Effect of different feeding systems (pasture and supplementation) on carcass and meat quality of Hereford and Braford steers in Uruguay

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Abstract

The feeding systems and breeds affect meat quality, mainly associated to color, intramuscular fat content and fatty acids composition. The Uruguayan extensive system is based on rangeland where supplementation with by products is increasing to improve animal performance. Seventy Hereford and Braford steers (380 kg of liveweight; LW) were randomly assigned to two treatments (T): T1: rangeland + supplementation (rice bran 1% of LW) and T2 (pasture dominated by Lotus corniculatus spp.). There was no effect of breed on carcass and meat quality traits. T1 produced heavier carcasses with higher yield and fat cover ($P<0.05$). No effect of treatments on muscle and fat color ($P>0.05$) were found. The feeding system did not affect ($P>0.05$) *Longissimus dorsi* muscle (LD) tenderness at 2, 7 and 14 days of ageing. Intramuscular fat content (IMF) of LD was no affected by treatments, but there was a tendency that T1 animals produced higher IMF (2.3 vs 1.9%). Saturated (SFA), monounsaturated (MUFA), and CLA contents were not affected by the diet ($P>0.05$). Linoleic content and n6:n3 ratio was higher ($P<0.05$) for supplemented animals. Supplementation improved carcass traits and did not have any effect on the main meat quality traits studied, although n6:n3 ratio was greater than the recommended level for promoting human health.

Introduction

Uruguay economy is strongly dependent on beef export. The production systems are mainly based on native pastures but other feeding strategies as by products or grain supplementation are growing to improve animal performance and modify meat quality traits according some market requirements. Generally, the results showed that grass-fed beef is often discounted compared to grain-fed beef because of consumer perceived differences in meat tenderness, color, and flavor acceptability (French et al., 2000). Currently there is interest in reducing the amount of grain and increasing the amount of forages due to the fact that consumer privilege health, food safety and environmental sustainability. The objective of this experiment was to evaluate the effect of different feeding systems (pasture vs supplementation) on carcass traits and meat quality in Uruguayan Hereford and Braford steers.

Materials and methods

Seventy steers (Hereford, n=35; Braford, n=35) with were grazed together on rangeland with winter supplementation (rice bran 1% of LW) and randomly assigned at 380 kg LW and 21 mo. of age to two feeding treatments (T) for a period of 120 days: T1: rangeland + supplementation (rice bran 1% of LW) and T2: pasture dominated by *Lotus corniculatus spp*. at a 4% of LW allowance. Rice bran (CP=13.6%; ADF=13.9%) was given once a day. Animals were killed in a commercial slaughterhouse, when they reached an average of 480 kg of LW per treatment. After slaughtering, carcasses were graded and hot carcass weight (HCW) was recorded. At 48 hs post mortem (p.m.) carcasses were ribbed between 10-11th rib and fabricated in primal cuts. Ultimate pH was recorded in *Longissimus dorsi* (LD) muscle using a pHmeter (Orion 210A) with gel device. The pistola cut (PC) and boneless cuts from this primal (Striploin, Tenderloin, Rump=RL) were weighed and retail yield of the RL (RL/PC*100=RLY) was calculated. Four steaks were vacuum-packed individually and sent to Meat Lab in INIA Tacuarembó. One steak was frozen at -20 ^{o}C for fatty acid composition and the others were aged 2, 7 and 14 d. at 2-4 ^{o}C for tenderness determination (Warner Bratzler model D2000- WB). Meat color was measured on the LD at 14 d of ageing in L*, a*, b* colour space using a colorimeter (Minolta C10) after 1 h of blooming. The LD steaks were placed inside polyethylene bags and cooked in a water bath until an internal temperature of 70 ^{o}C. About six 1.27-cm diameter cores were removed from each steak parallel to the muscle fiber orientation. A single peak shear force measurement was obtained for each core and an average value was calculated for each steak. Total lipid was measured by solvent extraction based on Folch *et al*. (1957) method and fatty acids were quantified by gas chromatography. Fatty acids are expressed as percentages of the sum of all fatty acids measured. The results were analysed by GLM procedure (SAS Institute Version 9.1, 2003), including breeds and treatments as random effects and LW as a covariate. LSM means and differences among treatments were estimated, using $\alpha = 0.05$ level.

Results and discussion

There was no effect of breed on carcass and meat quality traits, although Hereford steers showed more (P<0.05) backfat thickness (BFT) and lower (P<0.05) rib eye area (REA) than Braford ones. Supplemented fed steers (T1) had higher BFT (P<0.05) than grass fed steers (T2). The final LW was identical for both treatments (Table 1). However, T1 cattle had heavier HCW (P<0.05) than T2 cattle. RL represent most of the economical carcass value. There was not effect (P>0.05) of the feeding systems on the weight of these cuts. Studying RLY, no differences were found between treatments (Table 1). del Campo *et al.* (2007) comparing grass fed vs corn supplemented (1.2% LW) steers reported differences (P<0.05) in RL weight but no differences (P>0.05) in RLY.

Table 1. Carcass traits of steers under different feeding strategies

Variable	T1	T2	P	Braford	Hereford	P
LW (kg)	472	472	ns	470	475	ns
HCW (kg)	241 a	235b	<0.05	238.5	237.5	ns
REA (cm^2)	59.3	57.0	ns	60.3 a	56.1 b	<0.05
BFT (mm)	6.4 a	5.3b	<0.05	5.2 b	6.5 a	<0.05
PC (kg)	53.7	52.8	ns	53.3	53.1	ns
RL (kg)	10.9	10.6	ns	10.8	10.7	ns
RLY (%)	20	20	ns	20	20	ns

Note: a, b = means with different letters among columns are significant different (P<0.05).

Carcasses from both treatments had not differences (P>0.05) in pH values at 48 h p.m. (Table 2). Meat color is an important criteria used by consumers at the moment of purchasing. With 14 d of ageing, no differences (P>0.05) were observed in L*, a* and b* meat color comparing both treatments (Table 2). However, del Campo *et al*. (2007) found differences in meat brightness (L*) between corn supplemented (1.2% LW) and grass fed Hereford steers (40.3 vs 39.3, P<0.05) with 20 days of ageing.

Table 2. Mean values of pH and color parameters of meat quality for treatments and breeds

Variable	T1	T2	P	Braford	Hereford	P
pH 48 hours	5.53	5.63	ns	5.64	5.68	ns
L* muscle	36.7	36.3	ns	38,03	37.45	ns
a* muscle	11.8	13.1	ns	18,32	19.13	ns
b* muscle	8.2	8.8	ns	12,61	13.19	ns

There was not effect (P>0.05) of treatments in shear force values for 2, 7 and 14 d. of ageing (Figure1). These results agree to the data reported by del Campo *et al*. (2007), who did not find differences (P>0.05) in LD hardness from corn supplemented (1.2% LW) and grass fed Hereford steers (3.6 vs 3.2 kgF and 3.2 vs 2.9 kgF, respectively) aged for 7 and 20 days. However, these hardness values are lower than the values obtained in our study (4.2 kgF with 14 d of ageing for T1 and T2). The intramuscular fat (IMF) content was for T1=2.3% and for T2=1.9%. The main fatty acids, oleic (18:1), palmitic (16:0) and stearic (18:0), accounted for 90 % of the total fatty acids in both treatments (Table 3). Linoleic (18:2) was higher (P<0.05) in IMF of supplemented cattle than grass-fed animals. This result disagrees with Alvarez *et al*. (2007), who reported linoleic content (P<0.05) of 7.54% and 6.30% for grass and corn supplemented (1.2%LW) steers, respectively. No other differences (P>0.05) were found in fatty acid profile. Arachidonic (20:4), eicosapentaenoic (20:5), docosapentaenoic (22:5) docosahexaenoic (22:6) were not included in the analysis. The n6:n3 ratio, calculated using linoleic and linolenic acids, was higher (P<0.05) for T1 than T2.

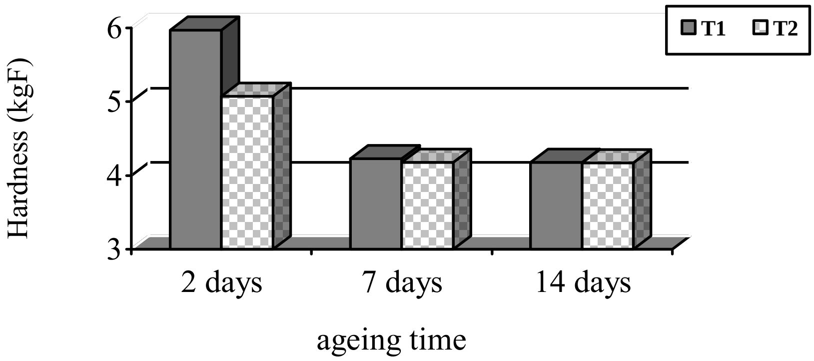

Figure 1. Meat hardness for both feeding system, with 2, 7 and 14 days of ageing.

Table 3. Mean values of meat fatty acid composition for treatments and breeds (%)

Variable	T1	T2	P
16: 0 (Palmitic)	26.01	24.72	ns
18: 0 (Stearic)	20.71	20.02	ns
18:1 (Oleic)	43.52	45.43	ns
18:2 (Linoleic)	2.31 a	1.67 b	<0.05
18:3 (Linolenic)	0.20	0.27	ns
CLA (linoleic acid conjugated)	0.30	0.31	ns
PUFA/SFA	0.06	0.05	ns
n6/n3	11.6 a	6.0 b	<0.05

Note: a, b = means with different letters among columns are significant different (P<0.05).

Conclusions

Some research showed that feeding system affects animal performance, carcass and meat quality traits. Production systems based mainly on pastures were associated with decreasing meat quality attributes. However, in this study the finishing strategy did not show substantial changes in carcass traits and meat quality. Supplementation improved carcass traits (HCW) and did not have any effect on the meat quality characteristics studied, although n6:n3 ratio was enough greater than the recommended levels for promoting human health. Further research should be conducted to study the effects of rangeland, pasture and pasture plus concentrate on carcass traits and meat quality in Uruguayan beef cattle.

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