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Effect of finishing system and weight gain rate on meat quality from crossbred Angus x Nellore steers (#61)

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Introduction

Manipulating growth rate could be a strategy to improve meat quality (Manni, 2018). Feedlot animals have a higher weight gain rate (WGR) and are slaughtered earlier when compared to the grazing animals (Maday, 2016), which promotes a shift towards to a more glycolytic muscle fiber in those animals when compared to those finished in grazing (Frylinck et al., 2013). In this sense, grazing animals tend to be more susceptible to have dark-cutting and tough meat (Nuernberg et al., 2005; Frylinck et al., 2013), since animals with an oxidative metabolism have lower glycogen and greater myoglobin concentrations and, consequently, darker meat than those with a glycolytic metabolism (Bidner et al., 1986; McKeith et al., 2016).

In general, the finishing system (FS) and the WGR seems to modify the muscle type fiber and its metabolism, which consequently affects the meat quality (Frylinck et al., 2013; McKeith et al., 2016). However, it is unclear which factor directly impact on meat quality, since within each FS animals slaughtered at constant age have different weights and those slaughtered at constant weight have different ages. We hypothesized that the weight gain rate (WGR) is responsible for differences on meat quality between feedlot and grazing animals. Therefore, this study was carried out to evaluate the effect of FS and WGR on meat quality from crossbred Angus x Nellore steers slaughtered at same age.

Methods

Thirty-six Angus x Nellore steers (341±23 kg body weight; 12±1 mo old) were used in a completely randomized design with a 2 x 2 factorial arrangement and 9 animals per treatment to evaluate the effects of FS (grazing or feedlot) and WGR (high or low). The WGR was controlled by the feed restriction and stocking rate in feedlot and grazing system, respectively. Animals were slaughtered at 140 d of feeding, and after 24-h of chilling (0 – 2 °C, the left half-carcass was divided into the region between the 12th and 13th ribs, where a 2.5 cm thick samples of *Longissimus thoracis* muscle was obtained and vacuum packed individually to evaluate meat color (L*, a* and b*; CIE, 1986), cooking loss and Warner-Bratzler shear force (WBSF) (AMSA, 2015). Data were analyzed by a variance analysis using PROC MIXED from SAS 9.4 software (SAS Institute Inc., Cary, NC). The effect of FS (grazing or feedlot), WGR (high or low) and their interactions were considered as fixed effect, and each animal was considered an experimental unit. Means were obtained by the PROC LSMeans and were compared using Student's t-test. Differences were considered statistically significant when $P \leq 0.05$.

Results

Despite of animals had different WGRs and, consequently, different body weights at slaughter in feedlot and grazing systems (Table 1), there was no interaction between FS and WGR for any meat quality attributes evaluated (Table 2). Thus, it suggests that other factors (diet, age at slaughter, physical activity, among others) within the FS may be responsible for the differences on meat quality from feedlot and grazing animals.

Meat from feedlot animals had greater values of L* ($P < 0.0001$), a* ($P = 0.0128$) and b* ($P = 0.0041$), and lesser values of WBSF ($P = 0.0001$) in comparison with those from grazing animals, without affecting cooking loss ($P = 0.2833$). Those results suggest that meat from feedlot animals had a more glycolytic postmortem metabolism when compared to those from grazing animals, which led to a brighter red meat in those animals, as reported by Vestergaard et al. (2000) and Frylinck et al. (2013). In addition, a glycolytic metabolism also can favor the calpain activity and, consequently, affect the extent of protein degradation (Ouali & Talmant, 1990), which may explain the lesser WBSF in feedlot animals found in the present study. Similarly, Nuernberg et al. (2005) and Frylinck et al. (2013) also reported that grazing animals have tougher meat when compared to the feedlot animals.

On the other hand, there was no effect of WGR on meat quality attributes ($P > 0.05$). Sinclair et al. (2001) suggested that there are limited possibilities to improve beef eating quality by modifying growth rate through diet. Therefore, the lack of effect on meat quality suggests that there was no change in muscle metabolism due to the WGR in animals slaughtered at 140 d on feed. Similarly, Perry & Thompson (2005) reported there was no clear relationship between WGR and WBSF. In addition, Thirkildsen et al. (2002) found no relationship between WGR and the activity of calpastatin, µ-calpain or m-calpain, concluding that WGR does not affect the proteolysis.

Conclusion

The WGR is not the factor responsible for the difference in meat color and tenderness from crossbred Angus x Nellore steers slaughtered at same age in different FS. In addition, FS impacts on meat color and tenderness whereas WGR has no effect on meat quality.

Notes

Trait	Finishing system (FS)		Weight gain rate (WGR)		*P*-value		
	Feedlot	Grazing	High	Low	FS	WGR	FS*WGR
L*	39.6±0.63	35.1±0.53	37.9±0.59	36.8±0.57	<0.0001	0.1915	0.5690
a*	17.3±0.35	16.1±0.30	16.9±0.33	16.5±0.32	0.0128	0.3318	0.6219
b*	13.9±0.35	12.5±0.29	13.5±0.33	12.9±0.32	0.0041	0.1836	0.7666
Cooking loss, %	26.6±0.72	27.7±0.61	26.8±0.68	27.5±0.65	0.2833	0.4874	0.1382
WBSF, N	66.4±3.01	84.1±2.55	74.5±2.85	76.1±2.73	0.0001	0.6800	0.2861

Table 2 – Effect of finishing system and weight gain rate on meat quality from crossbred steers
WBSF = Warner-Bratzler shear force.

Trait	Feedlot		Grazing	
	High	Low	High	Low
Average daily gain, kg/d	1.58±0.20	0.85±0.10	0.91±0.05	0.60±0.04
Final body weight, kg	582±46	456±36	463±18	419±17

Table 1. Characterization of experimental treatments.

Notes