P-10-17

Effect of slaughter criteria on postmortem metabolism and meat quality from crossbred Angus x Nellore cattle finished in grazing finishing system (#509)

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Introduction

Color and tenderness are the main meat quality traits evaluated by consumers at the time of purchasing and eating, respectively (Manni et al., 2018), and these traits are significantly determined by the extent and rate of postmortem pH decline (England et al., 2014). Meat with ultimate pH near 5.6 exhibits the most desirable quality traits, while ultimate pH ≥ 5.8 is usually referred to as dark cutting (Page, Wulf, & Schwotzer, 2001). Dark cutting is usually attributed to the lack of muscle glycogen, which is a necessary substrate for glycolysis and normal pH decline. In general, grazing animals are slaughtered later, and tend to be more susceptible in developing dark cutting and have tougher meat (Priolo, Micol, & Agabriel, 2001). In this sense, finishing system, time on feed, age, body weight at slaughter influence the postmortem metabolism, and consequently meat quality (Matthews, 2011). Therefore, this study was carried out to evaluate the effect of slaughter criteria on postmortem metabolism and meat quality from crossbred Angus x Nellore cattle finished in grazing finishing system.

Methods

Thirty-six Angus x Nellore steers (334±13 kg body weight [BW]; 12±1 mo old) were allocated in a continuous grazing finishing system (*Brachiaria brizantha* cv. *Marandu*), and supplemented with 0.5% of concentrate BW/head/day at the dry season. Treatments consisted of two slaughter criteria: 1) TF - animals were slaughtered with 140 days of feeding; 2) BW animals were slaughtered when reached 530 kg of BW (Table 1). At slaughter samples of the *Longissimus thoracis* (LT) were collected and immediately frozen in liquid nitrogen and kept at -80°C for lactate and pH analyzes. After 24h of chilling (0-2 °C) left half-carcass was divided between the 12th and 13th ribs, and a 2.5 cm thick sample of LT muscle was obtained to evaluate meat color (L*, a* and b*; CIE 1986), cooking loss and Warner-Bratzler shear force (WBSF; AMSA 2015). To simulate *in vitro* glycolysis, 12 LT samples of each treatment were randomly selected, grounded in liquid nitrogen and homogenized in a buffer as proposed by England et al. (2014) and aliquots were collected after 0, 30, 120, 240, 480, 720, and 1440 min. The pH samples were prepared using the iodoacetate method as described by Bendall (1973). Lactate analyses was performed according to the methodology proposed by Bergmeyer (1984) and modified to 96-well plates (Hammelman et al., 2003). Data of meat quality were analyzed by analysis of variance using the MIXED procedure of SAS 9.4 (SAS Institute Inc., Cary, NC) as a completely randomized design considering the slaughter criteria as a fixed effect. The pH and lactate data were evaluated as time-repeated measures, considering as fixed effect the slaughter criteria, time of measurement and their interaction. Means were obtained by the PROC LSMeans and considered statistically significant when $P \leq 0.05$.

Results

There was an interaction between slaughter criteria and time for pH ($P = 0.0357$; Figure 1) and lactate ($P < 0.0001$; Figure 2). The BW animals had higher pH values than TF, in all evaluated times ($P<0.05$), except for 1440 min, when they did not differ. In addition, BW animals had higher lactate concentrations at 30, 120 and 240 min ($P < 0.0001$) and tended to be higher in 480 min ($P = 0.0744$) when compared to TF animals, on the other hand, no differences were observed at 0 and 1440 min. Vestergaard et al. (2000) showed that animals in an extensive system with a higher BW showed a more glycolytic metabolism when compared to those slaughtered with a lower BW. According to Kim J. et al. (2013) increasing the proportion of fast-twitch glycolytic fibers in porcine *Longissimus* muscle has been shown to increase the rate and extent of postmortem pH decline. This may explain our pH results, in which BW animals were heavier and stayed longer in the finishing system, may have a slightly more glycolytic metabolism when compared to FT animals, leading to an increase in the rate and extent of postmortem pH decline. These differences may be attributed glycolytic flux, buffer capacity, glycolytic capacity and activity of glycolytic enzymes, which are factors controlling the rate and extent of postmortem metabolism (Matarneh et al., 2018). In addition, it can be suggested that glycogen was not a limiting factor for the decline of pH because the ultimate pH of the both slaughter criteria were below 5.8.

There was no effect of slaughter criteria on meat color and WBSF (Table 2). These results are in accordance with Frylinck et al (2013) and Sami et al (2004), who found no differences on meat quality of animals slaughtered with different time on feed in grazing system. According to Varman and Sutherland (1995), the age at slaughter of the grazing steers increases muscle myoglobin concentrations and the meat becomes darker. However, we

Notes

suggest that the lack of difference in the color in this study may be attributed to the age of the animals, which were slaughtered less than 23 months old.

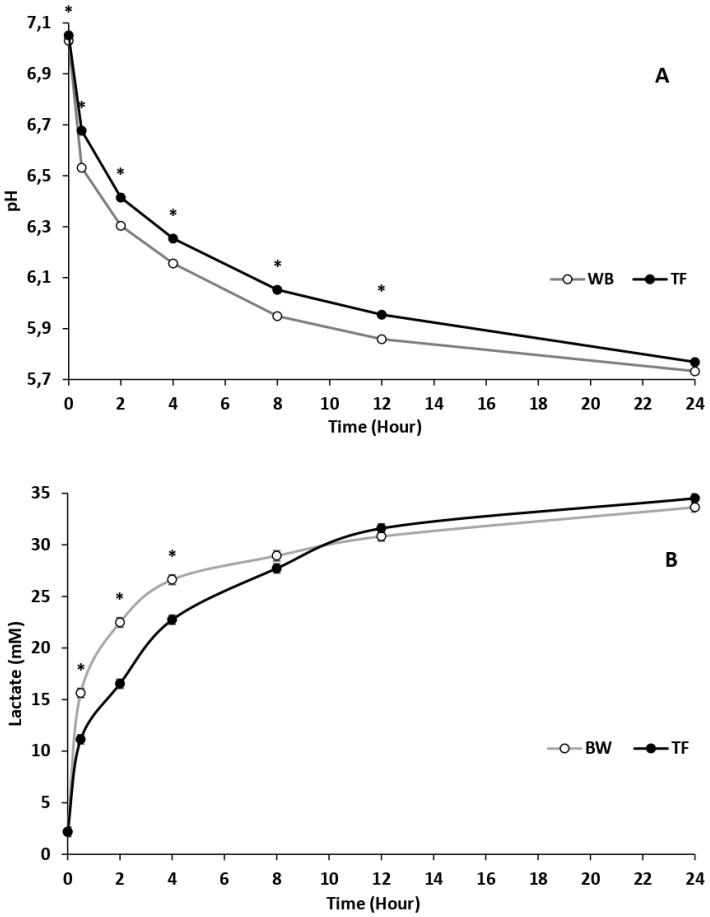

Fig 1– Effect of slaughter criteria on meat pH (A) and lactate (B) simulated by in vitro glycolysis
¹BW = 530 kg of body weight. ²TF = 140 d of feeding.

Conclusion

Animals slaughtered based on body weight criteria have higher rate and extent of pH decline, but this does not affect meat color and tenderness of castrated Angus x Nellore males in grazing finishing system.

Notes

Trait	BW[1] (n=15)	TF[2] (n=18)
Age at slaughter, months	22±1	17±1
Time of feeding, d	283	140
Final body weight, kg	525±15.6	441±15.5

Table 1 – Characterization of treatments according age, time of feeding and final body weight.
[1]BW = 530 kg of body weight.
[2]TF = 140 d of feeding.

Trait	BW[1] (n=15)	TF[2] (n=18)	*P*-value
L*	34.8±0.53	35.1±0.48	0.6884
a*	16.5±0.36	16.1±0.33	0.3776
b*	12.3±0.32	12.5±0.29	0.6654
WBSF, N	81.8±3.39	84.1±3.14	0.5802
Cooking loss, %	27.0±0.71	27.7±0.65	0.5020

Table 2 – Effect of slaughter criteria on meat color, cooking loss and Warner-Bratzler shear force
WBSF = Warner-Bratzler shear force.
[1]BW = 530 kg of body weight. [2]TF = 140 d of feeding.

Notes