# FASTER PRE *RIGOR* PH DECLINE IS ASSOCIATED TO GREATER MYOFIBRILLAR FRAGMENTATION IN *TRICEPS BRACHII* MUSCLE OF EXCITABLE *BOS INDICUS* CATTLE

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## I. INTRODUCTION

Beef from cattle with excitable temperament is associated with reduced quality. The stress responsiveness throughout production period can be aggravated before slaughter, when cattle is facing a great number of novelty. Stress can negatively influence Ca<sup>2+</sup>-dependent proteolysis of skeletal muscle [1], which could be worst in muscles with greater contribution of oxidative fibers. On the other hand, pH and temperature declines can be determinant of protease activation and dependent of cattle stress responsiveness. Therefore, the present study was conducted to verify the relationship between pH and temperature decline in the *Tricpes brachii* (TB) muscle with proteolysis in beef exposed to prolongued aging.

## II. MATERIALS AND METHODS

All experimental procedures involving animal care were conducted in accordance with the FZEA/USP Animal Care and Use Committee Guidelines (6493190121). From a group of 72 Nellore males, a subgroup of 23 was selected based on temperament tests. Chute score and flight speed were determined and used to calculate temperament index [2], that 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 (noncastrated and immunocastrated). The pH and temperature decline were recorded at 1, 3, 6, 9 and 24h *post mortem* in the TB muscle, which was excised from carcasses at 24h. Small pieces from the TB muscle were vaccum packaged and aged for 1, 7, 14 and 28 days. After each aging period the muscles were frozen using liquid nitrogen and stored to further myofibrillar fragmentation index (MFI) analysis [3]. The statistical model included the gender as a block, the fixed effect of temperament time, and interaction, with random effects of animal and slaughter. For pH and temperature the factorial design used was  $2 \times 5$ ; 2 temperaments (excitable or calm) and 5 times *postmortem*, while for MFI it was  $2 \times$ 4 aging periods. The mixed model was tested using SAS software and time/aging was considered a repeated measure.

# III. RESULTS AND DISCUSSION

The pH decline was affected by the interaction between temperament and time *post mortem* (P = 0.02). The pH in TB from calm animals showed greater values at 6 and 9h *post mortem* compared to pH in the TB from excitable cattle (Figure 1A). Additionally, the pH in TB from calm animals at 3 and 6h post mortem were similar. Temperature decline in the TB was affected (P < 0.001) by time *post mortem* (Figure 1B). The TB fragmentation index was affected by the interaction between temperament and aging period (Temperament × Time: P = 0.04; Figure 2). Fragmentation index in the TB from calm animals was similar at the initial aging period, but improved from 7 to 14 and from 14 to 28d. On the other hand, TB from excitable animals improved from 1 to 7, and from 7 to 28d of aging, with 14d showing intermediate values. At 7d of aging, MFI was greater in TB from excitable animals

when compared to calm animals, which was not expected. However, adrenergic stimulation of calcium pumps, at ATP expenses, may accelerate glycolysis [4]. Therefore, the faster pH decline in TB from excitable cattle positively contributed to early calpain-1 activation, once decreasing ATP concentrations and acidic conditions can lead to sarcoplasmic reticulum disfunction, increasing sarcoplasmic  $Ca^{2+}$  [5]. No differences were observed between MFI values at final period, with overall values of 103.6 ± 2.72.



brachii muscle from Nellore male classified as calm or excitable



Figure 2. Myofibrillar fragmentation index (MFI) in *Triceps brachii* muscle from Nellore male classified as calm or excitable and aged up to 28 days. \*Difference between temperament within aging period. <sup>a,c</sup>Difference during aging within calm temperament. <sup>x,z</sup>Difference during aging within excitable temperament.

## IV. CONCLUSION

Myofibrillar fragmentation index in the *Triceps* brachii muscle was influenced by cattle temperament and it is associated with rate of pH

decline. Faster pH decline was positively associated with earlier fragmentantion, which was verified in muscle from excitable animals.

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