Genetic Association For Growth, Reproductive And Carcass Traits In Guzerá Beef Cattle

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Introduction

In Brazil, slaughters pay more for adequate weight carcass, fat thickness and carcass meat yield. Measuring these traits at earlier ages, would increase the annual genetic gain. Considering that the prime selection is making at weaning, it is important to verify the existence of genetic associations between carcass traits and body weight at weaning age. Reproductive traits need to be evaluated because they are associated directly with the productive efficiency. Guzerá beef cattle represent a considerable part of the country herd, being the second most used zebu beef cattle, is adapted to tropical regions and is a very productive breed. The present investigation aims to provide tools for the selection of Guzerá breed animals participating in a cattle breeding program and obtain genetic parameters for growth, reproductive and carcass traits.

Material and methods

Animals and data file. The present study was conducted using data of Guzerá animals that participated in the Guzerá Breeding Program, coordinated by the National Association of Breeders and Researchers (Associação Nacional de Criadores e Pesquisadores – ANCP). Body weight data from animals measured at 210 (BW210) were used. The carcass traits studied were a prediction of longissimus muscle area (LMA) and back fat thickness (BF). The reproductive trait data was age at first calving (AFC).

Measurements. An ALOKA 500V apparatus equipped with a 3.5 MHz, 17.2 cm linear transducer (Aloka Co. Ltd., Tokyo, Japan) and an acoustic coupler in conjunction with an image capturing system (Blackbox, BIOTRONICS, Inc., Ames, IA, USA) were used to make

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the ultrasound measurements for prediction of carcass traits. These images were then analyzed in a centralized laboratory responsible for the quality of the data. The LMA and BF traits were measured across the Longissimus dorsi muscle between the 12th and 13th ribs.

Data editing and contemporary groups. Preliminary analyses of all traits were performed to eliminate inconsistent data. Least square analysis, using the GLM procedure of SAS (SAS 9.1, SAS Institute, Cary, NC, USA) aided in defining the fixed effects considered in the models. The birth season affect significantly ($P < 0.05$) BW210, LMA and BF and was defined as: rainy season, for animals born between October and March; and dry season, for animals born between April and September. For LMA and BF the contemporary groups (CG) consisted in animals belonging to the same sex, year and birth season. For BW210, the CG consisted in animals with the same sex, herd, year and birth season. Cow age at calving was used as a covariate for BW210. For AFC, the contemporary groups (CG) consisted in birth year and herd.

Statistical analysis. Genetic parameters estimation were performed using the Restricted Maximum Likelihood Method (REML) for multi-trait animal models, using the WOMBAT software (MEYER, 2007). The relationship matrix included 26,160 animals. The mixed model used for BW210 was $y = Xb + Z_1a + Z_2m + e$, in which: *y* is the vector of the dependent variable; *X* is the incidence matrix for fixed effects, thereby associating the elements of b and y; *b* is the fixed-effects vector (contemporary group); Z_1 and Z_2 is the incidence matrix for direct and maternal random effects, thereby associating the elements of a and y; *a* is the random-effects vector for direct additive genetic effects; *m* is the random-effects vector for maternal genetic effect and *e* is the residual-effects vector. For AFC, LMA and BF the maternal genetic effect was not included in the mixed model. For BW210, a linear and quadratic effect of the covariate dam age was considered.

Results and discussion

Descriptive statistics for BF, LMA, AFC and BW210, are presented in Table 1. The mean for BW210 was higher to that reported by Mucari and Oliveira (2003) in Guzerá beef cattle and similar to Yokoo et al. (2010) in Nellore beef cattle. Yokoo et al. (2010) verified smaller means for LMA and BF compared with present work. Grossi et al. (2008) found AFC similar to ours, around 36 months.

The additive direct heritability estimates for BF, LMA, AFC and BW210, were equal to 0.51, 0.48, 0.14 and 0.29, respectively and are presented in Table 2. The estimate for additive maternal heritability for BW210 was equal to 0.075 (0.015). Mucari and Oliveira (2003), studying a single Guzerá herd found direct heritability for BW210 around 0.14 and maternal heritability equal to 0.01. Grossi et al. (2008), analyzing Nellore beef cattle data found lower values for AFC 0.07 (0.04). The high heritability estimates for carcass traits may have occurred because of their small data number.

Analysis shown that the genetic correlation among the traits are favorable for most of them, BW210 had correlations of 0.48 (0.15) and -0.52 (0.11) with LMA and AFC, respectively. AFC presented correlations of -0.37 (0.21) and -0.63 (0.18) with BF and LMA, respectively.

Correlation between LMA and BF was 0.91 (0.07). Due to their favorable genetic correlation, selection for body weight and carcass traits can lead a genetic improvement in reproductive traits. LMA tends to increase if the selection takes BW210 as criteria, although few changes in BF should be observed, favorable correlation was observed between BF and AFC.

Table 1: Number of animals (N) contemporary groups (CG), sires (SIRE) and dams (DAM), mean, standard-deviation (SD), minimum and maximum values for a prediction of back fat thickness (BF) and LM area (LMA), age at first calving (AFC) and body weight at 210 (BW210) days of age.

Trait	N	Mean	SD	Min	Max	CG	SIRE	DAM
BF(mm)	604	2.98	1.07	0.90	7.62	12	98	508
LMA (cm^{2})	611	59.83	10.52	33.03	91.29	12	99	513
AFC (months)	3,194	37.49	5.85	22.00	49.00	383	447	2,358
BW210 (kg)	9,208	181.62	33.08	90.00	298.00	541	512	4,941

Table 2: Direct heritability (diagonal) and genetic (above the diagonal) and phenotypic (under the diagonal) correlation estimates for a prediction of back fat thickness (BF) and LM area (LMA), age at first calving (AFC) and body weight at 210 (BW210) days of age in Guzerá cattle, in multi-trait analyses.

Trait	BF	LMA	AFC	BW210
BF(mm)	**0.51±0.14**	0.91±0.07	-0.37±0.21	0.10±0.17
LMA(cm^2)	0.47±0.04	**0.48±0.12**	-0.63±0.18	0.48±0.15
AFC(months)	-0.07±0.15	-0.26±0.15	**0.14±0.03**	-0.51±0.10
BW210 (kg)	0.18±0.04	0.29±0.04	-0.23±0.03	**0.29±0.03**

Conclusion

These results clearly show that the traits have sufficient additive genetic component and will respond to selection. The traits have favorable genetic correlation among them and a genetic improvement in one could represent progress in the others. Ultrasound measurements are expensive for Brazilian farmers and the favorable correlations among the traits indicate that selection in BW210 and AFC should improve LMA but little progress in BF is expected. So it is important to look for other growth or reproductive traits that have stronger and favorable correlation with BF.

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