GENETIC CORRELATIONS BETWEEN DAYS TO FIRST CALVING AND SCROTAL CIRCUMFERENCE AND WEIGHT AT 12 MONTHS OF AGE IN A CANCHIM BEEF CATTLE HERD[1]

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INTRODUCTION

Scrotal circumference and body weight are traits usually used to compose selection indices to increase fertility and growth rate in beef cattle in Brazil. The relationship between these and other important traits, especially those associated with female precocity, fertility and productivity, should be well investigated if selection is supposed to bring about improvement in the production system as a whole.

The objective of this study was to estimate genetic correlations between female days to first calving (DFC) and male scrotal circumference (SC) and male and female body weight (BW) at 12 months of age, in a Canchim beef cattle herd, with the purpose of verifying the effect of selection for SC and BW on female fertility.

MATERIAL AND METHODS

The data used in this study belong to a Canchim (a composite 5/8 Charolais + 3/8 Zebu) herd owned by Embrapa's Southeast - Cattle Research Center, located at São Carlos county, State of São Paulo, Brazil. Animals from this herd were grown on pastures, receiving mineral mixture and health care, as needed for the region.

Days to first calving data were from heifers which participated in the breeding seasons from 1957 to 2003. These breeding seasons did neither have a fixed month to begin nor to finish, had variable length, and in some years there were two breeding seasons, one in the first and another in the second semester.

Days to first calving were calculated as the difference between calving date and date of the beginning of the breeding season. As proposed by Johnston and Bunter (1996), females which did not conceive during the breeding season received a penalty and had their DFC calculated as 21 plus the highest DFC for its contemporary group. In this study, two data sets were analyzed for DFC, one with those females which did not conceive during the breeding season (DFC_P), and one without these animals (DFC). Inclusion of the females which did not conceive increased the number of observations from 1,197 to 1,840.

Body weights, recorded from 1953 to 2004, were standardized to 365 days of age, and SC data were collected from 1982 to 2004, except in 1990 and 1991.

Two-trait analyses of DFC and DFC_P with SC and BW by the restricted maximum likelihood methodology were done, using MTDFREML (Boldman *et al.*, 1993). For these analyses, the statistical model for DFC and DFC_P included fixed effects of contemporary group, composed of breeding season and mating type (natural service or artificial insemination), and bull, and the additive direct random effect. For SC, the model included fixed effects of contemporary group (year-month of birth) and age of animal as a covariate (linear effect), and additive direct and maternal permanent environmental random effects, while for BW the model included fixed effects of contemporary group (sex-year-month of birth) and age of dam as a covariate (linear and quadratic effects), and additive direct and maternal permanent environmental random effects. For the analyses of DFC and DFC_P with SC, residual covariance was zero, since traits were measured in different animals.

RESULTS AND DISCUSSION

A summary of the data analyzed is presented in Table 1. Means are within the range of those found in literature for different breeds of beef cattle (Johnston and Bunter, 1996; Pereira *et al.*, 2000; Mercadante *et al.*, 2002; Gianlorenço *et al.*, 2003; Forni and Albuquerque, 2005).

Table 1. Number of observations, number of contemporary groups (CG), mean, standard deviation (SD), minimum and maximum values of days to first calving with (DFC_P) or without (DFC) females which did not conceive, male scrotal circumference (SC) and male and female body weight (BW) at 12 months of age

Traits	Number	CG	Mean	SD	Minimum	Maximum
DFC (days)	1,197	166	328.3	38.0	268	519
DFC_P (days)	1,840	188	348.5	48.5	268	540
SC (cm)	1,450	107	21.0	3.7	11.5	34.1
BW (kg)	6,326	500	219.7	44.0	98.5	389.9

Genetic parameter estimates are presented in Table 2. Heritabilities of DFC and DFC_P are higher than those obtained in earlier studies (Johnston and Bunter, 1996; Mercadante *et al.*, 2002; Forni and Albuquerque, 2005), and suggest that genetic progress is possible by selection for this trait. DFC showed higher heritability than DFC_P, result which differs from that reported by Mercadante *et al.* (2002), whose estimates were the same with or without the inclusion of heifers which did not conceive. Heritability estimates of SC and BW are within the range of those found in literature in Brazil (Gressler *et al.*, 2000; Gianlorenço *et al.*, 2003; Mucari and Oliveira, 2003; Forni and Albuquerque, 2005).

Estimated genetic correlations of SC with DFC and DFC_P were favorable, indicating that selection to increase male SC should reduce female days to first calving. These estimates are higher than those obtained with Nellore cattle by Pereira *et al.* (2000) and Forni and Albuquerque (2005), -0.04 and -0.14, respectively. Genetic correlations of BW with DFC and DFC_P, on the other hand, were positive, indicating, despite their low magnitude, that selection to increase BW should also increase days to first calving. These results are similar to those obtained by Johnston and Bunter (1996), but different from the one reported by Forni and Albuquerque (2005) whose genetic correlation estimate between days to first calving and yearling weight was close to zero (-0.02). Considering genetic parameters estimated in this study, and intensities of selection of 1.75 for males (10% retention) and 0.80 for females (50% retention), selection for SC would be 88.8% as effective to change DFC as direct selection, showing that SC could be a good selection criterion to improve female days to first calving.

Table 2. Genetic parameter[A] estimates of days to first calving with (DFC_P) or without (DFC) females which did not conceive, male scrotal circumference (SC) and male and female body weight (BW) at 12 months of age

Traits (1 and 2)	h^2_1	h^2_2	c^2_2	r_g
DFC and SC	0.23	0.37	0.13	-0.32
DFC and BW	0.22	0.31	0.11	0.15
DFC_P and SC	0.15	0.35	0.14	-0.30
DFC_P and BW	0.15	0.31	0.11	0.16

[A] h^2_1 = heritability of trait 1; h^2_2: heritability of trait 2; c^2_2: fraction of the total variation attributed to maternal permanent environment for trait 2; r_g: genetic correlation between traits 1 and 2.

CONCLUSION

Considering the favorable genetic correlation, scrotal circumference at 12 months of age could be used as a selection criterion to improve reproductive performance of heifers of the studied Canchim herd, as measured by days from the beginning of the breeding season to first calving. However, selection to increase body weight at the same age is expected to have an opposite effect.

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