BEEF QUALITY OF YOUNG BULLS VS CASTRATED FROM THE NORWEST ARGENTINA PRODUCTIVE AREA

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Abstract – The objective was to carry out a survey on 2-teeth young bulls vs castrated beef quality ('Criollo', Zebu, Brangus/Braford cattle) produced in the northwest region of Argentina, looking at physico-chemical and organoleptic aspects considering the effect of ageing up to 30 days. Samples of Longissimus dorsi muscle (9-13 rib) were collected on castrated or young bulls confined up to 20-23 month of age. The pHu, color (L*,a*,b*; Minolta), cooking losses, Warner Bratzler shear force (Instron 1140) and texture sensory parameters (8 trained assessors) were determined. Data were analyzed using the Proc Mixed (SAS), with differences among treatments analyzed by Tukey test. Young bulls were leaner, had higher final pH, WB shear force and were less colored and tender that castrated cattle. After 14 days of ageing, samples were brighter and tender than fresh meat; with the biggest differences being evident from 4 to 14 days compared to the 14 to 30 days period. Castration proved to be the most influential factor in the qualitative characterization of meat from cattle raised on feedlot system for typical biotypes bred in the northwestern Argentina. In conclusion, the Criollos, Zebu and Crossbred intact males result in less colored meat and require longer ageing times for achieving tenderness values that are similar to castrated animals.

Key Words – Ageing, Castration, Tenderness

- INTRODUCTION

The creation of the category 'young bull' (MEJ *macho entero joven*) on November 2010 (Ministry of Agriculture, Livestock and Fisheries, Res 4.906/2010) allows the use of a product that is currently little explored in Argentine beef market. Fattening of bovine intact males is an interesting alternative in countries where the use of growth promoters is prohibited, to obtain lean carcasses or animals with similar fat level at heavier slaughter weights in confinement systems. The available information in Argentina on the meat quality of this new category of animals is scarce and more so for 'Criollos' or Zebu biotypes.

Argentinean consumers are very demanding in terms of high quality beef 1. Some authors have observed differences in tenderness 2, 3; or meat color 4, 5 between castrated and intact animals, while other studies showed no differences between the two categories 6, probably due to differences in the age of the animals at the time of comparison. To the best of our knowledge there have not been a detailed and complete study about beef quality from young bulls for the different areas of Argentina and much less, a study of the northwest productive region for native and zebu breeds. Our objectives were to determine the qualitative properties of the meat from castrated or young bulls according to the productive area on 'Criollos', Zebu and

Brangus/Braford cattle and to study the effect of different ageing times up to 30 days, simulating commercial conditions.

- MATERIALS AND METHODS

The characterization study was conducted in the northwest region on intensive (i.e., feedlot) productive system on steers (S) or intact (B) animals slaughtered at the same age within each breed. Animals belonged to 'Criollos' (C), Zebu (Z) and Brangus/Braford (Bra) breeds; and their dental chronological age was 2 permanent teeth.

Samples

Animals slaughtered at 20-23 months of age in a commercial fridge were sampled to obtain the Longissimus dorsi muscle (9 to 13 ribs; 59 samples) and transported (-18ºC±1) to the Meat Quality Laboratory of the Faculty of Agronomy (University of Buenos Aires). Samples were vacuum-packed (Multivac packaging A300-16) as a method of conservation. The packaged samples were placed in a refrigerator with temperature and light control to simulate retail conditions of exhibition. Ageing times were 4, 14 and 30 days.

Determinations

The determinations included final pH (pH meter Hanna with fine-tipped electrode Ingold 406 M3); color according to the CIELAB System, L* (lightness), a* (redness) and b* (yellowness) while saturation was calculated as [C*= (a*2 + b*2)0.5] using a Minolta Chroma Meter-CR300 [7]; tenderness with a Warner Bratzler shearing attachment (Instron 4442 Universal Testing Machine; Canton, MA, USA) on cooked samples (water bath heated at 70ºC for 50 minutes or roasted in double contact grill to reach 71ºC ± 1ºC in the center of the sample (cold point), monitored by thermocouples). For texture sensory determinations, samples were analyzed by an analytical panel of 8 trained assessors according to international standards and experience in sensory analysis of beef [9, 10, 11]. Each assessor received samples (1x1x1cm cubes) in containers coded with three digit random numbers. Tenderness was assessed using an unstructured linear scale of 10 cm without anchorage; with the ends of the scales corresponding to the intensity of the attribute: extremely soft (lower limit: 0) and very tough (upper limit: 10). Statistical analysis of data was performed using the Proc Mixed of SAS [12]. Differences among treatments were analyzed by Tukey test ($p < 0.05$).

- RESULTS AND DISCUSSION

In general (Table 1), all parameters were influenced by the animal category (castrated and intact). Young bulls were leaner, had higher final pH values and were tougher in both instrumental measurement (WB) and in the sensory evaluation (tenderness). Some authors [6, 13] found differences in WB hardness between castrated and intact fresh beef explained by differences in muscle fragmentation index (MFI) in the LD. Other authors [14] also observed differences in tenderness between young bulls and castrated, greater in semimembranosus than in longuissimus muscle, due to the higher content of total and insoluble collagen.

Regarding color, the meat of young bulls was less bright and had lower red and yellow index values and consequently, less color saturation ($p<0.001$) than the castrated animals. Our data were partially consistent with those of Zhang et al. [15] who worked in feedlot animals and

reported a lower Longissimus dorsi muscle luminosity on intact compared to castrated animals. This is contrary to that observed in a previous literature review [16], where the authors concluded that the color differences between castrated and intact were minimal and also contrary to recent observations on hereford beef that were more red in young bulls [2], possibly attributable to increased stress sensitivity of intact males.

The biotype only showed differences ($p < 0.05$) in hardness, evaluated by cooking bath. No other parameters were different when comparing the mean values of the castrated and intact and up to 30 days of ageing. 'Criollos' and Zebu showed similar and higher thoughness than Brangus/Braford animals when samples were cooked in bath cooking but were no different among them when samples were cooked in double contact grill, highlighting the importance of the cooking method when measuring the hardness.

Table 1 Meat quality according to the castrated/intact category and breeds for 4 to 30 days of ageing

									Probability			
	Category (C)		Breed (Br)			Days (D)			Cat	Brd	D	RMSE
	S	B	C	Z	BB	4	14	30				
Backfat (cm)	5.55	4.94	4.33	5.66	5.37	4.81	5.50	4.73	.05	ns	ns	2.8
pH	5.48	5.61	5.45	5.55	5.55	5.50	5.56	5.55	.0015	ns	ns	0.16
L*	42.3	38.0	39.6	42.5	40.7	38.8 a	41.1 b	41.5 b	<.0001	ns	.0065	3.23
a*	21.0	18.7	20.9	20.1	19.6	20.7	20.6	18.9	<.0001	ns	ns	2.47
b*	11.1	8.64	11.0	10.1	9.55	10.1	10.3	9.68	<.0001	ns	ns	1.01
C*	23.7	19.9	23.6	20.9	21.7	22.8	23.0	21.3	<.0001	ns	ns	2.12
L*bl[1]	42.5	38.1	42.1	40.1	40.7	-	40.3	41.3	<.001	ns	ns	3.29
a* bl[1]	17.6	16.6	17.1	17.3	17.0	-	17.4	26.9	.0028	ns	ns	1.74
b* bl[1]	6.15	4.51	5.73	4.92	5.44	-	5.37	5.47	.0005	ns	ns	1.84
C* bl[1]	18.6	17.3	18.1	18.2	18.0	-	18.3	17.8	.0046	ns	ns	2.0
WBw[2]	3.45	4.28	3.87 a	3.84 a	3.14 b	4.41 a	3.57 b	3.19 b	<.0001	.02	<.0001	0.85
WBr[3]	3.25	4.25	3.60	3.82	5.51	4.22 a	3.14 b	3.00 b	<.0001	ns	<.0001	1.00
Cook Loss %	22.2	22.5	22.8	22.0	19.4	21.8	21.1	24.9	ns	ns	ns	3.6
Tend[4]	3.05	4.88	2.68	3.96	4.16	4.43 a	3.23 b	-	<.0001	ns	.0006	0.95

Category: S: Steers and B: young bull; 1. Breed: C: Criollo; Z: Zebu; Bra: Brangus/Braford; L*, a*, b*, C* bl: after 50 minutes of blooming; 2. WBw: water bath cooking; 3. WBr: roasted samples; 4.Tend: sensorial tenderness. Different letters indicate significant differences $p<0.001$

Ageing time influenced luminosity, WB shear force and tenderness. In contrast, meat colour and pH of the meat did not change for any category or biotype with the ageing time. After 14 days of ageing, samples were brighter than fresh meat and remained equal up to 30 days.
Regarding the WB hardness, the largest differences between the values of shear force were evident from 4 to 14 days, withlittle improvement in tenderness observed from 14 to 30 days. These results are consistent with those observed in previous studies on the hardness of Pampa Argentina matured beef [17]. Sensory tenderness was assessed only at 4 and 14 days.

Similarly to what was observed with the WB hardness, assessors found a more tender beef after 14 days of ageing compared with fresh meat.

CONCLUSION

The category of 'castrated or intact' proved to be the most influential factor in the qualitative characterization of beef from cattle raised on feedlot systems for typical biotypes bred in the Northwestern Argentina, resulting in less bright and less chrome, more WB hardness and lower sensory tenderness for intact males meat. The ageing time was important for the luminosity, shear force and tenderness of the beef, but the greatest differences were observed between 4 and 14 days. Prolonged maturation, up to 30 days, did not alter the colorimetric parameters and slightly improved WB shear force (less hardness). In conclusion, the breeding of biotypes ‘Criollos’, Zebu and Crossbred intact males in confined systems, determine less colored meat and require longer ageing times for achieving tenderness values similar to that of their castrated peers.

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