CONSEQUENCES OF FETAL AND PRE-WEANING GROWTH FOR THE CHARACTERISTICS OF *LONGISSIMUS* MYOFIBRES AT 30 MONTHS OF AGE IN HEIFERS SIRED BY PIEDMONTESE AND WAGYU BULLS

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Growth early in life and the genotype of the sire influence growth, carcase yield and/or eating quality characteristics of meat in cattle at 30 months of age (Greenwood *et al.* 2005, 2006a). To study this in relation to muscle hypertrophy, structure and metabolism, we investigated the characteristics of *m. longissimus lumborum* (LL) myofibres, using antibodies against myosin heavy chain isoforms (Greenwood *et al.* 2006b, c), in 30 month old heifers sired by Piedmontese and Wagyu bulls after slow or rapid fetal growth and slow or rapid growth to weaning.

Weight of LL was lower at 30 months of age in low birth weight, slow pre-weaning growth and Wagyu-sired heifers than in their counterparts (Table 1), but differed only due to sire genotype (Piedmontese 4411 g *v.* Wagyu 4145 g, s.e.d. 77.1 g) at equivalent carcase weight (353 kg). Percentage of type 1 myofibres was higher in heifers grown slowly to weaning than in those grown rapidly. Piedmontese-sired heifers had a higher percentage of type 2X, a lower percentage of type 2A, and tended to have less type 1 myofibres which had a smaller cross-sectional area (CSA) than Wagyu-sired heifers. There were no interactions between sire-genotype and birth weight or pre-weaning growth. The only birth weight × pre-weaning growth interaction was for CSA of the intermediate or transitional type 2AX myofibres, which were about 1% of myofibres. Neither HSCW nor LL weight was significantly associated with percentage or cross-sectional area of any of the myofibre types.

Table 1. Least squares means for myofibre characteristics of the *m. longissimus lumborum* of heifer cattle (n=78) at 30 months of age, as affected by birth weight, pre-weaning growth and sire-genotype

	Birth weight (kg)		Pre-weaning growth		Sire-genotype			
Variable	Low (27.3)	High (35.9)	Low (501 g/d)	High (806 g/d)	Piedmontes	Wagyu	s.e.d	Effects and interactions[A]
Number of cattle	38	40	40	38	40	38		
Liveweight (kg)	594	655	612	637	625	624	11.7	B,P
Carcase weight (kg)	335	370	345	360	357	348	7.0	B,P
Muscle weight (g)	4097	4453	4191	4358	4463	4086	114	B,G
% myofibres[B]								
Type 1	31.3	30.5	32.4	29.5	29.7	32.1	1.36	P,G*
Type 2C	1.04	1.10	1.14	1.01	1.05	1.09	0.36	-
Type 2A	23.6	25.7	24.3	25.0	21.3	28.0	1.63	G
Type 2AX	4.99	5.59	4.90	5.68	5.19	5.39	0.97	-
Type 2X	39.0	37.2	36.6	39.6	42.7	33.5	2.45	G
Myofibre CSA (μm^2)[C]								
Type 1	4062	4244	4112	4193	3891	4415	226	G
Type 2C	2795	3629	2759	3665	3095	3329	473	P
Type 2A	5248	5167	5148	5267	4928	5487	341	-
Type 2AX	6591	6175	6409	6357	5977	6789	446	G*,BxP
Type 2X	7198	7107	7021	7238	7445	6860	388	-
Overall	5708	5731	5585	5854	5735	5704	267	-

[A] Main effects and interactions (significant $P<0.05$, * tendency $P<0.10$) determined using REML are shown for each variable. [B] Type 1, type 1 myosin heavy chain (MHC) ≡ slow oxidative; Type 2C, intermediate between type 1 and type 2A; Type 2A, type 2A MHC ≡ fast oxidative-glycolytic; Type 2AX, intermediate between type 2A and type 2X; Type 2X, type 2X MHC ≡ fast glycolytic. [C] CSA, cross-sectional area.

We conclude that chronic retardation of fetal and pre-weaning growth do not alter LL myofibre characteristics at 30 months of age, consistent with our findings that eating quality of beef, and carcase weight-specific mass of LL and retail yield are little affected by early growth (Greenwood *et al.* 2006a). Piedmontese-sired heifers have a greater proportion of LL comprising more glycolytic than oxidative myofibre types than Wagyu-sired heifers, reflecting differences in muscularity and marbling (Greenwood *et al.* 2006a).

GREENWOOD, P.L., CAFE, L.M., HEARNSHAW, H. and HENNESSY, D.W. (2005). *Rec. Adv. Anim. Nutr. Aust.* **15:** 183-95.

GREENWOOD, P.L., CAFE, L.M., HEARNSHAW, H., HENNESSY, D.W., THOMPSON, J.M. and MORRIS, S.G. (2006a). *Aust. J. Exp. Agric.* **46:** 257-69.

GREENWOOD, P.L., DAVIS, J., GAUNT, G.M. and FERRIER, G.R. (2006b). *Aust. J. Agric. Res.* **57:** 1-12.

GREENWOOD, P.L., GARDNER, G.G. and HEGARTY R.S. (2006c). *Aust. J. Agric. Res.* **57:** (*in press*).

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