PATAGONIA (ARGENTINA) BEEF QUALITY

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Abstract – The objective was to carry out a survey on 0-2 teeth castrated beef quality (British cattle) produced in Patagonian region of Argentina, looking at physico-chemical and organoleptic aspects depending on the production system and considering the effect of ageing up to 30 days. Samples of Longissimus dorsi muscle (9-13 rib) were collected on confined, grazing and grazing + supplementation animals slaughtered at the same commercial category. The pHu, color (L*,a*,b*;Minolta), cooking losses, Warner Bratzler shear force (WBSF) and sensory parameters (8 trained assessors) were determined. Data were analyzed using the Proc Mixed (SAS), with differences among treatments analyzed by Tukey test. Production system and ageing time showed significant effects on color, pH and cooking water losses but did not affect WBSF values. The value of hardness in all cases was less than 4.70lb. Sensory analysis showed similar flavor among production systems with higher color for the pasture-raised animals. Tenderness presented interaction 'diet X time' but feedlot meat seemed to be tenderer. For all systems, off flavor were negligible to 30d ageing. Regardless of the production system, for British cattle, meat from the 'Patagonian-region' of Argentina showed physico-chemical and sensory attributes suitable for consumption as fresh meat and it may considered as very tender due to the young age of slaughter of animals.

Key Words – Patagonian region, cattle, meat quality, ageing.

I. INTRODUCTION

Argentina has been divided in five beef cattle producing areas, namely "Pampeana" Region (I), Northeast (II), Northwest (III), Central semiarid (IV) and Patagonian (V) [1]. The territory of the region of Patagonia starts at the south of the Colorado River, occupying an area of 930,638 km^2. Its contribution to the national economy stands on energy but also supplies the national and global market with fruit, various seafood and wool. In this region there are places with the highest rainfall in the country (mountain range) and large areas of dry land in the central area. It is clearly dominated by the semi-desert environments, with less than 200 mm per year and scarce water resources. In the Patagonian plateau the dominant species is the sheep while the foothill has ecological conditions that allow production forestry, extensive cattle and intensive sheep and cattle.

The Patagonian cattle contribute 2.5% of the national stock and has great growth potential for its health status ('Foot and Mouth Disease free without vaccination', internationally recognized) [2]. In recent years an increase in beef production using foothill extensive rearing system for production of calves and feedlot finishing calves in arid plateau was evident. The genetic base of cattle is mainly British (mostly Hereford) and a lower proportion of 'criollo'. Patagonian people consume meat from young animals (slaughter range: 300 – 350kg live weight). Grazing animals come from the summer pastures in the mountains and/or valleys but not overwinter so they are sold before the first frost. Then, the sale weight of these animals depends on climatic conditions (rainfall and temperature) that affect the supply of grass during spring-summer.

Both the internal and export markets classification of meat according to their quality increase the added value to the product. Beef quality from animals fattened in some of these regions has only been partially characterized [3]. Our objectives were to determine the qualitative properties of the

meat according to the production system used in response to the characteristics of the cattle from the 'Patagonian' region (V), on the physical, rheological and sensory characteristics considering the effect of ageing up to a month.

II. MATERIALS AND METHODS

The characterization study was conducted in the Patagonian region on three production systems: Extensive (grazing), Semi-extensive (grazing + supplementation) and Intensive (feedlot) for animals slaughtered at the same commercial category. Grazing animals fed natural grasslands as "mallín" grass. Animals belonged to Hereford and Angus breeds; their dental chronological age was 0-2 permanent teeth.

Samples

Due to the extension of the Patagonian region, 2 slaughterhouses were selected (with authorization for meat national transit), one in the northeast region (Río Negro province 40°48′S 63°00′O) and other in the western region (Chubut province 43°05′00″S 71°28′00″). Animals slaughtered at 300kg live weight average were sampled to obtain the Longissimus dorsi muscle (9th to 13th ribs; 59 samples) and transported under cold conditions (by plane, with dry ice) to the Meat Quality Laboratory of the School of Agriculture (University of Buenos Aires, 1000 and 2000 km away from each slaughterhouse). 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 (Hanna pH meter with fine-tipped electrode Ingold406 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 [4]; 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). For sensory determinations, samples were roasted in double contact grill to reach 71ºC ± 1ºC in the center of the sample (cold point), monitored by thermocouples) and then were analyzed by 8 trained assessors according to international standards and experience in sensory analysis of beef [5, 6, 7]. Each assessor received samples (1x1x1cm cubes) in containers coded with random, three-digit numbers. Tenderness, global color and Flavor were assessed using an unstructured linear scale of 10cm without anchorage; with the ends of the scales corresponding to the intensity of the attribute: extremely soft, light (lower limit: 0) and very tough, dark (upper limit: 10). Statistical analysis of data was performed using the Proc. Mixed of SAS [8]. Differences among treatments were analyzed by Tukey test ($p < 0.05$).

III. RESULTS AND DISCUSSION

Animals raised in extensive (pasture) systems were lighter (296 kg) than semi-extensive (pasture + grain, 309 kg) and feedlot (315 kg) because of the difficulty of following the fattening on pasture in autumn-winter. With the exception of hardness, production system showed important effects on pH, cooking losses and color of meat; the intensive system samples were brighter but more colored and had higher cooking losses. The greater color saturation (C*) may be due, in part, to the heavier weight of the animals. Ageing time influenced pH, luminosity, redness, yellowness, cooking losses, and WBSF. The pH value decreased and luminosity increased after 14 days of ageing (pH 5.55 average at 4 and 14d vs 5.45 at 30d; L* 40.5 average at 4 and 14d vs 42.6 at 30d; $p<0.01$). Ageing time determined higher cooking losses (20.5, 21.5 and 23.6; $p<0.01$) and values of b* (7.44, 9.18 and 10.3 at 4, 14 and 30d; $p<0.01$) while a* and C* parameters didn't change with ageing time (a*: 18.3, 19.1 and 19.2; C*: 17.6, 17.9 and 19 for 4, 14 and 30d). Regarding WBSF, although it numerically decreased with time, that was not significant ($p>0.1$). These results are consistent with those observed in previous studies on the WBSF of Pampeana region (I) matured beef [9].

Table 1. Influence of diet (average of 3 maturing times) on pH, color, WBSF, cooking losses, and sensory parameters of Patagonian meat.

	Productive system (P.S.)			Probability			RMSE*
	Ext.	SE	Inten	P.S.	Day	Int.	
Sample number	20	19	20				
pH	5.63 a	5.52 b	5.42 c	<.01	.004	ns	0.15
L*	38.6 a	41.2 b	43.8 c	<.01	.013	ns	2.99
a*	16.8	20.9	19.3	<.01	.053	.016	1.58
b*	7.39 a	10.4 c	9.40 b	<.01	<.01	ns	1.22
C*	15.6	20.0	19.3	<.01	ns	.003	3.02
Cooking losses %	20.8 a	22.3 bc	23.0 c	.002	.001	ns	2.85
WBSF, lb	4.62	4.57	4.55	.282	.741	ns	0.81
Grill Cooking Loss %	18.9 a	18.5 a	21.8 b	.007	<0.01	ns	3.38
Color	4.35 a	4.96 a	3.72 b	<.01	.004	ns	1.66
Flavor intensity	3.64	4.11	4.10	.08	.09	ns	1.87
Off flavor	0.91	0.65	1.03	.08	.03	ns	1.44
Tend.	3.49	3.17	2.74	.003	.342	.002	1.64

Ext.: extensive system (grazing); SE: semi extensive system (grazing + supplement); Inten.: Intensive system/feedlot). Probability: P.S.: production systems; Day: days of ageing; Int.: interaction. *Root Mean Square Error. L*, a*, b*, C*: after 50 minutes of blooming; Tend.: Sensory Tenderness. Different letters indicate significant differences p<0.01

Feedlot animals showed lower color and higher grill cooking losses and tenderness (diet x time, P<0.01) than pasture-raised animals. There were not differences among production systems on flavor intensity. For all systems, off flavor were negligible up to 30days of conservation. Regarding ageing time, most of sensory parameters were affected. Cooking losses increased with ageing time (14,8; 19,7 and 24,6 for 4, 14 and 30days; P<0.01), and the same held true for off flavor (0,6; 0,9 and 1,1; P<0.05) and tenderness (3.27; 3.17 and 3.00; P>0.01), while color remained stable after 14 d (4 vs 4,5 average 14 and 30d; P<0.01). Flavor intensity was no affected by time.

IV. CONCLUSION

As expected, the production system and ageing time affected pH value, instrumental colour and cooking losses but did not affect tenderness. Due to the young age of the animals, the meat was tender in all systems and although numerically increased with time of ageing, this variation was not significant. From a sensory standpoint, the meat from the pasture-based production systems were less tender and more colored than feedlot but all meats presented similar flavor without significant off flavour. Ageing time did not improve the sensory tenderness. Regardless of the production system, for British cattle, meat from the 'Patagonian-region' of Argentina showed physico-chemical and sensory attributes suitable for consumption from 4 days of ageing and it may be considered as very tender due to the young age of slaughter of animals.

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