RESISTANT PH DECLINE IS RELATED TO SLOWER RATE OF BEEF TENDERIZATION IN EXCITABLE *BOS INDICUS* CATTLE

Patricia Maloso Ramos[1*], Ana Claudia da Silva[2], Eduardo Francisquine Delgado[2] and Saulo Luz Silva[1]

[1]Department of Animal Science, College of Animal Science and Food Engineering, University of Sao Paulo, Pirassununga/SP, Brazil

[2]Department of Animal Science, "Luiz de Queiroz" College of Agriculture, University of Sao Paulo, Piracicaba/SP, Brazil

*Corresponding author: ramospm@usp.br

I. INTRODUCTION

Beef from *Bos taurus indicus* is linked to a slower rate of tenderization when compared to taurine cattle [1] but that animal type is broadly used in tropical areas, like Brazil. Also, despite the detrimental effect for tenderization observed in non-castrated cattle [2], it will produce heavier carcasses as a result of their natural anabolic testosterone. Testosterone also influences cattle temperament, and more excitable animals are related to inferior beef quality [3]. Since immunocastration can be beneficial for animal welfare and beef quality when compared to surgical castration [4], and the rate of tenderization is already limited by calpastatin in this type of cattle [5], it was hypothesised that excitable Nellore males, independently of gender, have slower rate of beef tenderization.

II. MATERIALS AND METHODS

All experimental procedures involving animal care were conducted in accordance with the Institutional Animal Care and Use Committee Guidelines of the College of Animal Science and Food Engineering at the University of Sao Paulo (6493190121). From a larger group of 72 Nellore males, a sub-group (n = 23) was selected based on temperament tests during the first handling (after animals were transferred from pasture and adapted to feedlot). Chute score and flight speed were determined and used to calculate temperament index [5]. The index was used to classify animals either as excitable or calm. Care was taken to select progenies from several bulls, as well as to represent two genders (non-castrated and immunocastrated). After slaughter, pH and temperature decline were measured (1, 3, 6, 9 and 24h *post mortem*) in the *Longissimus lumborum* (LL) muscle, where steaks were sampled, vacuum packaged and aged during four times *post mortem* (48, 192, 360 and 696 hours). Cooking loss and Warner-Bratzler shear force (WBSF; N) were determined. Data was analyzed as a factorial design [2 × 2; 2 genders (non-castrated or immunocastrated) and 2 temperaments (excitable or calm)], using a mixed model with random effect of slaughter date and fixed effects of gender (G), temperament (T), time *post mortem* (time), as well as its interactions. Time *post mortem* was considered a repeated measure.

III. RESULTS AND DISCUSSION

There was a interaction effect between temperament and time *post-mortem* for pH decline ($p = 0.067$); pH at 3h *post mortem* was higher in LL from excitable than calm animals (Figure 1A). Also, it was observed a gender effect for temperature decline ($p = 0.025$; Figure 1B). Cooking losses increased during time ($p = 0.07$) without impact from temperament, gender or interaction (Figure 2A). On the other hand, there was a interaction effect for WBSF (G × T × time: $p = 0.077$; Figure 2B). Taken together the resuts pointed that the resistance in pH decline observed in animals classified as excitable was related to less extented beef tenderization for this group. Beef from excitable animals showed tougher beef ($p < 0.05$) compared to calm immunocastrated animals after 696 hours *post mortem*.

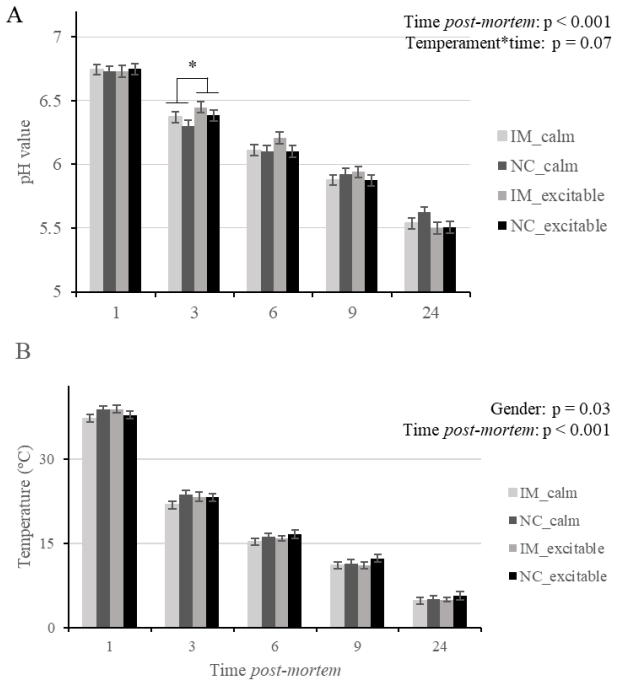

Figure 1. pH (A) and temperature (B) decline *post-mortem* in *Longissimus lumborum* muscle from Nellore males feedlot finished and divided according to gender (IM = imunocastrated; NC = non-castrated) and temperament. *p = 0.045.

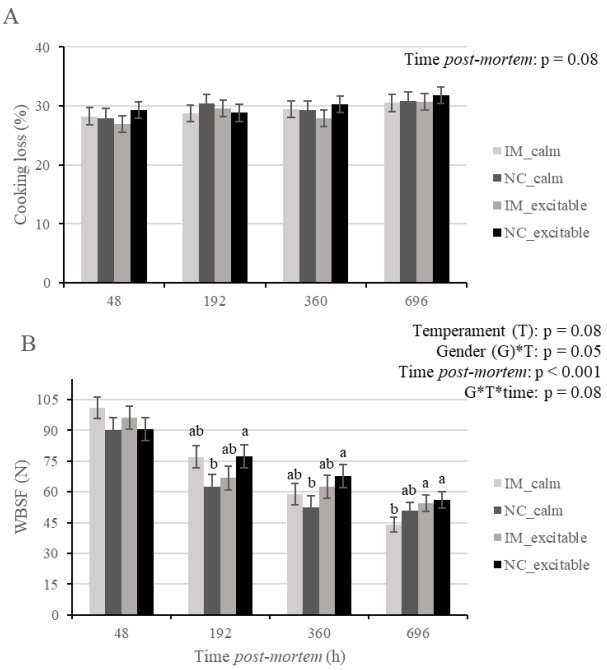

Figure 2. Cooking loss (A) and Warner-Bratzler shear force (B) in aged beef (*Longissimus lumborum* muscle) from Nellore males feedlot finished at and divided according to gender (IM = imunocastrated; NC = non-castrated) and temperament. [a,b]different letters within time indicate differences (p < 0.05).

IV. CONCLUSION

Nellore males classified as excitable would not benefit from immunocastration as well as calm animals. Therefore, temperament in Nellore cattle must be considered when adopting immunocastration and aiming for superior beef quality produced in tropical areas.

ACKNOWLEDGEMENTS

This work was partially supported by FAPESP (grant number 2020/08936-9) that also supported scholarship for the first author (grant number 2021/10205-5).

REFERENCES

1. Ramos, P.M., Wright, S.A., Delgado, E.F., van Santen, E., Johnson, D.D., Scheffler, J.M., Elzo, M.A., Carr, C.C. & Scheffler, T.L. (2020). Resistance to pH decline and slower calpain-1 autolysis are associated with higher energy availability early *postmortem* in *Bos taurus indicus* cattle. Meat Science 159: 107925.
2. Morgan, J.B., Wheeler, T.L., Koohmaraie, M., Savell, J.W. & Crouse, J.D. (1993). Meat tenderness and the calpain proteolytic system in Longissimus muscle of young bulls and steers. Journal of Animal Science 71: 1471-1476.
3. Sant'Anna, A.C., Valente, T.S., Magalhães, A.F.B., Espigolan, R., Ceballos, M.C., Albuquerque, L.G. & Paranhos da Costa, M.J.R. (2019). Relationships between temperament, meat quality, and carcass traits in Nellore cattle. Journal of Animal Science 97(12): 4721-4731.
4. Gómez, J.F.M., Saran Netto A., Antonelo, D.S., Silva, J., Sene, G.A., Silva,H. B., Dias, N.P., Leme, P.R. & Silva, S. L. (2017). Effects of immunocastration on the performance and meat quality traits of feedlot-finished Bos indicus (Nellore) cattle. Animal Production Science 59(1): 183-190.
5. Ramos, P.M., Santos-Donado, P.R., de Oliveira, G.M., Contreras-Castillo, C.J., Scheffler, T.L., Silva, S.L., Martello, L.S. & Delgado, E.F. (2022). Beef of Nellore cattle has limited tenderization despite pH decline in *Longissimus lumborum*. Scientia Agricola 79(3): e20200340.