

SHORT COMMUNICATION

ESTIMATES OF GENETIC CORRELATIONS BETWEEN SIRE SCROTAL CIRCUMFERENCE AND OFFSPRING AGE AT FIRST CALVING IN NELLORE CATTLE

R. Martins Filho¹ and R.B. Lôbo²

ABSTRACT

The scrotal circumference (SC) of 3,393 young bulls and the age at first calving (AFC) of 703 daughter cows, were recorded during 1984 to 1989 in Nellore cattle in Northwest São Paulo State, Brazil. The least-squares means and standard errors were 31.03 ± 0.93 cm and 35.81 ± 0.17 months for SC and AFC, respectively. Heritabilities, estimated from paternal half-sib correlations were 0.36 ± 0.07 for SC and 0.19 ± 0.09 for AFC. The genetic correlation between SC and AFC estimated by Yamada's (Jpn. J. Gen. 37: 498-509, 1962) formula was -0.44. This suggests the possibility of earlier selection for female fertility based on the scrotal circumference of the sire.

INTRODUCTION

Several researchers since the original paper of Falconer (1952), who extended the idea of genetic correlation to include the genotype-environment interaction, have proposed formulae for estimating genetic correlations between traits measured in different individuals (Robertson, 1959; Dickerson, 1962). Yamada (1962) clearly defined these ideas and presented the formulae for random and mixed

¹ Departamento de Zootecnia, Centro de Ciências Agrárias, UFPI, 64000 Teresina, PI, Brasil.

² Departamento de Genética, Faculdade de Medicina de Ribeirão Preto, USP, 14049 Ribeirão Preto, SP, Brasil. Send correspondence to R.B.L.

models. The first application in European cattle of Yamada's formula was made by Brinks *et al.* (1978), who estimated the genetic correlation between sire scrotal circumference and offspring age at first calving as -0.71. Toelle and Robinson (1985) also reported a significant genetic correlation (-0.38) between scrotal circumference and age at first calving in Hereford cattle. The objective of the present study was to estimate genetic correlation between sire scrotal circumference and offspring age at first calving in Nellore cattle maintained under tropical conditions.

MATERIAL AND METHODS

The data included 3,393 record of scrotal circumference measured in young bulls and 703 of age at first calving, in Nellore cattle from three herds, raised on pasture. The animals were born from 1984 to 1989, and belong to the Companhia de Financiamento Mercantil (CFM) located in Northwest São Paulo State. Mean annual temperature was 24°C. Yearly rainfall was about 1008 mm.

Statistical analyses

Data were analysed by the least-squares and maximum likelihood methods of Harvery (1987) for estimating genetic variances and heritabilities, using the following linear model:

$$Y_{ijkl} = \mu + a_i + B_j + (aB)_{ij} + F_k + \epsilon_{ijkl},$$

where Y_{ijkl} is the response variable; μ is the overall mean; a_i is the sire effect (random); B_j is the herd effect (fixed); $(aB)_{ij}$ is the sire-herd interaction (random); F_k is a set of effects (month of measurement, month and year of birth), and ϵ_{ijkl} is an assumed random error NID $(0, \sigma^2)$.

Each trait was separately adjusted for significant fixed effects, then converted into standard units by dividing each trait measure by its standard deviation.

The adjusted records were analysed for estimation of sire variance and sire-sex interaction, using the model:

$$Y_{ijk} = \mu + a_i + S_j + (aS)_{ij} + \epsilon_{ijk},$$

where Y_{ijk} , μ , a_i , and ϵ_{ijk} are as previously defined; S_j is the sex effect (fixed), and $(aS)_{ij}$ is the sire-sex interaction effect (random).

The genetic correlation was estimated by Yamada's (1962) formula:

$$r_g = (\sigma_a^2 - 0.5\sigma_{as}^2) : [(\sigma_a^2 + 0.5\sigma_{as}^2) - 0.5(\sigma_1 - \sigma_2)^2],$$

where σ_a^2 is the sire variance component (genetic group, variances of half-sib progeny); σ_{as}^2 is the sire-sex interaction variance component; σ_1 and σ_2 are standard deviations for traits 1 and 2, respectively.

RESULTS AND DISCUSSION

Table I show the least-squares means and heritabilities estimated from paternal half-sib correlations for SC and AFC.

Table I - Number of animals (N), least squares means and standard error (SE), and heritability estimates for SC and AFC traits.

Traits	N	Means \pm SE	$h^2 \pm$ SE
SC (cm)	3,393	31.03 \pm 0.93	0.36 \pm 0.07
AFC (months)	703	35.81 \pm 0.17	0.19 \pm 0.09

The means (35.81 months and 31.03 cm for AFC and SC, resp.) are considered satisfactory for zebu cattle raised on pasture under tropical conditions. The overall age for young sires when the measures were taken was 20 months.

The heritability estimates were 0.36 \pm 0.07 and 0.19 \pm 0.09 for SC and AFC, respectively. The genetic correlation between SC and AFC was -0.44. These results suggest the existence of an important correlation between the traits studied, and indicate the possibility of indirect selection in females based on direct selection of young sires for increased scrotal circumference.

ACKNOWLEDGMENTS

We are grateful to the management of the CFM company for providing the data. Research supported by CNPq.

Publication supported by FAPESP.

RESUMO

Foram estimadas correlações genéticas usando registros de circunferência escrotal (CE) e idade ao primeiro parto (IPP) de 3.393 tourinhos e 703 vacas, meio-irmãos paternos da raça Nelore criados

em regime de pasto, no Estado de São Paulo, Brasil. As médias por quadrados mínimos e os coeficientes de herdabilidade estimados por correlação entre meio-irmãos paternos para CE e IPP, foram $31,03 \pm 0,93$ cm; $35,81 \pm 0,17$ meses; $0,36 \pm 0,07$; $0,19 \pm 0,09$, respectivamente. A correlação genética estimada pela fórmula de Yamada (Jpn. J. Gen. 37: 498-509, 1962) entre as duas características foi de $-0,44$, indicando que a CE em animais jovens é favoravelmente correlacionada com IPP, medida em suas meio-irmãs paternas.

REFERENCES

- Brinks, J.S., McInerney, M.J. and Chenoweth, P.J. (1978). Relationships of age at puberty in heifers to reproductive traits in young bulls. *Proc. West. Sect. Amer. Soc. of Anim. Sci.* 29: 28-30.
- Dickerson, G.E. (1962). Implications of genetic-environmental interaction in animal breeding. *Anim. Prod.* 4: 47-64.
- Falconer, D.S. (1952). The problem of environment and selection. *Amer. Naturalist* 86: 293-298.
- Harvey, W.R. (1987). *User's guide for LSMLMW (Mixed Model Least-Squares and Maximum Likelihood Computer Program)*. Wooster, Ohio State University, 59p.
- Robertson, A. (1959). The sampling variance of the genetic correlation coefficient. *Biometrics* 15: 469-485.
- Toelle, V.D. and Robinson, O.W. (1985). Estimates of genetic correlations between testicular measurements and female reproductive traits in cattle. *J. Anim. Sci.* 60: 89-100.
- Yamada, Y. (1962). Genotype by environmental interaction and genetic correlation of the same trait under different environments. *Jpn. J. Gen.* 37: 498-509.

(Received December 19, 1990)