TENDERNESS IN BEEF *LONGISSIMUS DORSI* MUSCLE OF HEREFORD, ANGUS, SALERS AND NELORE CROSSES. THE INFLUENCE OF *POSTMORTEM* AGEING

Franco, J [1*], Feed, O[1], Bentancur, O[2].

[1], Facultad de Veterinaria, Faculty of Veterinary, UDELAR, Montevideo, Uruguay

[2] Facultad de Agronomía, Faculty of Agronomy, UDELAR, Montevideo, Uruguay

* jufra@fagro.edu.uy

Abstract – The influence of the breed and ageing time on instrumental tenderness was studied. 245 steers from Hereford (H) and F1 crosses, breeding sires of Angus (A), Salers (S) and Nelore (N) breed mated to Hereford dams were used. Steers were slaughtered at 730± 52 days at similar fat thickness. Samples of the *Longissimus dorsi* were randomly selected and aged for 3, 7 and 14 days between 1 and 4°C. No interaction effects were found between breed and ageing. At each time Nelore crosses meat was less tender than the other genotypes. Nelore crosses attain shear force values of tender meat at 14 days of ageing while the other crosses achieve these values at 7 days of ageing.

I. INTRODUCTION

Researchers are continuously looking for ways to maximize beef production efficiency, including genetic benefits due to crossbreeding. Meat from *Bos indicus* cattle is known not only to be inferior but also more variable in tenderness than cattle of *Bos taurus* origin (1)
The most relevant consequence of ageing is an improvement in meat tenderness (2). Ageing effect depends on the potential tenderness of the breed observed, in crossbred steers and heifers representing diverse breed types (0–62.5% Bos indicus) (3), Also, (4) found that breed (Continental breeds) significantly influenced the ageing process in cattle slaughtered at 450 kg live weight. The objective of the present research was to determine the influence of breed and ageing time (3, 7 and 14 days) on instrumental meat tenderness

II. MATERIALS AND METHODS

Instrumental meat tenderness were evaluated from 245 steers from Hereford pure breed and F1 crosses, breeding sires of Angus, Hereford, Salers and Nelore breed mated to Hereford dams. Steers were slaughter in a commercial packing plant at the same fat thickness, with a slaughter age of 730 ± 52 days. Stunning was performed with a captive bolt. Carcasses were suspended from the Achilles tendon and, 35 min on average after stunning, were chilled under commercial conditions at 4º C for 24 h. pH of each carcass was measured at 24 h postmortem on carcass lumbar region with a penetrating electrode (pH-meter Crison 507). *Longissimus thoracis* and *lumborum* muscle (between T10 and L6) was removed from the left half of the carcass and sliced into 3.5 cm thick samples and vacuum-packaged individually. Steaks were trimmed of all external fat and peripheral connective tissue and randomly assigned either to one of three postmortem aging periods (3, 7 or 14 d) stored at 2°C, and subsequently frozen at -27°C until further analyses were performed. Samples were cooked in a double boiler until it reaches a temperature in the thermal center of 70°C. The cooked steaks were cooled (2 to 4 h) until they had equilibrated to room temperature (approximately 21°C, monitored using a stainless steel meat thermometer). Six to eight cores (1.27 cm in diameter) were removed parallel to the muscle fiber orientation which were subjected to the shear force of a Warner Bratzler shear device with an Instron texturometer.
Univariate analysis of variance were performed, for genotype, ageing time and the interaction, using GLM (General Linear Models) Procedure of SAS statistical software version 9.1 (9).

III. RESULTS AND DISCUSSION

Least squares means of Shear Force for the three ageing period are presented in figure 1.

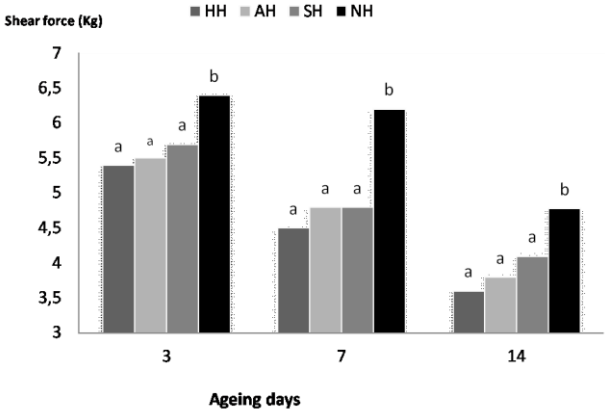

Figure 1. Meat shear force of the different genotypes during the postmortem ageing. a,b : different letters by ageing days differ p<0.05.

Shear force for different genotypes showed significant differences (p <0.05) for 3 days aged meat reaching values above 6.4 kg for NH crosses, differing from the others, who obtained 5.4kg values for HH, 5.54 kg for AH and 5.7 kg for SH crosses respectively.

As ageing time progresses at 7 days NH crosses remained the highest shear force values of 6.2 Kg differing from other crosses evaluated.

Beef produced by *Bos taurus* steers exhibited a much faster rate of postmortem tenderization from 3 to 7 d (17% *vs.* 3.2%). Significant interactions between biological type and length of aging that affected shear force values has been reported, with beef from *Bos taurus* breeds having a much faster rate of post mortem tenderization than *Bos indicus* types (5). The difference in shear force between *Bos taurus* and *Bos indicus* types, although significant, became less pronounced over longer aging periods (5) Similar results was found in animals 1/2 or 3/4 Brahman that showed a lower rate of ageing than Angus and 1/4 Brahman between 1 and 10 days postmortem (6). These results were confirmed by (7), which mentions that 5/8 Sahiwal crosses failed the tenderizing rate that achieving Hereford Angus crosses.

However, our rates were lower than those reported by (8) who found a decrease in SF of 18.1% and 26.0%, respectively, between 1 and 7 days of ageing in Brangus cattle. Consequently, shear force values were substantially lower (P < 0.05) for steaks from *Bos taurus* cattle at 3 d and remained lower (P < 0.05) at 7, and 14 d of aging. The slower rate of tenderization during the first 7 d postmortem for beef produced by *Bos indicus* steers likely was associated with its higher calpastatin activity (1, 5, 6, and 7).

At 14 days of ageing although a significant effect in reducing shear force was noted, NH crosses has a significant difference from the others, with values of 4.7 kg vs. 4.1 kg for SH crosses, 3.8 Kg for AH crosses and 3.6 kg for HH.

IV. CONCLUSION

These results suggest that steaks from Nelore crosses steers are less tender than Hereford, Angus and Salers crosses. Taking into account tenderness evolution during ageing, 14 days are required for meat of Nellore crosses to achieve shear force values, corresponding with a tender meat. Therefore, ageing is a valuable tool for reducing the differences in meat quality, making a more homogeneous product for the consumer, but the ageing period required must be differential depending on the cattle breed.

REFERENCES

1. Wheeler TL, Savell JW, Cross HR, Lunt DK, and Smith SB (1990) Mechanisms associated with the variation in tenderness of meat from Brahman and Hereford cattle. Journal of Animal Science 68, 4206–4220.

2. Johnston DJ, Robinson DL, Reverter A, Ferguson DM (2001) Sources of variation in mechanical shear force measures of tenderness in beef from tropically adapted genotypes, effects of data editing and their implications for genetic parameter estimation. Australian Journal of Experimental Agriculture 41, 991–996.

3. Shackelford, S. D., T. L. Wheeler, and M. Koohmaraie. 1995. Relationship between shear force and trained sensory panel tenderness ratings of 10 major muscles from Bos indicus and Bos taurus cattle. J. Anim. Sci. 73:3333–3340.

4. Campo, M. M., Sañudo, C., Panea, B., Albertí, P., & Santolaria, P. (1999). Breed type and ageing time effects on sensory characteristics of beef strip loin steaks. Meat Science, 51, 383–390

5. O'Connor, S. F., Tatum J D, Wulf D M, R D Green and G C Smith 1997 Genetic effects on beef tenderness in Bos indicus composite and Bos taurus cattle. J Anim. Sci. 75: 7 1822-1830

6. Johnston, D. D., Huffman, R. D. S. E. Williams and D. D. Hargrove. 1990. Effects of percentage Brahman and Angus breeding, age-season of feeding and slaughter end point on meat palatability and muscle characteristics. J. Anim. Sci. 68:1980–1986

7. Whipple, G., M. Koohmaraie, M. E. Dikeman, J. D. Crouse, M. C. Hunt, and R. D. Klemm. 1990. Evaluation of attributes that affect longissimus muscle tenderness in Bos taurus and Bos indicus cattle. J. Anim. Sci. 68:2716–2728.

8. Gonzalez, C.B.; Gallinger, M.M.; Pazos, A.A., and Lasta, J.A. (1997). Tenderness in beef longissimus dorsi of Hereford, Aberdeen Angus and Brahman cross-breed steers. In Proceedings 43rd ICOMST (pp 564-566) 27 July to 1 August. Auckland New Zealand.

9. SAS, 2000. SAS/STAT Users Guide, Version 8, First Edition, Volume 2. SAS Institute Inc., Cary, NC, USA.
.