Live weight, carcass dressing percentage and meat pH according of bovine sexual type and solid fasting

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ABSTRACT – This study was developed aiming to evaluate the influence of sexual type and solid fasting pre-boarding in the live weight (LW) carcass dressing percentage (DP), as well as in the digestive tract size and meat pH. In a total of 197 Nellore cattle from farms located in northern of Mato Grosso, Brazil, categorized according to sex type: bulls, steers, heifer and cow were evaluated, which were submitted to handling with and without pre-boarding overnight solid fasting on farm, totaling approximately 40 and 23 hours of fasting, respectively, and transported by average of 79.5 km to bovine slaughterhouse. At pre-fasting weighing on average, bulls, steers and cows did not differ themselves (P≥0.05), but were superiority of heifers (P<0.05); in the boarding and slaughter weights there was no difference (P≥0.05) between bulls and steers, being these more heavier weight than the cows, and cows more than the heifers (P<0.05). After solid fasting overnight, at boarding weight, animals submitted to fasting were weighing less than non-submitted, 469.0 and 484.3 kg, respectively, however, at slaughter, the average of live weight, hot carcass and mainly DP were similar (P≥0.05), confirming that solid fasting on farm is unnecessary and unjustifiable animal handling.

I. INTRODUCTION

The animal phenotypic diversity is correlated with the interaction between genetic and the environment in which the animal is inserted. Thus, animal breed, crosses, sex type, nutrition strategy, pre-slaughter handling and growth stage (weight and age) are traits, which may influence carcass composition and/or meat quality [1].

Carcass dressing percentage (DP) is defined as the percentage of the hot carcass weight (HCW) to animal live weight (LW), obtained before slaughter. Technical discussions between farmers and meat industry occur, in that farmers argue that low DP are related to extensive and unnecessary carcass cleanups trimming and/or problems in the weighing [2], while the industry argue against that are due to errors in the farm weighing and/or that animals with different genetic, sex, age, nutrition status and carcass fat cover have different DP.

According to Sainz (3), the DP depends on muscle contents and its relation to bone and fat content, being that, DP increases with better animal muscularity and decreases with high fat content, as well as, with increment of visceral proportion, which corresponds mainly to the digestive tract, which can range from 8 to 18% of LW. The same author adds that the DP will determine the financial return to farmer and to industry as well, as it is related to the amount of marketable meat.

The muscle:fat relation is the most variable carcass component and it the most influence on DP. Additionally, Coutinho Filho *el at* (2) mentioned diet type, animal age, sex and breed with the potential to change the DP; they further explain that pre-slaughter handling, water access, feed fasting time, increase or decrease the DP. Thus, this study aimed to evaluate the influence of sexual type and solid fasting pre-boarding in the live weight, carcass dressing percentage, as well as in the digestive tract size and meat pH.

II. MATERIALS AND METHODS

The experiment was conducted in a bovine slaughterhouse, registered on Federal Inspection Service (number 3348) in Sinop city, Mato Grosso, Brazil. In a total of 197 Nellore cattle from farms located in northern of Mato Grosso were evaluated, that were transported by landed and asphalted road overall average of 79.5 km and a bulk density average of 369.83 kg/m². The animals were categorized according to sex type: bulls (non-castrated male), steers (castrated male), heifer (young female) and cow (old female), and

submitted to handling with and without pre-boarding overnight solid fasting on farm, totaling approximately 40 and 23 hours of fasting, respectively.

The effect of solid fasting pre-boarding was verified through three weighings: PRE-FASTING: the animals were individually indentified and weighed on the day preceding the boarding, and randomly separated into two groups, one feeding *ad libitum* and another with restricted solid overnight (group with solid fasting); INBORDING: immediately before shipping the animals were weighed again on the calibrated farm scales; SLAUGHTER: after transport and waiting 16±2 hours in the slaughterhouse pens, the animals were weighed again, in one calibrated scale installed immediately before the stunning box.

At all time, except during the transport, water was available for both groups, and in the slaughterhouse the animals were kept in the pens with density of 2.5 m^2/animal, with water sprinkler system for thermal comfort, and all slaughter procedure was developed by industry with approving of Federal Inspection.

At evisceration moment, the unclean gastrointestinal tract (GI: rumen, reticulum, omasum, abomasum, small intestine, large intestine and anus) was weighted too. All weights were performed individually, maintaining reciprocity among LW, HCW and TGI. After 24 h of carcass chilling (0±2°C) the muscle *Longissumus* pH was measured between the 12th and 13th rib.

The experiment was conducted with a completely randomized design in a split-plot design, considering the sexual type of plot and solid fasting as sub-plot. All data was analyzed using the PROC MIXED of Statistical Analysis System - SAS 9.0 (4), with random effect attributed to the animal, and 0.05 was adopted as the tolerable upper limit for Type I errors.

III. RESULTS AND DISCUSSION

At pre-fasting weighing showed in Table 1, on average, bulls, steers and cows did not differ themselves ($P \geq 0.05$), but superiority of heifers weight ($P < 0.05$). In the boarding and slaughter weights there was no difference ($P \geq 0.05$) between bulls and steers, but there was difference ($P < 0.05$) between heifers and cows. Males always had heavy weights than females, because, males have more muscle tissue than females, as a result of the presence of steroid hormones that promote great influence on the growth of animals [5].

The average cow GI weight was 57.52 kg and showed higher ($P < 0.05$) than the other animals tested, and consequently reflected in the highest proportion of GI:HCW, which possibly can be explained by the lower HCW/Slaughter (54.5%) when compared to 56.3, 56.0 and 55.6% of bulls, steers and heifers, respectively and without difference themselves. In accordance to Vaz et al (6), adult females GI have the highest capacity of food intake because of body maintenance, weight gain, gestation and lactation requirements.

Table 1. Means of Nellore live weight obtained at pre-fasting, boarding and slaughter, hot carcass weight, gastrointestinal tract weight, beef pH, according to sexual type and solid fasting pre-boarding

Parameter[1]	Sexual Type				Solid Fasting		*P*		
	Bulls	Steers	Heifers	Cows	Fasting	Non-fasting			
Number	72	31	60	34	89	108	--	--	--
Pre-fasting weight, kg	516.80a	530.75a	438.90b	529.67a	501.18	498.08	0.405	0.001	0.199
Boarding weight, kg	502.29a	501.76a	422.88c	479.76b	484.34a	469.00b	0.020	0.001	0.071
Slaughter weight, kg	487.40a	485.79a	394.36c	455.88b	459.53	452.18	0.239	0.001	0.334
Hot carcass weight, kg	274.25a	272.35a	219.41c	248.34b	255.86	251.31	0.210	0.001	0.587
Digestive tract, kg	42.39b	34.65c	42.46b	57.52a	44.16	44.35	0.871	0.001	0.064
Digestive tract:HCW, %	15.44c	12.77d	19.56b	23.37a	17.53	18.04	0.299	0.001	0.395
Meat pH	5.81	5.73	5.77	5.79	5.78	5.77	0.589	0.317	0.621
HCW: Pre-fasting weight, %	53.13	51.30	49.96	46.87	51.00	50.42	0.075	0.001	0.001
HCW:Boarding weight, %	54.63	54.27	51.89	51.82	53.09	53.52	0.103	0.001	0.012
HCW:Slaugther weight, %	56.30a	56.04a	55.61a	54.50b	55.69	55.54	0.606	0.001	0.342

Means in the same row in the same variation source, with different lower letters, are different ($P < 0.05$).

[1]HCW – hot carcass weight

Regarding solid fasting, at pre-fasting weight, no difference (P≥ 0.05) was observed, in order that all animals originally belonged to the same group, just randomly distributed, but after solid fasting overnight, at boarding weight, animals submitted to fasting were weighing less than non-submitted, 469.0 and 484.3 kg, respectively. However, at slaughter, the average of LW, HCW, GI, GI:HCW, pH 24 hours and mainly DP using the slaughter weight (HCW:Slaughter) were similar (P≥0.05), being that there was an interaction between sex type and fasting solid handling to DP using pre-fasting and boarding weights.

Because none difference were observed in the HCW, GI:HCW and mainly DP, using the live weight as slaughter, with solid fasting on farm, demonstrating that the adoption of this handling is laborious and absolutely unnecessary. There were no impact on the meat pH (Table 1), possibly due to a continuous volatile fatty acids production in the rumen during fasting conditions[7], that help to keep the muscle glycogen reserve; but, solid fasting on farm could cause high levels of stress to the animal[8].

The meat final pH is affected by the metabolism of glucose and lactate lactic acid and reduction of pH is one of the most important requirements for transforming muscle in meat. The final average pH was 5.77, in the range between 5.40 and 5.80 that is considered adequate by Mach et al (9).

The interaction (Table 2) between sex type and solid fasting to HCW:Pre-fasting weight demonstrated that DP was highest for bulls and lowest for cows, with intermediate values for steers and heifers; and to HCW:Boarding weight, defined that DP was highest for male and lowest for females, probably because of hormone status as previous discussed.

Table 2. Interaction between solid fasting and sexual type

HCW[1]:Pre-fasting weight				
	Bull	Steer	Heifer	Cow
Non-Fasting	52.17^{Aa}	51.32^{Ab}	50.12^{Ab}	47.33^{Ac}
Fasting	51.48^{Aa}	51.28^{Aa}	48.91^{Bb}	46.40^{Ac}
HCW[1]:Boarding weight				
	Bull	Steer	Heifer	Cow
Non-Fasting	54.79^{Aa}	54.23^{Aa}	51.02^{Bb}	51.12^{Ab}
Fasting	54.48^{Aa}	54.31^{Aa}	52.76^{Ab}	52.53^{Ab}

Means in the same column, with different capital letters are different (P<0.05).

Means in the same row, with different lower letters are different (P<0.05).

[1]HCW – hot carcass weight

About the use of solid fasting revealed effect (P<0.05) just in heifers to DP using the pre-fasting and boarding weight, with values of 51.02 and 52.76% to non-fasting and fasting, respectively to HCW:Boarding weight. DP is an important feature for the farms and industry, because is directly associated to market price, and it is influenced by several factors, among them, the handling adopted in the farm [10], which in this study demonstrated influence only for heifers, but no difference when considering the live weight at slaughter (HCW:Slaughter weight). One factor that influenced the difference in heifers DP is associated with high levels of endogenous hormones and more stress of this animals, on this account, older and castrated animals tend to be slower or more calm [11], being less impacted by solid fasting tested.

IV. CONCLUSION

Males and heifers had the highest carcass dressing percentage when compared to cows; and solid fasting on farm did not increased the carcass dressing using the live weight obtained at slaughter moment, therefore it is an unnecessary and unjustifiable animal handling.

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