measured by ELISA. Data were analysed by repeated measures ANOVA, within feeding period, using the proc mixed procedure in SAS (9.4) with sire, day, diet and their interactions, where appropriate, as fixed effects. Stepwise regression was used to assess the potential concentrations of T3, T4 and their ratios to predict body composition and intake.

There was no effect of sire on T3, T4 or T3/T4 ratio when wethers were offered 100% of maintenance, but during differential feeding there was a tendency for a sire x day interaction for T3/T4 ratio (P=0.06, Table 1). This interaction indicated that sire 4 had greater T3/T4 ratio at D35 than other sires, and by D70 sires 3 & 4 had similar ratios that were greater than the sires 1 and 2. This interaction is likely related to the sire x diet interaction that was detected for T3, during the same period (P<0.05). Sires 2 & 4 had greater T3 than others when offered a restricted diet; however, when offered an *ad lib* diet, sire 2 had lower T3 compared to other sires 3 & 4 (P<0.01). Regression analysis highlighted that T4 at day 35 accounted for 26% of the variation in lean tissue mass ($y = 39389 + 247.14604x$; $r^2 = 0.2614$; $P < 0.05$), and T3/T4 ratio at day 70 accounted for 55% of the variation in lean mass at day 70 ($y = 58384 + -259467x$; $r^2 = 0.5466$; $P < 0.01$). T3/T4 ratio at day 70 accounted for 62% of the DMI in *ad libitum* wethers ($y = 3.1732 + -23.5765x$; $r^2 = 0.6239$; $P < 0.01$).

Table 1. Effect of sire (S) and diet (N) on triiodothyronine (T3) and thyroxine (T4) in adult Merino wethers offered 100% of maintenance or a differential diet, either 60% of maintenance (RES) or *ad libitum* (ADLIB), for 35 days

	Sire				SEM	Diet			SEM	P - value			
	1	2	3	4		RES	ADLIB	S		N	S*D	S*N	
Day (D) 0-35													
T3	0.72	0.92	0.81	0.94	0.127	-	-	-	ns	-	0.07	-	
T4	18.90	12.80	15.66	17.38	5.351	-	-	-	0.10	-	ns	-	
T3/T4 ratio	0.04	0.06	0.05	0.06	0.014	-	-	-	ns	-	0.08	-	
Day 35-70													
T3	0.54	0.63	0.74	0.81	0.210	0.87	0.50	0.202	0.10	**	ns	*	
T4	23.71	16.45	15.95	19.52	6.335	20.26	17.55	6.163	ns	0.08	ns	ns	
T3/T4 ratio	0.04	0.05	0.06	0.07	0.007	0.06	0.05	0.005	*	ns	0.06	ns	

*P<0.05, **P<0.01, ns=not significant

The T3 concentrations and T3/T4 ratios on differential feeding indicate that there may be sire dependant responses to nutrition. Some of these sire related influences may also be linked to the relationships between T4, T3/T4 ratio and lean tissue and DMI. Future work will investigate the usefulness of thyroid hormones as potential biomarkers of body composition and DMI.

References

L. Todini, A. Malfatti, A. Valbonesi, M. Trabalza-Marinucci, A. Debenedetti, (2007). *Small Ruminant Research*. 68(3): 285-290

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