EFFECT OF GRAZING SYSTEM WITH DIFFERENT FORAGE AND SUPPLEMENTATION ALLOWANCES ON HEREFORD STEERS PERFORMANCE AND MEAT QUALITY IN URUGUAY

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1 ABSTRACT

Uruguayan meat production systems are based mainly on grazing pastures. More intensive systems have been growing by adding concentrate to grazing animals to improve beef performance and meat quality. Thirty two Hereford steers of 20 months of age, were randomly assigned to 4 treatments as a result of combining 2 levels of forage allowance (LFA; 2% and 4% of live weight, LW) and supplementation (S: 0.8 and 1.6 % LW of ground sorghum), being: T1 = 4 % LFA + 0 % S; T2 = 2 % LFA + 0 % S; T3 = 2 % LFA + 0.8 % S and T4 = 2 % LFA + 1.6 % S. Steers from T1 and T4 produced heavier carcasses (HCW) and higher back fat thickness (BFT). Treatments did no affect (P>0.05) ultimate pH, intramuscular fat, meat color at 48 hours after slaughter, tenderness of meat (aged for 7 and 20 days). No treatment differences on PUFA concentration and PUFA/SFA and n6/n3 ratio were found. However, meat of T4 animals presented the higher concentration of MUFA, particularly oleic fatty acid. Meat of treatments based only on pasture (T1 and T2) presented the higher concentration of linolenic and stearic fatty acids. Meat produced on improved grass-fed in extensive grazing systems or combined with low supplement levels, could promote productivity and human health.

2 INTRODUCTION

In recent years, human health concern in relation to consumption of red meats has been increased. In this regard, a lot of information about the effect of diet on the composition of intramuscular fat of meat from ruminants has been generated, associated to its potential impact on human health. Some trials have compared grass based production systems versus feedlot systems (Enser *et al.*, 1998; Realini *et al.*, 2004; Raes *et al.*, 2004; Purchas *et al.*, 2005). The inclusion of grain allows an intensification of the extensive grazing systems of meat production by improving individual animal performance, productivity per unit of area, and generally profit. It is also important to know the effect of including different levels of grain in the diet of the animals on the fatty acid composition in meat produced. However, there is minor research contributions which have studied the effect of the inclusion of different grain or concentrate levels in the diet of grazing animals (French *et al.*, 2000; French, *et al.*, 2003; Alvarez *et al.*, 2007; del Campo *et al.* 2007). The main objective of this study was to evaluate the effect of different levels of forage allowance and supplementation of Hereford steers on the animal performance, carcass quality, meat quality and fatty acid composition.

3 METHODS

This experiment was carried out at the Basaltic region of Uruguay, using an improved pasture (*Trifolium repens*, *Lotus corniculatus* and *Lolium multiflorum)*, grazed by 32 Hereford steers (2 years of age and 303.5 ± 15.3 LW kg). Four treatments, as a result of combining 2 levels of forage allowance (LFA; 2% and 4% of live weight, LW) and supplementation (S; 0.8 and 1.6 % LW of ground sorghum), were evaluated, where: T1 = 4% LFA + 0% S; T2 = 2 % LFA + 0% S; T3 = 2% LFA + 0.8% S and T4 = 2% LFA + 1.6% S. The concentrate was grounded sorghum grain. The variables measured *in vivo* were: fasted live weigh gain (FLWG), fasted final live weight (FFLW), rib eye area (REA) and back fat thickness (BFT) by ultrasound scanning. The following carcass and meat quality parameters were measured: hot carcass weight (HCW), pistola cut weight (PCW) and the weight of the most valuable meat cuts, meat color, tenderness, and ultimate pH (pH) at 48 hours *pos mortem*. Color measurements were taken using a Minolta Colorimeter (model C-10). Tenderness was obtained from six cores (1.27 cm) removed from each sample using a WBSF machine (G-R Electric Manufacturing Co, Manhattan, KS). Samples of the *Longissimus dorsi* were obtained 48 h after slaughter to determine fatty acids composition of. Total lipid was measured by solvent extraction based on Folch *et al.* (1957) method and fatty acids were quantified by gas chromatography. The information was analysed using the statistical GLM procedure of SAS, with an analysis of variance in a model including block and treatment as main effects. Mean of the treatments were compared by test lsmeans test (P<0.05). Also, some variables were adjusted by their respective co-variants.

4 RESULTS

Table 1 - Mean values of animal performance characteristics, carcass traits and meat quality parameters.

Variable	Treatments				P
	4 % LFA + 0 % S	2 % LFA + 0 % S	2 % LFA + 0.8 % S	2 % LFA + 1.6 % S	
FLWG (g/d)	1.217^{ab}	0.753^{c}	1.115^{b}	1.297^{a}	**
FFLW (kg)	422.9^{ab}	369.1^{c}	411.1^{b}	432.3^{a}	**
REA (cm^2) [1]	51.2^{a}	43.6^{b}	45.8^{b}	47.6^{b}	*
BFT (mm) [1]	5.21^{a}	2.80^{b}	3.51^{b}	4.99^{a}	**
HCW (kg)	217.3^{a}	183.0^{b}	208.3^{a}	219.2^{a}	**
PCW (kg)	47.3^{a}	41.3^{b}	48.0^{a}	48.5^{a}	**
SF (kgF) 7 days	5.14	4.53	5.47	4.55	ns
pH 48	5.62	5.52	5.68	5.64	ns
L*	37.1	38.0	37.8	38.5	ns
a*	12.9	14.6	13.8	15.9	ns
b*	10.3	11.3	11.3	12.3	ns

References: [1] adjusted by FFLW.
ns: not significant (P>0.05), *: P<0.05 and **: P<0.01.
a, b, c: means with different letters among columns are significant different at P<0.05.

Table 2 – Mean values of intramuscular fat (g/100g muscle) and fatty acid composition (g/100g of FA).

Variable	Treatments				P
	4 % LFA + 0 % S	2 % LFA + 0 % S	2 % LFA + 0.8 % S	2 % LFA + 1.6 % S	
IMF (g/100g)	2.50	2.47	2.41	2.46	ns
Fatty acids (g/100g FA)					
C 16:0	28.85	26.69	27.56	28.11	ns
C 18:0	16.53^{a}	17.89^{a}	16.49^{a}	14.38^{b}	*
C 18:1	37.50^{bc}	36.36^{c}	39.35^{ab}	41.64^{a}	**
C 18:2	3.62	4.12	3.66	2.89	ns
C 18:3	1.45a	1.46a	1.25ab	1.06b	*
CLA	0.53	0.55	0.54	0.54	ns
SFA	48.47	47.53	46.96	45.30	ns
MUFA	41.33^{b}	40.79^{b}	43.33^{b}	45.26^{a}	*
PUFA	9.25	10.13	9.07	10.72	ns
PUFA/SFA	0.20	0.22	0.20	0.26	ns
Ω6: Ω3	1.67	1.68	1.84	1.88	ns

References: ns: not significant (P>0.05), *: P<0.05 and **: P<0.01.
a, b, c: means with different letters among columns are significant different at P<0.05.

5 CONCLUSIONS

The production system affected animal performance and carcass quality, improving them as the level of supplementation increased. Meat quality characteristics (tenderness, ultimate pH, meat color and IMF) were not affected by either LFA or by S. Linolenic acid concentration was higher in pure pastoral systems. Finally, it can be stated that meat produced on grass-fed combined with low supplement levels, would also promote human health.