GENETIC PARAMETER ESTIMATES FOR CARCASS AND MEAT TRAITS IN NELLORE CATTLE

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Abstract – The objective of this work was to estimate genetic parameters for carcass and meat traits in Nellore. Data from 884 males for loin muscle area, backfat thickness, marbling and tenderness were used. The (co) variance components were estimated by restricted maximum likelihood. For all traits, records three standard deviations above or below the average of the contemporary groups (CG) and CG with less than 3 animals were deleted. The model included random effect of animal and CG as fixed effect and the age of the animal at slaughter as covariable (linear and quadratic effects). The heritability estimates ranged from 0.15 ± 0.14 to 0.29 ± 0.18 and genetic correlations were -0.25 ± 0.61 to 0.58 ± 0.43. The carcass and meat traits have genetic variability and marbling will respond to selection faster than the other traits. Selecting to increase loin muscle area will genetically change marbling in the same direction.

Key Words – Beef cattle, Genetic correlation, Heritability

I. INTRODUCTION

Brazil plays an important role in the world food production, especially beef production. The traits associated with beef quality, such as carcass and meat traits, have increased their importance in determining the price of meat and the access to new markets. According to [1], in order to reach different markets and to produce higher added value meat cuts, not only is necessary to increase meat production, but also to improve the quality of meat products. However the lack of a meat classification system and others factors such as the absence of uniformity in age at slaughter, backfat thickness and marbling of beef cuts, limit the expansion of Brazilian meat industry. Carcass traits such as loin muscle area and backfat thickness are quantitative indicators of carcass quality, and play a key role in the marketing of meat products [2]. For these same authors, loin muscle area is correlated with amount of muscle and of edible portion yield, while backfat thickness is used as an indicator of the degree of finishing. Marbling is an indicator of intramuscular fat and it affects meat flavor and tenderness [3]. Tenderness is the main factor influencing meat organoleptic characteristics and its acceptance by consumers.

The objective of this work was to estimate genetic parameters for carcass and meat traits such as loin muscle area, backfat thickness, tenderness and marbling in Nellore cattle, in order to provide information to improve these traits through selection.

II. MATERIALS AND METHODS

Data from 1,187 animals spread in eight farms participating in three beef cattle breeding programs (Delta Connection G, Paint - CRV Lagoa and Nellore Qualitas), were used. The animals were reared on pasture, and were confined only for finishing for a period of ninety days. The average age of the animals at slaughter was 704 ± 52 days.

Traits were: loin muscle area (LMA), backfat thickness (BFT), index of marbling (MB) and tenderness measured by shear force (SF). Carcass and meat traits records were obtained in commercial slaughter houses in different regions of the country. The carcasses were cooled for a period of 48 hours. During boning, a sample of one inch (2.54 cm) from the *Longissimus dorsi* (between 12-13th ribs) was extracted from the left side of each carcass.

The loin muscle area was measured by the quadrant points method (each square corresponds to one cm^2), and the sum of all the squares corresponds to the *Longissimus* area. The backfat thickness was assessed with a caliper, measured at an angle of 45 degrees from the geometric center of the sample. A visual grading scale (USDA - Quality and Yield Grade, 1997; adapted in the Laboratory of Meat Quality and Certification – LQCC for *Bos indicus*), varying from 0 to 6, was used to determine the marbling score.

The standardized procedure proposed by [4] was used to measure shear force. The samples were thawed until they reach a temperature of 2 º C to 5 º C. Later they were placed in identified racks and weighed and cooked until reaching inner temperature of 71°C. Then the samples were cooled to environmental temperature, weighed again and placed in the refrigerator for 12 to 24 hours. Immediately after this period, 6-8 meat cylinders were extracted of each sample, ½ inch of its central region in longitudinal direction of the muscle fibers using a dielectric device. To determine tenderness, a Salter Warner-Bratzler Shear Force mechanical with capacity of 25 kg and a speed of 20 cm/minute was used. The shear force was the arithmetic mean of the 8 cylinders, expressed in kg force (kgf).

The contemporary groups (CG) were:farm and year of birth, management group at weaning and at yearling. Records above or below three standard deviations from the CG mean and CG with less than 3 animals were deleted. Number of animals in the numerator relationship matrix was 3.141.

Genetic parameters were estimated with an animal model by restricted maximum likelihood method using the computer program Wombat [5]. The model included CG as fixed effect and the age of the animal at slaughter as a covariable (linear and quadratic effects).

III. RESULTS AND DISCUSSION

The heritability estimates for carcass and meat traits were low to moderate (Table 1). Marbling will respond to selection faster than other traits. Higher heritability estimates for marbling 0.37 [6] and 0.44 [7] were reported in Brahman cattle. The heritability estimates obtained for loin muscle area and backfat thickness were lower than those reported in the literature for zebu breeds, varying from 0.35 to 0.63 for LMA, and from 0.36 to 0.55 for BFT [6,7,8].

Table 1 Heritability estimates and their respective standard errors for carcass and meat traits

Trait	h^2	SE
LMA	0.16	0.13
BFT	0.15	0.14
MB	0.29	0.18
SF	0.18	0.15

h^2=heritability; SE=standard-error; LMA= loin muscle area; BFT= backfat thickness; MB= index of marbling; SF= shear force

For tenderness, the heritability estimated in the present work agreed with those reported in the literature for *Bos indicus* [6, 7].

The genetic correlation estimated between LMA and BFT was low and positive indicating that long term selection to increase LMA will increase BFT. A genetic correlation close to zero was estimated between LMA and SF, pointing out that selection to increase LMA will not change SF. Similar results (-0.04 ± 0.31) were reported by [7] .The genetic correlation obtained between LMA and MB was moderate and positive. This result agrees with those reported for Brahman, 0.44 [6] and 0.17 [7].

Table 2 Genetic correlation estimates between carcass and meat traits

Traits		rg
LMA	BFT	0.20 ± 0.61
	MB	0.58 ± 0.43
	SF	0.04 ± 0.60
BFT	MB	-0.20 ± 0.56
	SF	-0.25 ± 0.61
MB	SF	0.25 ± 0.50

rg=genetic correlation; LMA=loin muscle area; BFT= backfat thickness; MB= index of marbling; SF= shear force

The genetic correlation estimates between BFT and the other traits (MB and SF) were negative and low, indicating that long term selection to increase BFT could decrease MB and SF. The estimated genetic correlation between MB and SF was low and positive, similar (0.08 ± 0.34) to that found by [9].

In general, the standard errors of the genetic correlations estimates were high, probably due to the small number of animals considered in the study.

IV. CONCLUSION

The carcass and meat traits have genetic variability and marbling will respond to selection faster than the other traits. Selecting to increase loin muscle area will genetically change marbling in the same direction.

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