

Invited Speaker Plenary 4: Animal Nutrition-CRCs

Consequences of growth retardation early in the life of cattle

PL Greenwood¹, LM Cafe^{1,2}, H Hearnshaw² and DW Hennessy²

Cooperative Research Centre for Cattle and Beef Quality, Armidale, NSW 2351

¹NSW DPI Beef Industry Centre, University of New England, Armidale, NSW 2351

²Formerly, NSW DPI Agricultural Research and Advisory Station, Grafton, NSW 2460

Background - The beef industry in Australia is subject to variable pasture availability and quality. This results in numerous growth path possibilities that may influence growth potential and body and carcass composition of cattle and eating quality of beef. Studies of cattle within pasture-based nutritional systems have failed to demonstrate substantial long-term differences in body or carcass characteristics due to prenatal nutrition and growth¹ or nutrition and growth from birth to weaning.¹⁻³ However, severe nutritional restriction from birth to weaning followed by concentrate (high energy) feeding from weaning resulted in increased fatness at the same live and carcass weights compared to cattle well-nourished to weaning.¹ Furthermore, the extent to which growth early in life interacts with genotype to influence long-term outcomes for growth, carcass and beef quality characteristics of cattle has not been investigated.

Objective - To determine the extent to which prenatal and pre-weaning growth influence subsequent growth, composition and meat eating quality of cattle sired by bulls with high muscle (Piedmontese breed) or high intramuscular fat (Wagyu breed) growth capacity.

Design - Piedmontese × Hereford (n = 120) and Wagyu × Hereford (n = 120) calves of low (28.6 kg, n = 120) or high (38.8 kg, n = 120) birth weight were nourished to grow slowly (554 g/d, n = 119) or rapidly (875 g/d, n = 121) to weaning at 7 months of age (total n = 240). They were grown from weaning to feedlot entry at 26 months of age on improved, temperate pasture, then lot-fed a grain-based diet until conclusion of the study at 30 months of age.

Outcomes - *Low birth weight calves* grew more slowly to weaning and in the feedlot, were 56 kg smaller on average at conclusion of the study, and had similar composition and eating quality characteristics compared to those of high birth weight. *Cattle grown slowly to weaning* weighed 70 kg less at weaning, grew more rapidly post-weaning but remained 40 kg lighter at conclusion of the study, and were leaner and had similar meat eating quality at 30 months of age compared to those grown rapidly to weaning. *Genotype × early-life nutrition interactions* were not evident.

Conclusions - Fetal growth retardation resulted in slower subsequent growth and reduced size of cattle, but had little effect on composition and meat eating quality at 30 months of age. In cattle grown slowly to weaning, compensation in weight was incomplete and cattle were leaner with similar meat eating quality at 30 months of age. These findings on consequences of low birth weight for body or carcass composition are consistent with previous research in cattle,¹ but in contrast to findings in sheep grown to 20 kg⁴ or 35 kg⁵ live weight in which increased fatness was evident following severe foetal growth retardation that resulted in low birth weight. However, our findings are consistent with previous studies in sheep^{6,7} that showed no adverse effects on eating quality due to restricted nutrition during pregnancy, and with previous research in cattle in which nutrition and growth early in life did not adversely affect beef eating quality characteristics.³

References

1. Tudor GD, Utting DW, O'Rourke PK. The effect of pre- and post-natal nutrition on the growth of beef cattle. III. The effect of severe restriction in early postnatal life on the development of the body components and chemical composition. *Aust J Agric Res* 1980; 31:191-204.
2. Berge P. Long-term effects of feeding during calthood on subsequent performance of beef cattle (a review). *Livestock Prod Sci* 1991; 28: 179-201.
3. Hearnshaw H. Effect of pre-weaning nutrition on post-weaning growth, carcass and meat quality traits. In: Hennessy DW, McLennan SR, Oddy VH, eds. *Growth and development of cattle. Proceedings of the growth and development workshop. Armidale: Cooperative Research Centre for Cattle and Beef Quality, 1997;59-67.*
4. Greenwood PL, Hunt AS, Hermanson JW, Bell AW. Effects of birth weight and postnatal nutrition on neonatal sheep: I. Body growth and composition, and some aspects of energetic efficiency. *J Anim Sci* 1998; 76: 2354-2367.
5. Villette Y, Theriez M. Effect of birth weight on lamb performances. II. Carcass and chemical composition of lambs slaughtered at the same weight. *Ann Zootech* 1981; 30: 169-182.
6. Nordby DJ, Field RA, Riley ML, Kercher CJ. Effects of maternal undernutrition during early pregnancy on growth, muscle cellularity, fiber type and carcass composition in lambs. *J Anim Sci* 1987; 64: 1419-1427.
7. Krausgrill DI, Tulloh NM, Shorthose WR, Sharpe K. Effects of weight loss in ewes in early pregnancy on muscles and meat quality of lambs. *J of Agric Sci Camb* 1999; 132:103-116.