



Genetic associations between hip height, body conformation scores, and pregnancy probability at 14 months in Nelore cattle



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ABSTRACT

Genetic parameters for hip height (HH), finishing precocity score (PRE), muscling score (MUS), bone score (BONE), and probability of pregnancy at 14 months (HP) were estimated using records of 121,086 Nelore animals born between 1984 and 2008 on 12 farms from three Brazilian states. The Bayesian linear-threshold analysis via the Gibbs sampler was used to estimate the (co)variance components applying a multi-trait animal model. Posterior mean estimates of heritability for HH, PRE, MUS, BONE, and HP were 0.36, 0.26, 0.26, 0.26, and 0.50, respectively. Therefore, the genetic improvement of these traits is possible. The genetic correlations between all traits studied were of low to high magnitude. High genetic correlations were observed between visual scores (0.85 and 0.99). Therefore, the simultaneous inclusion of PRE, MUS and BONE in a selection index does not seem to be necessary for the present population. The genetic correlation of HP with HH and visual scores ranged from -0.06 to 0.25 , indicating that selection for traits related to body structure and conformation has little or no effect on HP.

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1. Introduction

Intensive selection for growth traits has been used in different beef cattle breeding programs. As a consequence of the growing market requirements for high-quality meat, traits related to body conformation of the animals have received increasing attention on the part of breeders. Body conformation scores are used as selection criteria to infer carcass quality (Shiotsuki et al., 2009). The most widely used body conformation scores are finishing precocity, conformation, and muscling. These scores are

easily obtained by trained examiners. In addition, they show moderate heritability and should therefore respond satisfactorily to selection (Van Melis et al., 2003).

In Brazil, beef cattle farming systems are based mainly on extensive pastures. As a consequence, the animals need to possess an adequate bone structure with sufficiently strong legs that guarantee support of their own weight. In this respect, evaluation of the bone structure of beef cattle may have benefits for the production system since it permits to obtain by selection animals that move around easily and can get their food efficiently.

Reproductive traits are also important for the production system, especially for Zebu animals reared in a tropical area (Eler et al., 2002). One reproductive trait commonly used as a selection criterion is the probability

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of pregnancy at 14 months. This trait presents high heritability, is favorably related to growth traits, and is easily measured (Silva et al., 2003; Eler et al., 2004). Formigoni et al. (2005) evaluating the economic value of the probability of pregnancy at 14 months, found that selection for this trait will contribute to reduce production costs.

The current scenario of beef production requires efficient improvement of both reproductive traits and body structure- and carcass-related traits. Studies investigating the genetic association between body structure and reproductive traits in Nelore cattle are scarce. Therefore, the objective of the present investigation was to estimate genetic associations between hip height (HH), finishing precocity score (PRE), muscling score (MUS), bone score (BONE), and probability of pregnancy at 14 months (HP) in Nelore cattle.

2. Material and methods

2.1. Data and cattle management

Data from the Genetic Breeding Program of Agro-Pecuária CFM Ltda. that have been stored and analyzed since 1994 by the Animal Breeding and Biotechnology Group, College of Animal Science and Food Engineering, Pirassununga, State of São Paulo, were used in this study.

The complete pedigree included 167,854 animals (up to eight generations) born between 1984 and 2008 on 12 farms located in the states of Mato Grosso do Sul, São Paulo, and Bahia. The farms included in this study belong to the same company, which uses standard basic procedures of data collection and storage. The animals were kept on high quality pasture (40% *Brachiaria brizantha*, 50% *Panicum maximum*, and 10% others) and received only salt and mineral supplementation. Calves born between the end of August and December remained with their dams on high-quality pasture up to 7 months of age. The breeding season ranged from November to January for

cows and from October to January for heifers. The females were placed randomly in lots with a group of bulls or in some cases in lots with a single bull. The cow-to-bull ratio was about 35:1. About 60 days after the end of the breeding season, heifers (approximately 14 months of age) were evaluated by rectal palpation or ultrasound for the diagnosis of pregnancy. The heifer pregnancy/probability of pregnancy at 14 months (HP) was analyzed as a categorical trait, with a value of 1 (success) assigned to heifers that were diagnosed pregnant and a value of 0 (failure) assigned to those that were not pregnant at that time.

The HH was measured using a metric tape and corresponds to the distance (in cm) from the ground to hip. The PRE is a measure of the ability of the animal to store fat reserves and is used to identify animals that will deposit finishing fat earlier. This variable was obtained by attributing visual scores ranging from 1 to 6, with a score of 6 indicating animals with greater fat reserves. The MUS takes into account the muscle mass of the animal. This variable was also measured by attributing scores from 1 to 6, with animals with more muscle mass receiving a score of 6. The BONE was attributed to each animal using the following visual scores: 1=light, 2=intermediate, and 3=heavy. The variable was evaluated based on the bone structure of the legs and hocks. All scores were attributed to observations made within the contemporary groups by three trained examiners. All observations of HH, PRE, MUS and BONE were made at yearling age (around 18 months of age). A general description of the data set used in this study is shown in Table 1. For all traits studied, records of animals in contemporary groups with fewer than 20 animals were excluded. In addition, data exceeding 3.5 standard deviations above or below the overall mean for HH were eliminated. As proposed by Harville and Mee (1984), records for the categorical traits HP and BONE of contemporary groups in which all scores were the same, i.e., groups without variability, were also eliminated.

Table 1

Description of the data set for hip height (HH), finishing precocity score (PRE), muscling score (MUS), bone score (BONE), and heifer pregnancy (HP) in Nelore cattle.

Item	Trait				
	HH (cm)	PRE (1–6)	MUS (1–6)	BONE (1–3)	HP (1 or 0)
Number of animals in the pedigree	137,769	161,842	165,191	78,337	55,430
Number of sires with progeny record	852	1032	1034	537	468
Number of dams with progeny record	41,393	50,367	52,060	21,244	18,367
Sires with more than 50 progeny	242	299	303	107	67
Animals with records	96,876	114,013	117,846	40,844	28,887
Mean of the trait	135.29	3.66	3.57	–	–
Standard deviation	6.91	0.93	0.94	–	–
Number of contemporary group	476	615	642	125	83
% Success	–	–	–	–	16.1
% Category 1	–	0.8	1.4	48.1	–
% Category 2	–	9.3	10.1	48.7	–
% Category 3	–	34.9	37.6	3.2	–
% Category 4	–	33.8	32.4	–	–
% Category 5	–	19.5	17.1	–	–
% Category 6	–	1.7	1.4	–	–

BONE: 1=light, 2=intermediate, 3=heavy; PRE: a score of 6 indicating animals with greater fat reserves; MUS: a score of 6 indicating animals with more muscle mass.

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