PE1.70 Study of carcass traits variability and beef quality in Nellore steers. 437.00

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Abstract—The present study had as objective to estimate the genetic variability of carcass and beef quality of Nellore steers. Progeny of 54 Nellore sires were evaluated, totaling 475 Nellore steers. Animals were reared in pastures until 18 to 20 month of age and, then, fed in feedlots with medium energy level diets of corn silage and supplements and slaughtered with a middle live weight of 550 kg, around 24 months of age. At slaughter individual hot carcass weights (HCW) were taken and, after 24 hours of chilling, pH (pH24), rib-eye area (REA), backfat thickness (BFT) and marbling scores (MAR) at Longissimus muscle were measured. Shear force measurements were taken after 7 days (SF7) and 14 days (SF14) of ageing. BFT influenced linearly MAR, SF7, SF14 (P<0.05). Age at slaughter (ASL) presented linear effect with MAR (P<0.05). Also, linear relationship between pH24 and SF7 (P<0.05) was detected. However, there were no effect of temperature when Warner-Bratzler Shear Force (TSF) was measured (P>0.05) on tenderness after 7 or 14 days of ageing. Is this research was found an important variability within Nellore steers, what shows the genetic potential of same sires for offspring production with better muscles and fat in the carcass and, also, tenderness suggesting a genetic influence of these traits in Nellore cattle.

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I. Introduction

BRAZIL is the first world supplier and the second world producer of beef, with a herd of 199 million of heads [5], where nearly 80% of them are heavily influenced by the Nellore (*Bos indicus*) breed. The tenderness differences between *Bos taurus* and *Bos indicus* have been studied for many years, trying to identify the physiological, biochemical and genetics aspects that promote this variability. Researches indicate that when the percentage of *Bos indicus* enhanced in a breeding, the tenderness decreases [14] and increases the tenderness variability [13].

In addition to tenderness, other carcass and meat traits seem to contain considerable variability in *Bos indicus*. Researches evaluating [6] crossbreeding of Brahman and Nellore with Angus breed, described a large variation in backfat thickness, rib-eye area and marbling between lineages within the families with the same proportion of *Bos indicus* genetic, where this variations were highest than the found between breeds. These differences, mainly related to marbling, suggested the genetic selection for these traits within the Nellore and Brahman breeds, because set the concept that *Bos indicus* have less capacity than *Bos taurus* breeds of add marbling in crossbreeding systems [7].

Furthermore, when beef quality variations are studied within a specie or breed, it should be consider the sire variability in the same breed [3], for the reason that variability can be related to genetic and physiologic aspects, varying with feeding type, sex, handling, age and kinship of the animal. Reports in the literature [12] describe that sires within a breed or breeding, when classified in relation to the major differences, can show more variability that founded between breeds, suggesting that sire selection within breeds should be used. Studies evaluating Nellore cattle [9], reported that carcasses of this breed have large variability and these variations could be related to the genetic differences between sires in this same breed. The present study had as objective to estimate the genetic variability between steers of Nellore referred to carcass and beef quality.

II. MATERIALS AND METHODS

All procedures involving animals described in this work were conducted according to the Institutional Animal Care and Use Committee Guidelines of the College of Animal Science and Food Engineering of the University of Sao Paulo, Brazil.

A. Animals and Slaughter Procedures

Progeny of 54 Nellore sires were evaluated, totaling 475 Nellore steers, with ages between 21 and 28 months. Animals were selected for growth, reproduction and conformation scores traits. They were maintained in tropical pasture until 18 to 24 months, and fed after that with medium energy level diets of corn silage and supplements and slaughtered with live weights around 550 kg. The slaughter occurred in six batches, that were considered as contemporary groups of this study. All slaughters procedures were made in accordance to Humanitarian Slaughter Guidelines as required by Brazilian law.

B. Carcass measurements

At slaughter carcasses were identified, weighted for determination of hot carcass weight (HCW) and chilled for 2ºC during 24 hours, for measurement of the pH at Longissimus muscle (pH24).

Rib-eye area (REA) and backfat thickness (BFT) were collected between the 12ª and 13ª ribs, at *Longissimus dorsi* muscle. Marbling scores (MAR) were evaluated according to USDA Quality Grade standards (1999) [11] with six evaluation scales (Slight to Moderately Abundant) corresponding to numerical classes of 400 to 900 points, respectively, each one sub divided in three classes of 25, 50, 75 points.

C. Shear force measurements

Warner Bratzler Shear Force (WBSF) measurements were collected from two samples of the Longissimus muscle, vacuum packed and aged for 7 days (SF7) and 14 days (SF14) at 2°C. WBSF determinations were performed according to AMSA [1] recommendations and the temperature (TSF) of all samples were measured before the Warner Bratzler Shear Force measurements at 7 (TSF7) and 14 (TSF14) days of ageing.

D. Statistical Analysis

The statistical model considered a structure of a paternal half-sib with sire as random effect, besides the fixed effects of batches and slaughter age (ASL), pH24, BFT and TSF. For the variance analysis was utilized the PROC MIXED procedure of SAS [10], with level of 5% of significance.

III. RESULTS AND DISCUSSION

The descriptive statistics of the analyzed traits are presented at Table 1. BFT influenced linearly MAR, SF7 and SF14 ($P<0.05$). All the evaluated traits in this study were influenced by slaughter contemporary group ($P<0.05$). ASL presented linear effect on MAR ($P<0.05$). There was detected linear relationship between pH24 and SF7 ($P<0.05$), but no effect was detected of TSF on tenderness in all ages periods ($P>0.05$).

The differences among sires that have offspring with lower and higher values for the HCW and REA traits was 4.08kg and 3.68cm^2 , respectively, as presented in Figures 1 and 2.

Table 1 – Descriptive statistics of age of slaughter (ASL, kg), pH at 24 hours of chilling (pH24), hot carcass weight (HCW, kg), rib-eye area (REA, cm^2), backfat thickness (BFT, mm), marbling (MAR, units), temperature before the Warner Bratzler Shear Force measurements at 7 (TSF7, °C) and 14 days of ageing (TSF14, °C), shear force at 7 (SF7, kg) and 14 days (FC14, kg) of ageing, measured in Nellore steers.

Trait	n	Ave	Min	Max	CV (%)
ASL	466	738.1	656.0	826.0	5.0
pH24	446	5.9	5.5	6.4	3.2
HCW	449	289.0	261.5	325.5	4.5
REA	462	58.0	40.3	90.0	8.7
BFT	466	4.3	1.0	9.0	41.8
MAR	474	427.1	400.0	600.0	9.9
TSF7	425	18.3	14.8	21.9	7.2
TSF14	446	18.3	14.5	20.9	7.5
SF7	462	5.9	2.4	9.6	23.4
SF14	463	4.9	1.6	8.4	7.3

n = number of observations; Ave = average; Min = minimum value founded in each trait; Max = maximum value founded in each trait; CV = coefficient of variation

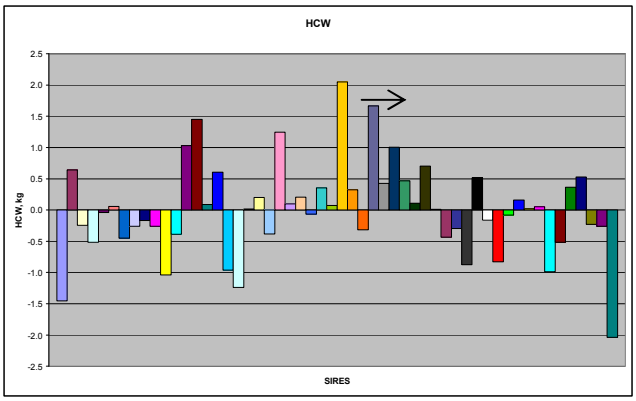

Figure 1 – Graphic representation of hot carcass weight (HCW) as a function of least squares of sires evaluated. The arrows indicate the sires with minimum and maximum value in this trait.

Thus, is evident the existence of variability within the Nellore breed on the genetic potential of some sires to improve muscle content on the carcasses and yield of commercial cuts of theirs offspring's. Same benefits can be enhanced by the selection for the muscles in the carcass and until others economic important traits like HCW and REA, which are great indicatives of carcass yield [2].

Same sires had positive values of BFT (Figure 3) and MAR (Figure 4), with a spread of approximately 2.5mm of BFT and 21 units of marbling scale between the sire with the lower and that one that obtained highest values in each of these traits.

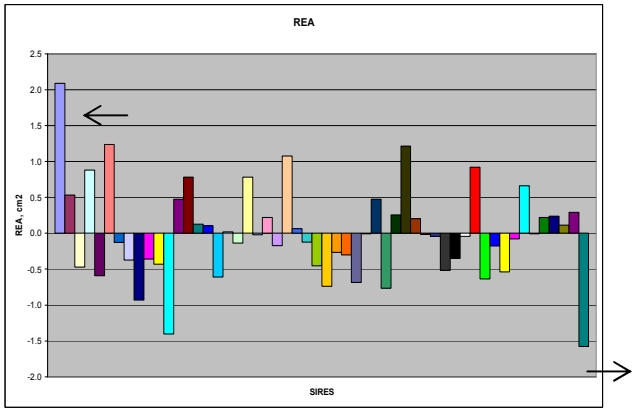

Figure 2 – Graphic representation of rib-eye area (REA) as a function of least squares of sires evaluated. The arrows indicate the sires with minimum and maximum value in this trait.

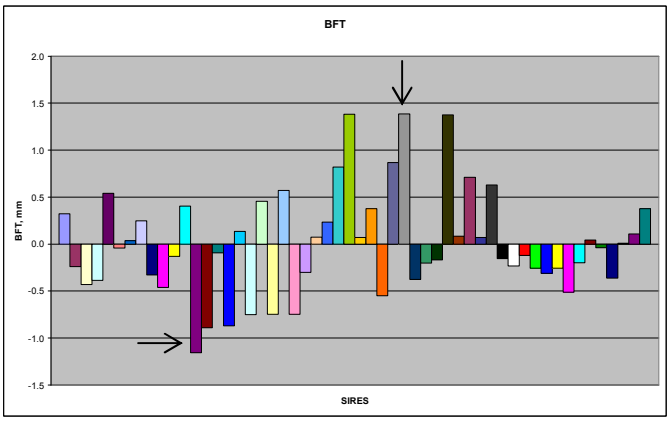

Figure 3 - Graphic representation of backfat thickness (BFT) as a function of least squares of sires evaluated. The arrows indicate the sires with minimum and maximum value in this trait.

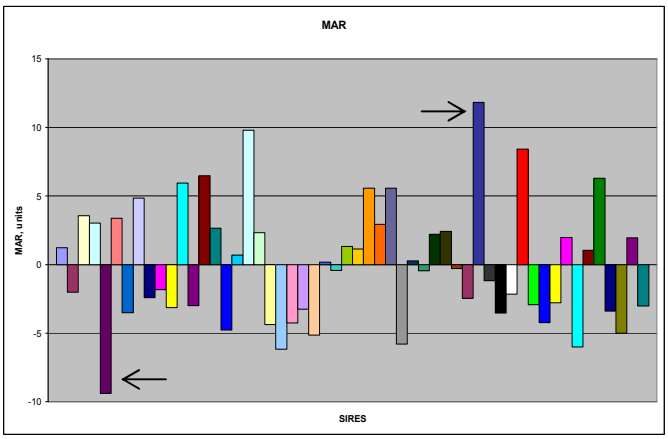

Figure 4 - Graphic representation of marbling (MAR) as a function of least squares of sires evaluated. The arrows indicate the sires with minimum and maximum value in this trait.

These spreads highlight that there are important differences among evaluated offspring sires and the animals that produce offspring with higher BFT and marbling should be selected.

This emphasize the importance of studies about the variability of fat depots in *Bos indicus* cattle, because this can elucidate the real potential of these breeds in add fat and marbling in their offspring's carcasses [4]. The variability detected among sires, for both BFT and MAR offered sufficient selection tools for carcass traits in Nellore cattle.

Statistically significant effects among sires were not detected for SF7 (P>0.05), but it was found variability between values of SF14 (P=0,06). However, is interesting to note that the difference between values of SF7 of sire that had offspring with less tender beef and the sire that had offspring

with more tender beef was 0.49kg (Figure 5), which may be considered an expressive value.

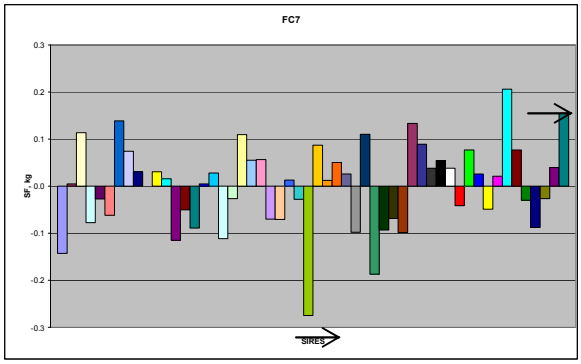

Figure 5 - Graphic representation of shear force at 7 days of ageing (SF7) as a function of least squares of sires evaluated. The arrows indicate the sires with minimum and maximum value in this trait.

The variability at 14 days of ageing became 0.57kg (Figure 6). In breeds that are adapted to the tropics, like Nellore, the effect of sire is the third largest source of tenderness variation of the Longissimus muscle, after the contemporary group and breed [8].

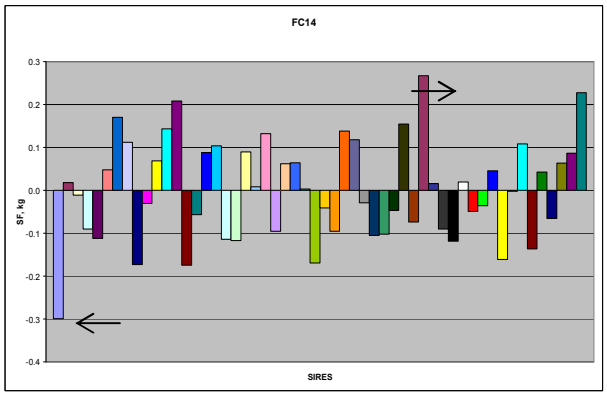

Figure 6 - Graphic representation of shear force at 14 days of ageing (SF14) as a function of least squares of sires evaluated. The arrows indicate the sires with minimum and maximum value in this trait.

It was possible to detect important differences among sires for offspring production with tender meat, suggesting a genetic influence of this trait in Nellore cattle. Considering that, one out of three kilograms of world marketed beef is of Brazilian beef and that ¾ of the Brazilian cattle herd has Nellore genetic influence, any improvement in beef tenderness of this breed, could have a great impact in the prices paid by the Brazilian beef.

IV. Conclusion

It could be verified that variability of carcass and meat quality in Nellore cattle exist. These traits can be included in animal breeding programs for the carcass and meat quality, resulting in expressive advances in Nellore herds selected for these traits.

Acknowledgement

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