Different levels of protein in the first winter may affect the meat quality of Uruguayan steers finished on pastures or grain?

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***Abstract*—** Sixty steers were fed during first winter with different levels and source of protein. The steers grazed on improved pastures until reached 350 kg of liveweight, assigned to a finishing period on pastures-P (n=30) or grain-G (n=30). Treatments were: T1) P13-P: diet with 13% of crude protein (PC) and fattened on P; T2) P13-G: 13% PC, fattened on G; T3) P15-P: 15% PC fattened on P; T4) P15-G: 15% PC fattened on G; T5) P17-P: 17% PC fattened on P; T6) P17-G: 17% PC fattened on G; T7) U100-P: 15% PC, using urea 0.5% of diet, fattened on P, T8) U100-G: 15% PC, urea 0.5% of diet fattened on G; T9) U50-P: 15% PC urea1% of diet, fattened on P, T10) U50-G:15% PC urea1% of diet fattened on G.

The aim was to evaluate the effect of the combination of the diets (first winter stocking and finishing periods) on carcass and meat quality (subcutaneous fat cover-SF, meatcuts/fat ratio- C:F, color of fat-FC and meat-MC, marbling- Marb). There was a clear effect ($P<0.05$) of the finishing period in SF, C:F, FC and MC. Grain diets improved FC and MC, presenting higher values of SF and lower C:F ratio than grass fed animals. It was not observed any clear effect of levels and source of protein in carcass and meat quality. Comparing T1 vs. T2, steers form T1 showed differences ($P<0.05$) on SF and Marb. Those results suggest that the level of protein could affect the growth of the animals and their tissue composition considering the finishing diet regimes.

Keywords— **beef, feeding regimes, meat quality.**

I. INTRODUCTION

The influence of previous plane of nutrition on subsequent finishing performance has been focused of many studies. There are different growth paths during early and later life and these paths are consequence of a combination of factors (nutrient quality and availability, animal genetic) (1). Normally, the post weaning conditions in Uruguay are determined by poor pasture availability and quality, affecting animal growth pattern. The efficiency of protein use for growth was greater in compensating cattle and suggested that higher protein:energy ratios may be required for such cattle. The objective of this study was to determine the effects and interactions of previous nutrition with different levels and source of protein and finishing regimen, pasture o grain.

II. MATERIAL AND METHODS

Sixty steers were fed during first winter with different levels and source of protein. The steers grazed on improved pastures until reached 350 kg of liveweight (LW), when they were assigned to a finishing period on pastures-P (n=30) or grain-G (n=30). Treatments were: T1) P13-P: diet with 13% of crude protein (PC) and fattened on P; T2) P13-G: 13% PC, fattened on G; T3) P15-P: 15% PC fattened on P; T4) P15-G: 15% PC fattened on G; T5) P17-P: 17% PC fattened on P; T6) P17-G: 17% PC fattened on G; T7) U100-P: 15% PC, using urea 0.5% of diet, fattened on P, T8) U100-G: 15% PC, urea 0.5% of diet fattened on G; T9) U50-P: 15% PC urea1% of diet, fattened on P, T10) U50-G:15% PC urea1% of diet fattened on G.

The steers were slaughtered in a commercial packing plant at 500 kg of final LW. Carcasses data was recorded (Hot carcass weight-HCW, subcutaneous fat cover-SF (by ultrasound in live animal), meat cuts/fat ratio of Pistola cut- C:F, color of fat-FC and meat-MC, marbling- MARB, mainly) at 36 h postmortem, measuring fat color by AUSMeat system on the whole carcass using a 1 to 8 points scale. Steaks for Warner Braztler shear force (WBSF) were individually vacuum packaged and frozen for subsequent analysis. Results were analyzed by analysis of variance using the GLM procedure of SAS (SAS Inst. Inc., Cary. NC).

III. RESULTS AND DISCUSSION

The effects of feeding treatments on carcass traits and yield cutability are shown in Table 1. It was not observed any effect of the treatments in most of the carcass traits (HCW and C:F). However, steers in T6 showed higher carcass length (CL) than steers in most of the other treatments. This could suggest that the offered levels of protein (P17) during the first winter plus grain at the finishing period affected bone pattern growth and carcass conformation index (PCC left side /CL). These animals had a lower (tendency) index, less conformation. No differences were found in the weight of the main cuts (rump and loin) and in the yield cutability among treatments. But when it was related meat cut with trimmings of fat, the steers grazed on pasture previous to slaughtering had a better ratio (C:F) than grain fed steers, for almost all protein levels at first winter. The animals in P13 didn´t show differences in C:F, for both finishing systems. Some research in Uruguay showed that a similar end point (weight), the feeding regimen (pasture, pasture plus supplement or grain) did not affect the yield cutability (2). In this experience, feedlot steers had more (P<0.05) fat than grass fed ones (9.1 vs 7.8mm respectively), although the ultrasound measurement of fat thickness in live animals and the grade of finishing in carcasses were not different among the ten treatments (P>0.05, data not shown). Most of the meat quality traits (Table 2) had been affected by finishing diet (P vs G). The meat colour – MC (L*) and fat colour (FC), as it was expected were different (P<0.05). Steers fattened on grain presented a score 2.1 in the AUSMeat scale and the ones on grass were classified as 2.9. Numerous studies have consistently shown that feedlot-finished cattle have whiter fat color scores than grass-fed animals (3). Despite of that, steers in T7 and T8 had similar FC (P>0.05) *Longissimus* muscle of animals in feedlot had better (P<0.05) L* values than those on grass (39.8 vs 37.5 respectively). Similar result was observed in Chroma ($\sqrt{a^2+b^2}$) muscle values, where meat from grain fed steers had higher values with 2 days of ageing, getting better appearance of colour than meat from grass-fed cattle (26.3 vs 24.5, respectively). No difference (P <0.05) on tenderness were found between treatments with this 2 days of ageing (3,6 vs 3,7 kgF for G and P respectively). These WBSF are in the observed range for Uruguayan Hereford cattle (3, 4).

The Marb score for all treatments is presented also in Table 2. No differences were observed in Marb among treatments and between finishing diet. The seers fattened on grass had similar Marb score than grain fed animals (249.7 vs 258.6, respectively). It was not detected a clear pattern of IMF content and distribution along all treatments content was not different between treatments (P>0.05). These values of Marb are according to reported by 4**.**

Comparing within protein level, steers on T1 showed differences (P<0.05) on SF and Marb with the animals finished on grain (T2). The T1 steers had lower SF (7.6 vs 10.4 mm) and lower Marb (215 vs 260) than grain fed steers. These differences were not observed in the other protein treatments. Protein levels of 13% in the first winter of the animal could affect fat deposition according to the diet of finishing (pasture or grain).

IV. CONCLUSIONS

Severe growth retardation of cattle early in life could reduce the growth potential and tissue composition, resulting in smaller animals at any given age. This could also be reflected in retail yield. At equivalent carcass weights, cattle that grown slowly after weaning could have leaner composition than those had rapid growth. The results obtained in this study suggest that the level of protein could affect the growth of the animals and their tissue composition considering the finishing diet regimes. There was not a clear evidence of the selected diets on growth, carcass and beef quality triats. However, steers with 13% of protein in the first winter could show different pattern and content of fat tissue whether they were finished on pasture and grain. Diet with 17% of protein could present a biggest bone structure (carcass length) and worst conformation index. More information is needed to extend the consequences of the interaction between genotype and nutrition on growth, yield and meat quality characteristics for Uruguayan beef production systems.

Table 1. Carcass traits and yield cutability

	PCC left	PCC	LC	PCC left/LC	C:F
Treat					
T1	123.2	248.7	148.9ab	0.83	11.5bc
T2	127.1	253.3	145.3ab	0.87	11.5bc
T3	129.0	257.0	135.3c	0.95	17.4a
T4	126.5	251.9	142.5ab	0.88	12.6bc
T5	124.2	250.1	142.8ab	0.87	13.1bc
T6	128.3	256.1	151.8a	0.84	9.8c
T7	124.5	250.0	146.5ab	0.85	12.4bc
T8	123.9	249.2	142.4bc	0.87	12.0bc
T9	124.1	250.0	137.6bc	0.90	14.2ab
T10	125.3	251.9	141.7bc	0.88	12.9bc
P	0.784	0.192	0.020	0.302	0.001

Table 2. Meat quality traits

	FC	Chroma	L*	WBSF	Marb
Treat.					
T1	3.2a	24.6	38.1	3.8	215.0
T2	2.2bc	27.6	40.7	3.1	260.0
T3	3.1a	24.6	38.2	4.2	196.7
T4	2.2bc	26.4	40.9	3.6	243.3
T5	3.0ab	23.9	37.9	3.3	268.0
T6	2.2bc	25.2	39.7	3.5	301.7
T7	2.17bc	23.7	37.9	3.43	260.0
T8	2.0c	25.1	37.9	4.5	258.0
T9	3.1a	26.0	36.2	3.8	210.0
T10	2.2bc	27.0	39.5	3.4	248.3
P	0.001	0.341	0.065	0.608	0.144

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REFERENCES

1. Greenwood P.L and L.M. Cafe (2007) Prenatal and pre-weaning growth and nutrition of cattle: long term consequences for beef production. Animal 1:9 pp 1283–1296.
2. del Campo M., G. Brito, J.M. Soares de Lima , D. Vaz Martins , C. Sañudo, R. San Julián , P Hernández F.Montossi. (2008). Effects of feeding strategies including different proportion of pasture and concentrate, on carcass and meat quality traits in Uruguayan steers. Meat Science 80.753–760.
3. Realini. C., S.K. Duckett., G. Brito., M. Dalla Rizza., & D. de Mattos. (2004). Effect of finishing on pasture vs concentrate and antioxidants on fatty acid composition. color and shelf life of Uruguayan beef. Meat Science 66(3) 567-577
4. Brito G., D. Chalkling, A. Simeone, J. Franco, V. Beretta, E. Beriau, J.M. Iriarte, D. Tucci and F. Montossi. (2009). Effect of finishing systems on meat quality and fatty acid composition of Uruguayan steers. 55th ICoMST, Denmark, pp 45-47 (Meat and Nutrition session).