EFFECT OF IMPORTANT ANCESTORS ON CARCASS AND MEAT QUALITY TRAITS OF NELLORE CATTLE

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Abstract – The Brazilian beef industry is responsible for a very important part of the country's agribusiness, which has a major influence in the world's beef trades. However, it is suffering pressures due to demands of consumers, environment issues, meat quality and sanitary standards. These factors make important productivity and efficiency of beef industry, focusing on consumers' demands. Several factors affect meat quality, ranging from animal-inherent traits such as breed and genetic heritage to pre and post-slaughter processes. This study investigated the influence of important Nellore base sires on carcass and meat quality traits. A total of 475 young bulls, progeny of 54 sires, were used to evaluate traits like hot carcass weight (HCW), ribeye area (REA), fat thickness (FT), marbling (MAR), color, drip loss (DL), cooking loss (CL) and shear force (FC) at 0, 7 and 14 days of ageing. Significant influence of sire ($P \leq 0.05$) was detected on REA, FT, MAR, DL and color at 14 of days of ageing. The results showed the use of bulls with high genetic merit for carcass and meat quality traits can provide important information to the establishment of lines specialized in improvement of carcass and meat quality traits in breeding programs of Nellore breed.

Key Words – *Bos indicus*, Fat thickness, Shear force

- INTRODUCTION

Beef quality standards can be defined as an interaction between color, visual appearance, tenderness, juiciness and flavor of the meat, and tenderness stands out as the main trait. Several factors can affect meat quality, including genetic, breed, sex, age and feeding and production systems, therefore, the proper handling of these factors should result in the production of high-quality beef. Genetic selection of animals helps in this process, either by choosing breeds that best suit production and market conditions or by selecting animals with genetic potential for the production of quality meat.

Nellore (*Bos indicus*) cattle are supposed to produce less tender meat when compared to *Bos taurus*. These differences have been the subject of research for several years, in order to determine the physiological, biochemical and genetic factors responsible for this variability [1,2]. Some authors argue that by increasing the percentage of *Bos indicus* in breeding programs decreases tenderness and increases the variability of this trait [1]. This variability can be attributed to the heterosis effects achieved in breeding and to the variation between bulls of the same breed regarding the genetic potential to produce tender meat. According to [3], bulls of the same breed, when classified in terms of major differences, may have greater variability than when different breeds are compared. Thus, it is expected to find in zebu cattle greater additive variability in traits of marbling, ribeye area, fat thickness and tenderness, suggesting, which allows, the selection of bulls within breeds for producting of high quality beef.

Brazil currently accounts for one third of the global beef exports [4] with production based on grazing systems and 90% of the Brazilian beef cattle is represented by Nellore herd [5]. Moreover, *Bos indicus* cattle in Brazil and India account for roughly 40% of the world beef cattle herd [6]. Therefore, strategies for genetic improvement for meat quality of Nellore breed can result in positive impacts on standardization and quality of Brazilian, African and Asian beef marketed worldwide.

This study investigated variability existence among Nellore sires for carcass traits and meat quality, giving subsidies to new research in this field and encouraging the selection of traits that may play an important role for Brazil to maintain the position earned in foreign markets as well as conquer markets that are more demanding by aggregating higher value to the Brazilian beef.

- MATERIALS AND METHODS

A total of 475 Nellore young bulls, aged between 21 and 28 months, born in the 2004 season, sired by 54 Nellore bulls were evaluated for carcass and meat quality traits.

Animals were kept, until 18 months of age, on pasture, and then placed in a feedlot and fed with a diet consisting of 70% corn silage and 30% of concentrate with 13% of crude protein and expected average daily gain of 1.3kg/animal/day. In the feedlot, the animals were divided into homogeneous lots for weight and sent for slaughter when they reached an average of 550 kg of body weight. Animals were slaughtered in six lots which were considered as contemporary groups, after an average fastening period of 12 hours with access to water in waiting pens.

At slaughter, the left side of each carcass were individually identified, weighed to obtain hot carcass weight (HCW) and chilled to 2°C for 24 hours. After the 24 hours of chilling, pH24 was measured in the *Longissimus* muscle as well as the ribeye area (REA), fat thickness (FT) and marbling score (MAR), at the 12th and 13th ribs cross section .
For measures of marbling (MAR) it was used the USDA's quality grade, with six scales, starting with "slight" (less marbled meat) up to "moderately abundant" (more marbled meat), which were converted into numerical values for the statistical analysis, starting at 400 points (slight) up to 900 points (moderately abundant).

For analyses of color, dripping loss (DL), cooking losses (CL) and shear force (SF), three samples of *Longissimus* muscle, 2.5 cm thick, were collected at the 12th, 11th and 10th ribs and aged for 7, 14 and 21 days, respectively. The samples were then identified, vacuum packaged and stored during the respective periods in a cold room with temperature set to 2°C.

Samples were taken out packages, placed them on aluminum trays and exposed to roomt temperature for 20 minutes. The sample color was determined by the average of three measurements at different points of each sample using a portable colorimeter model MiniScan XE, brand Hunter Lab, light source D65, observation angle of 10 degrees and cell open of 30 mm. The scale L*, a*, b* of CIELab system, where L* is the chroma associated with light (L*= 0, black; = 100, white), a* is the chroma varying from green (-) to red (+); and b*, varying from blue (-) to yellow (+), was used. From the values of a* and b*, chroma (C*) was determined according to [7], which is the intensity of one color, i.e., the quality that can distinguish dark and light colors, at the color saturation degree. It was also used Hue (H*) as a variable to distinguish names and families of colors and the result of the pulse differences and wave lengths that produce the color sensation in the retina.

Analyses of DL, CL and SF were performed following the standards recommended by [8]. Cooked samples were used to determine the shear force in eight cylindrical cores of 1.27 cm (½") of diameter using an electrical drill [9]. The shear was performed in a Warner Bratzler Shear Force. The value of shear force of each sample was represented by the arithmetic mean of the values of shear force obtained from the eight cores.

The statistical model used to detect variability among the bulls regarding the traits studied considered a structure with half-sibs with paternal bull as a random effect , in addition to appropriate fixed effects. This allowed estimating variance components associated with the bull effect and testing the estimated value of bull contribution using PROC MIXED of SAS statistical package [10].

- RESULTS AND DISCUSSION

The P values for the traits evaluated in this study are shown in Table 1. A critical analysis of that Table will show ancestor statistically significant effects ($P \leq 0.05$) on REA, FT, MAR, DL14, L* and H* at 7, 14 and 21 days of ageing. FT affected linearly MAR, SF7, SF14, DL14 and L* 14 ($P \leq 0.05$). All traits evaluated in this study, except CL7 and CL14, had the effect of slaughter batch ($P \leq 0.05$). Slaughter age had a linear effect only on traits of MAR ($P \leq 0.05$). The pH showed a linear effect ($P \leq 0.05$) with most of traits, except with SF14, SF21, CL7, DL14 and H*21. Temperature of sample shearing (TSS) had no effect on SF in any ageing period ($P \geq 0.05$).

Table 1 P values for effects of sire, slaughter batch (SB), slaughter age (AGE), pH at 24 hours of cooling (pH24), FT and TSS on HCW, pH at 24 hours of cooling (pH24), REA, FT, MAR and L* values (L*), Chroma (C*), Hue (H*), SF, DL and CL at 7, 14 and 21 days of ageing

Traits	Effects					
	Sire	SB	AGE	pH24	FT	TSS
HCW	0.19	<0.0001†	0.12	-	-	-
pH24	0.60	<0.0001†	0.77	-	0.95	-
REA	0.05†	<0.0001†	0.66	-	-	-
FT	<0.0001†	0.0002†	0.78	-	-	-
MAR	0.03†	<0.0001†	0.02†	-	<0.0001†	-
SF7	0.15	0.0366†	0.49	0.05†	0.02†	0.98
SF14	0.06	<0.0001†	0.67	0.08	0.04†	0.76
SF21	0.18	0.0040†	0.22	0.15	0.71	0.20
DL7	0.63	<0.0001†	0.76	0.02†	0.76	-
DL14	0.001†	<0.0001†	0.18	0.16	0.02†	-
DL21	0.14	<0.0001†	0.13	0.001†	0.13	-
CL7	0.68	0.6878	0.85	0.14	0.62	-
CL14	0.54	0.0866	0.97	0.04†	0.84	-
CL21	0.19	<0.0001†	0.27	0.02†	0.40	-
L*7	0.004†	<0.0001†	0.85	0.002†	0.86	-
L*14	0.002†	<0.0001†	0.61	0.0005†	0.05†	-
L*21	0.05†	<0.0001†	0.67	0.008†	0.54	-
C*7	0.81	<0.0001†	0.64	<0.0001†	0.82	-
C*14	0.42	<0.0001†	0.67	<0.0001†	0.36	-
C*21	0.11	0.0013†	0.56	<0.0001†	0.92	-
H*7	0.003†	<0.0001†	0.52	0.008†	0.23	-
H*14	0.02†	<0.0001†	0.71	0.03†	0.13	-
H*21	0.002†	<0.0001†	0.30	0.07	0.64	-

- CONCLUSION

There is variability among Nellore bulls to produce progeny with high carcass and meat quality. Information on hot carcass weight and ribeye area may be used in Nellore breeding programs to increase weight and amount of muscles, especially prime cuts, of the carcass. The use of Nellore bulls with high genetic value for intramuscular and subcutaneous fat in breeding programs of beef cattle can bring significant advances in meat quality of Nellore and, consequently, the Brazilian beef. These results can help Nellore breeding programs to identify genetic lineages for improved carcass and meat traits.

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