Tenderness in Beef *Longissimus dorsi* Muscle of Hereford (H), Aberdeen Angus (A) and Brahman Cross-breed Steers. The influence of *Post-mortem* Ageing.

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Introduction

There has been well established the economic value of *Bos indicus* breeds of cattle, particularly Brahman, in animal production. However Brahman and Brahman crossbred cattle have been discriminated against by several sectors of beef industry. That discrimination has been supported in the modification of certain meat quality factors, specially tenderness, which is considered by our consumers as the major palatability trait.

Many authors have reported that as percentage of *Bos indicus* breeding increases the level of tenderness decreases and(or) the variability in tenderness increases (Williams *et al.*, 1987; Crouse *et al.*, 1989; Gallinger *et al.*, 1992; Johnson *et al.*, 1990). Moreover, Wheeler *et al* (1990) indicated that when *Bos indicus* influence is present, the percentage of *Bos indicus* accounts for more of the variation in tenderness than any other factors.

Another important aspect in meat quality research is that several post-*mortem* procedures have been shown to improve ultimate meat tenderness. Generally, increasing tenderness post-*mortem* treatments have a greater effect on less tender meat (Savell *et al.*, 1981) and particularly, post-*mortem* storage at 0° to 5° C which dramatically increases meat tenderness (Penny, I. F., 1980).

The objectives of this research were 1. to confirm our previous results in Brahman 1/4 [Brahman x Angus (BA1/4) and Brahman x Hereford (BH1/4)], 2. to determine the quality profile of Brahman 3/8 (BA3/8 and BH3/8) and 3. to demonstrate that ageing improve meat tenderness in all cross-breed studied. These results would allow to define the maximal percentage of Brahman to use in crossbreeding programs in Argentina (Pampa´s region) and to propose the use of ageing as an alternative industrial treatment to get an improvement.

Materials and Methods

Sixty steers representing six breed types which differ in the ratio of Brahman (A, BA1/4, BA3/8, H, BH1/4 and BH3/8) were used in this research. The selected steers were feed on high quality pasture until slaughter. The steers were slaughtered at similar fattening level, which was monitored both visually -by three trained evaluators- and with real-time ultrasound measurements. After chilling (36 hs after slaughtering) the right *Longissimus dorsi* (LD) were dissected and identify as fresh-samples. The left one were vacuum packed and aged for 7 days at 1°C (aged samples).

Warner-Bratzler Shear Determination (W-B). Samples cubes (5 cm x 5 cm x 5 cm) were packed in polyethylene bags and cooked in a 70°C water bath. After cooking, five 1.27 cm cores were removed parallel to the muscle fibbers with a hand coring device. Core were sheared twice on a Warner-Bratzler shearing appliance.

Sensory Panel Evaluation (SPE). Frozen meat steaks were cut off 2.5 cm thick and then tempered at 5 to 7°C for 24 h prior to cooking in a pan broiler. Steaks were turned around when their internal temperature was 40 °C and removed from the pan broiler when they reached 70°C. The members (7 to 8) of descriptive attribute sensory panel were trained and tested all samples according to methods described by Cross et al. (1978) and AMSA (1978).

Panellists in individual booths, evaluated three 1.27 cm cubed samples for overall tenderness and connective tissue based on 8-point scales (8 = tender, none; 1= though, abundant).

Myofibrillar Fragmentation Index (MFI). Myofibrils were isolated and MFI was determined in LD samples according to the procedure described by Olson et al (1976). Protein concentration was determined by the Biuret method of Gornall et al (1949).

Total and Soluble Collagen Content (TSCC). The procedure of Hill (1966) was used to determine total and percentage heat-soluble intramuscular collagen. Hydroxyproline in the fractions was determined by the spectrophotometric method of Bergman and Loxley (1963) and converted to total collagen by multiplying by a factor of 7.14.

Statistical Analysis. Analysis of variance was performed using the General Linear Model procedure of SAS (1985) that included the fixed effect of breed, trait and their interactions. Means separation for significant ($P < 0.05$) main effects was accomplished by Tukey´s mean separation test (Steel and Torrie, 1980).

Results and Discussion

SPE scores for overall tenderness (fig.1 a,b) and W-B values (not shown) for LD steaks showed not significant difference among cross-breed at 0 and 7 d post-*mortem*, this could be explained by the high variability found in these results. The data from W-B showed that ageing improved tenderness ($p < 0.05$) in all cross-breed except for 3/8-type and overall tenderness score revealed that ageing produce tender meat in all cross-breed except for BA3/8. These results agree with those reported by Crouse *et al.* (1989), Johnson *et al.* (1990) and Sherbeck *et al.* (1995) where the pure-bred Hereford and Angus steers were not different from 1/4Brahman and these researchers also demonstrated that the influence of a high percentage of *Bos indicus* inheritance resulted in less tender meat. Different post-*mortem* periods (Wheeler *et al.* 1990, Whipple *et al.* 1990, Johnson *et al.* 1990) revealed a different breed group (pure-bred and their cross-breeds) response to post-*mortem* ageing. We did not find a differential response between pure-bred and 1/4B and else ageing did not produce tenderization in 3/8-breed type.

The connective tissue amount scores (SPE) and the TSCC values were not significantly different among genotypes and between traits (data not shown). Generally, the collagen evaluation is a subject that arise discrepancies among researchers, Whipple *et al.* (1990) and Crouse *et al.* (1989) found that Brahman-crosses had higher connective tissue amount. However we found, like Whipple *et al.* (1990), no differences among breed crosses in total and percentage of soluble collagen. Similar results were obtained by Wheeler *et al.* (1990) and Johnson *et al.* (1990) moreover, these authors confirmed that total amount of connective tissue was not affected by breed groups.

MFI values had a tendency to decrease when percentage of *Bos indicus* increase. Cross-breeds with 3/8 Brahman blood were more though than 1/4 crosses and pure-bred Hereford and Angus steers ($p < 0.05$). In both breed groups ageing improved tenderness ($p < 0.05$; fig. 1 c,d).

In this study it was demonstrated again the high correlation between tenderness and MFI values (Olson *et al.* 1976, Koohmarie *et al.* 1987). Our results agree with Whipple *et al.* (1990), they had got a higher MFI value for H x A than their crosses at all post-*mortem* periods.

It is our opinion, that neither solubility nor quantity of collagen were contributing factors to explain differences in tenderness observed among breed crosses found, and that the myofibrillar components may be the major contributors to tenderness variability in the animals.

Generally, MFI identifies differences in muscle fibber integrity and had shown to be closely related to sensory panel tenderness and W-B values (Davis *et al.* 1980), however we could not find a close correlation between breed groups MFI and SPE determinations, and W-B values. This could be explained by the data dispersion found on 3/8 breed groups.

Conclusion

These results suggest that steaks from steers with more than 25% of Brahman-blood are less tender than its pure-bred, even when slaughtered at similar fattening levels. Post-*mortem* ageing improves tenderness without different response among cross-breeds. Taking into account these results we are able to point out that beef from quarter-blood Brahman cross-breed steers could be included in crossbreeding programs. A greater *Bos indicus* inheritance could be used in certain areas where the conditions are rigorous, but we suggest the use of post-*mortem* tenderization procedures to get desirable meats.

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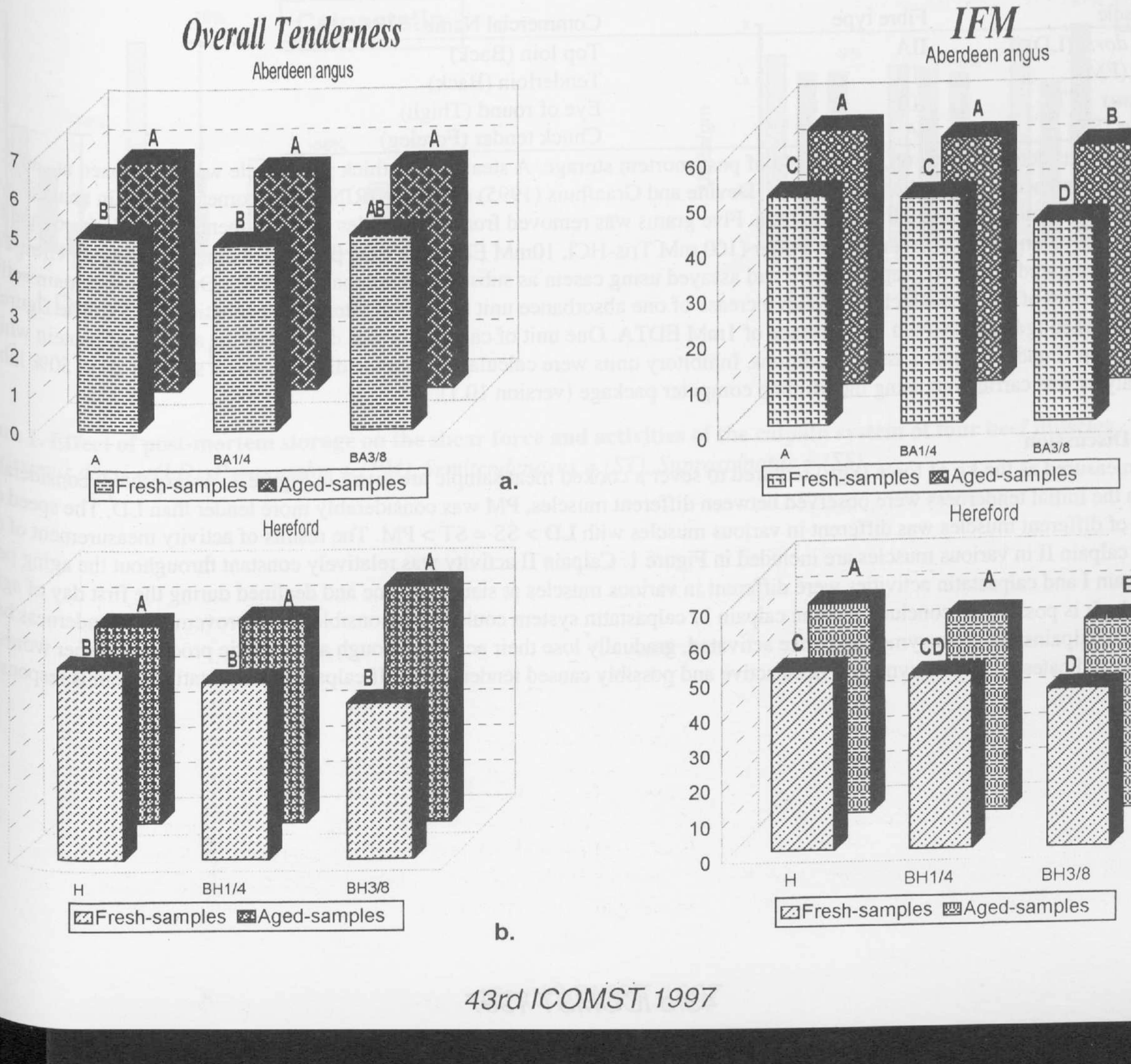

a. b. c. d. fig.1