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Uruguayan beef calves compensatory growth: Meta-analyses

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Introduction and Objective

Compensatory growth is a physiological process whereby an animal has the potential, after a period of restricted feeding, to accelerates its growth during re-alimentation (Hornick et al., 2000). In beef production systems, but particularly on pasture-based ones, compensatory growth is frequently used by farmers to reduce production costs through redistributing feed supply from a time of the year when pasture availability and/or quality is low towards a time when pasture is plentiful.

Several experiments have been carried out in Uruguay evaluating different nutritional regimens in post weaned beef calves during the first winter of life and the subsequent effect on lifetime performance. However, there is a need to summarise this information because variability across studies (severity and duration of restriction, age, genotype, gender, nature of diet during restriction and quantity and quality of the diet during re-alimentation) affect the response. Indeed, Nicol and Kitessa (1995) in a quantitative review, showed that the focuses need to be greater on the re-alimentation period than on the restriction period. For these reasons, the objective of this study was review national published information and conduct a meta-analysis evaluating: a) compensatory growth in Uruguayan beef calves, and b) compensatory growth under different re-alimentation diets (natural grass vs. sown pasture).

Materials and Methods

A review of the published data from INIA evaluating compensatory growth in beef calves since the year 2000 was undertaken. Seventeen experiments with 32 comparison were evaluated. Population characteristics were: 1,635 calves, with 9±1 month of age, 175±20 kg of body weight, British or Indicus crossbred (Hereford, Aberdeen Angus and Braford).

The restriction period during the rearing of the first winter was on average 96±14 days, and the refeeding period was an average of 136±60 days on either natural grass (improved or not) or sown pasture (alfalfa + orchard grass, or ryegrass, or tall fescue + white clover + birds foot trefoil), referencing extensive and intensive systems, respectively. A linear mixed model regression analysis that contained fixed effects for parameters of interest and a random effect of study was used to evaluate relationships. The models were derived using the Mixed procedure of the statistical software SAS. The model with discrete predictor variable(s) suggested by Sauvant et al. (2008) was used, weighting each observation by the inverse of the squares of their standard errors, which are the standard errors of each mean (s.e.)

Results and Discussion

Compensatory growth index across all experiments with their 32 comparisons was 19% (Table 1). Keane and Drennan (1994) suggested based on their results and the background of other authors, that compensatory growth on pastures is lower in calves than in steers (30-50% vs. 60-80%, respectively). Indeed, Nicol and Kitessa (1995) summarized the data of 57 experiments in New Zealand with calves on grazing conditions and found a compensatory index of 37%.

Table 1. Live weight and ADG during restriction (96±14 days) and re-alimentation period (136±60 days) for un-restricted and restricted treatments.

	Un-restricted	Restricted	SE	p-value
Initial weight (kg)	174	174	3	ns
Weight at the end of restriction period (kg)	244	210	7	**
ADG during restriction period (kg/day)	0.73	0.36	0.05	**
Weight at the end of refeeding period (kg)	321	294	7	**
ADG during refeeding period (kg/day)	0.63	0.67	0.04	*

ns = non significant; * = p<0.05; ** = p<0.01

Moran and Holmes (1978) discussed how the quality of the diet during refeeding affects the capacity of compensatory growth. In fact, the higher quality of the diet during the re-alimentation, the greater the compensatory growth response. Our results agree with those findings with higher compensatory index responses evident when refeeding on sown pastures versus natural grass (33% vs. 8%, respectively; Table 2). Indeed, we report similar values of compensatory index in calves grazing on sown pasture as those reported by Nicol and Kitessa (1995) for calves grazing mostly on ryegrass.

Table 2. Live weight and ADG during restriction (99±13 and 94±14 days) and re-alimentation period under natural grass or sown pasture (118±49 and 157±64 days, respectively) for un-restricted and restricted treatments.

	Natural grass: 445 calves (8 experiments, 17 comparisons)			
	Un-restricted	**Restricted**	**SE**	**p-value**
Initial weight (kg)	169	168	6	ns
Weight at the end of restriction period (kg)	227	194	9	**
ADG during restriction period (kg/day)	0.61	0.24	0.06	**
Weight at the end of refeeding period (kg)	301	270	9	**
ADG during refeeding period (kg/day)	0.64	0.65	0.03	ns

ns = non significant; * = p<0.05; ** = p<0.01

	Sown pasture: 1190 calves (9 experiments, 15 comparisons)			
	Un-restricted	**Restricted**	**SE**	**p-value**
Initial weight (kg)	181	181	3	ns
Weight at the end of restriction period (kg)	262	230	7	**
ADG during restriction period (kg/day)	0.85	0.51	0.08	**
Weight at the end of refeeding period (kg)	344	322	4	**
ADG during refeeding period (kg/day)	0.62	0.70	0.08	**

ns = non significant; * = p<0.05; ** = p<0.01

Finally, one of the main factors that explain compensatory growth is an increase in feed intake (Sainz et al., 1995). However, the higher fiber content in natural grass related to sown pasture (50-80% vs. 35-55% NDF, respectively) could be affecting the intake capacity and therefore the maximum compensatory growth could not be fully expressed in this situation.

Conclusion

The ability of calves to express compensatory growth in Uruguayan grazing conditions of production is relatively low. However, the compensatory growth response is much greater when re-alimentation is practiced on high quality sown pasture relative to natural grass.

Key words: beef cattle; compensatory index; review

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