

The effect of reactivity of Nellore cattle in some meat quality traits

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Abstract— The study examined the possibility to identify individual differences in behaviour of Nellore cattle and the implications in meat quality traits. A total of 76 Nellore cattle, aged 24 months were observed. The reactivity of the animals were evaluated by breathing, (1=imperceptible, 2=rhythmic perceptible, 3=perceptible with gasp), locomotion in the balance (1=stopped, 2=slow locomotion, 3 = fast locomotion) and flight speed (1=stagnant, 2=slow speed, 3=fast speed). After slaughter, carcass pH at 1 and 24 hours was measured. Following, three *Longissimus dorsi* muscle samples of 2.5 cm thickness were collected from between 12th and 13th ribs for analysis of tenderness at 1st, 7th and 14th days *post mortem*. Statistical analysis were performed utilizing the MIXED procedure of SAS, considering a model with pH (1h and 24h), Warner Bratzler Shear Forces, at 1st, 7th and 14th days *post mortem* as dependent variables and sexual condition (C=intact and castrated) and the reactivity traits as independent variables. The means and standard deviations for pH at 1 and 24 hours were 6.68 ± 0.17 , 5.57 ± 0.16 , respectively. For meat tenderness at 1st, 7th and 14th days *post mortem* were 8.76 ± 1.66 , 7.70 ± 1.39 , 6.43 ± 1.16 kgf, respectively. Analysis demonstrated that there were not significant effects for breathing and locomotion. However were observed significant effect for flight speed influenced in meat tenderness at 7 days ($P < 0.07$) and 14 days ($P < 0.10$). The inclusion of neuroendocrine traits will help to elucidate the biological mechanisms involved individual differences in reactivity.

Keywords— behavioral test, flight speed, shear force

I. INTRODUCTION

In livestock the temperament inter individuals variation at behavioural of animals has received greater interest in recent years due to the connection

between excitability, animal physiology, growth performance and meat quality [1,2]. Moreover because the routine work with beef cattle include handle and diverse measures such as weighting that require docile animals.

Temperament studies with Nellore cattle are very important to livestock in Brazil due to the large participation of that breed in the Brazilian beef cattle industry (around 80% of the herd) and it is known that bad temperament has been considered a problem for zebu breeds, such as Nellore [3].

Overall, stress and stressful response elicited from temperament animals promote economic implications. In meat quality can result in higher ultimate pH or faster early *post mortem* pH decline with consequent dark cutting condition [4,5]. Selection for improved temperament can facilitate human work (handler) and animal welfare benefits.

The objective of this study was to evaluate individual differences in behavior of Nellore cattle and the implications in meat quality traits.

II. MATERIAL AND METHODS

A. Animals

The experiment was conducted at College of Animal Science and Food Engineering. Seventy-nine animals (39 steers and 40 young bulls, 24-month old) of Nellore brand were feedlot finished and slaughtered in accordance with Brazilian legislation.

B. Behavioural tests

Temperament was scored while standard management practices were applied to the animals. The method utilized were quantitative observations

based in scores adapted from Hearnshan and Morris (1984)⁶. During processing just one observer assessed the temperament of each animal. The reactivity of the animals were evaluated by breathing (1 = imperceptible, 2 = rhythmic perceptible, 3 = perceptible with gasp), locomotion in the balance (1 = stopped, 2 = slow locomotion, 3 = fast locomotion) and flight speed (1 = stagnant, 2 = slow speed, 2 = fast speed).

C. Post slaughter measurements

The slaughter was performed following humanity standard procedures at a local slaughterhouse. The pH and temperature of carcass were measured at 1 and 24 hours *post mortem*. Carcasses were split, weighed and then chilled at 0-2°C before processing on the following day after slaughter. At 24 hours *post mortem*, 4 beefs of 2.5 cm each were removed from *Longissimus dorsi* (LD) muscle at 12th rib toward cranial. The beefs were vacuum packaged and kept at 2-4°C for until 14 days for subsequent Warner-Bratzler Shear Force (WBSF) determination. At 1st, 7th and 14th days, the samples was removed of cold chamber and cooked in electric broiler cookery to an internal temperature of 40°C, flipped, and cooked to a final internal temperature of 71°C. Steaks were stored overnight at 8°C, subsequently eight 1.27-cm-diameter cores were removed from each steak parallel to the fiber direction. Each core was sheared once perpendicular to the muscle fibers using the WBSF equipment with a crosshead speed of 250 mm/min.

D. Statistical analysis

Statistical analysis were performed utilized the MIXED procedure of SAS, considering a model with pH (1h and 24h), Warner Bratzler Shear Forces, at 1st, 7th or 14th days *post mortem* as dependent variables and sexual condition (C=intact and castrated) and the reactivity traits as independent variables.

III. RESULTS AND DISCUSSION

The estimative of means, standard deviation, minimum and maximum measurements recorded for meat quality are presented in Table 1. The means shear force demonstrated that meat was becomes tender during *post mortem* storage days at 4°C, as expected.

Table 1 Means, Standard Deviation (SD), minimum and maximum observations of measurements for meat quality in Nellore cattle.

Variable ¹	n	Mean	SD	Minimum	Maximum
pH 1h	78	6.68	0.17	6.27	7.06
pH 24h	79	5.57	0.16	5.32	6.12
WBSF_0d (kg)	79	8.76	1.66	4.27	12.43
WBSF_7d (kg)	79	7.70	1.39	4.61	10.32
WBSF_14d (kg)	79	6.43	1.16	3.63	9.90

¹ WBSF = Warner-Bratzler Shear Force measured at 0, 7 and 14 days *post mortem*; pH 1h and 24h = intramuscular pH obtained at 1 hour and 24 hour *post mortem*.

The frequency distribution of individuals for reactivity classes is showed at Table 2. The majority of animals presented calm behavioural for breathing and intermediate for locomotion and flight speedy.

Table 2 The frequency distribution of individuals for reactivity measured for score during weighting animals.

Category	Score	Frequency (%)
Breathing	1	77.2
	2	8.9
	3	13.9
Locomotion	1	24.0
	2	58.2
	3	17.7
Flight Speed	1	2.5
	2	69.6
	3	27.8

Statistical analyses demonstrated no significant effects for breathing and locomotion within dependent variables (pH and shear force). However it was observed that flight speedy can influence tenderness at 7th day ($P<0,07$) and 14th day ($p<0,1$) of aging. Animals faster (score 3) presented shear force values decreased (beefs more tender). Figure 1 illustrates this relationship graphically showing that calves exiting faster possessed a significant lower WBSF than their faster counterparts. These results

could be an indicator that cattle more susceptible to stress stay stopped, without reaction to flee from the source of the distress. However, Hall et al. (2011)² found negative correlation between exit velocity and WBSF at 14th days *post mortem* indicating that faster exiting animals have WBSF values increased.

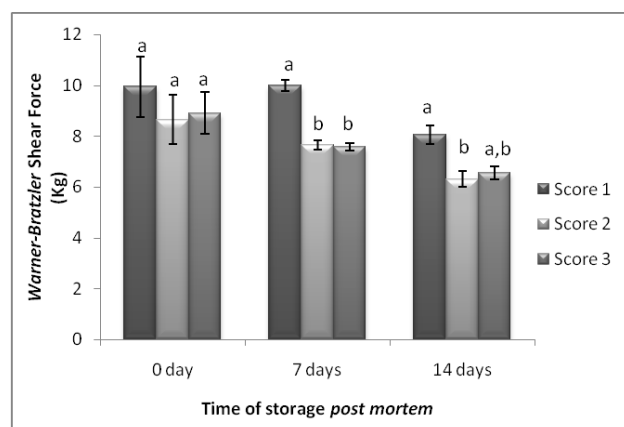


Fig. 1 Means (\pm SD) of Warner-Bratzler Shear Force (Kg) for different flight-speed scores within each time of meat aging.

IV. CONCLUSION

In conclusion, it is difficult to evaluate behavioural animal to predicted meat quality. The inclusion of neuroendocrine traits will help to elucidate the biological mechanisms involved individual differences in reactivity.

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