HERITABILITY ESTIMATES OF PREGNANCY IN NELORE HEIFERS

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INTRODUCTION

Nowadays, in Brazil, there is a strong economical pressure for improving the productive efficiency of beef cattle. Recently, several studies have been developed for increasing Zebu heifers fertility. However, the selection for traits that indicate sexual precocity of females is not simple. Several traits have been used in order to optimise the reproductive performance of heifers, such as age at puberty and age at first calving but there is not a consensus regarding the best trait to be considered.

The probability of pregnancy has been studied as a categorical trait applying non-linear models with the objective of determining the sexual precocity of females (Evans et al. 1999, Doyle et al. 2000). Differently of the age at first calving, probability of pregnancy at early ages is directly linked to the precocity of the animal. It indicates the probability of the heifer to be pregnant in a certain age. This is a binary trait which takes the value 1 for pregnant heifers (success) and zero for those that did not conceive (failure).

The aim of this study was to estimate the heritabilities for two traits: probability of pregnancy at 18 months of age and probability of pregnancy until 27 months of age in Nelore heifers.

MATERIAL AND METHODS

Data from heifers born between 1990 and 1996 in Agropecuária Jacarezinho farm in São Paulo state, Brazil, were analysed. There is an anticipated breeding season during autumn (April and May) for heifers, with the goal of exposing them to the first mate until 18 months of age. Usually, it is 60 days long. The heifers, which do not conceive in this season, will have a new chance in the second one with all the females of the herd. This occurs during summer (raining season: November to January) and it is 70 days long. Females which do not conceive in this latter season, are discarded.

Two different traits were analysed: PP₁₈ - Probability of pregnancy at 18 months of age - it included all the heifers that were exposed to a bull around 18 months of age; and PP₂₇ - Probability of pregnancy until 27 months of age - it included all the heifers exposed to a bull or inseminated in the two breeding seasons. For both traits, heifers with a successful pregnancy were scored as “1” and those which failure to get pregnant were scored as “0”. The total number of animals, contemporary groups, successful and failure percentage are presented in table 1.
Table 1. Number of animals (n), contemporary groups (CG), success and failure percentage for PP₁₈ and PP₂₇

<table>
<thead>
<tr>
<th>Trait</th>
<th>n</th>
<th>CG</th>
<th>% success</th>
<th>% failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>PP₁₈</td>
<td>12,854</td>
<td>338</td>
<td>17.58</td>
<td>82.42</td>
</tr>
<tr>
<td>PP₂₇</td>
<td>15,595</td>
<td>522</td>
<td>60.40</td>
<td>39.60</td>
</tr>
</tbody>
</table>

Contemporary group (CG) was defined as: herd, year, season of birth, management groups at birth, weaning and yearling, and mating type (AI, single mating or multiple sires). Contemporary groups with less than 4 animals and groups with standard deviation of zero for probability of pregnancy (with all animals 0 or 1) were deleted.

The model of analysis included the random effect of animal, fixed effect of contemporary group and linear and quadratic effects of age of dam as covariate. The traits were analysed using a maximum a posteriori probit threshold model - MAP (Gianola and Foulley, 1983; Harville and Mee, 1984) to predict breeding values on the underlying scale and the method ℕ (Reverter et al.1994b) to estimate variance components. Method ℕ is an estimation procedure based on a linear regression of more accurate on less accurate genetic predictions. The more accurate genetic predictions were obtained from all the data and less accurate genetic predictions were generated from a random 50% sub-sample of the data. The expected value of the regression coefficient is one. If the regression coefficient is different from one it indicates presence of bias. When the regression coefficient is higher or lower than one, it means that the heritability is, respectively, under or overestimated. The Method ℕ regression coefficient can be interacted up to "1". The criterion of convergence employed was $10^{-9}$ for the Fisher score interactions, which is required to obtain the MAP predictions (Reverter et al. 1994a).

RESULTS AND DISCUSSION

The mean and standard-error of heritability estimates and the 95% confidence intervals obtained by Box-Cox transformation for both traits are presented in table 2

Table 2. Estimates of heritability means ($h^2$), standard errors (SE) and 95% confidence intervals (95% CI) for PP₁₈ and PP₂₇ in Nelore herd

<table>
<thead>
<tr>
<th>Trait</th>
<th>$h^2$</th>
<th>SE</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>PP₁₈</td>
<td>0.366</td>
<td>0.033</td>
<td>0.144 to 0.668</td>
</tr>
<tr>
<td>PP₂₇</td>
<td>0.078</td>
<td>0.003</td>
<td>0.034 to 0.122</td>
</tr>
</tbody>
</table>

The heritability estimates for PP₂₇ was much lower than for PP₁₈. Probably this has happened because the former is recorded when most of the females have already reached physiological condition to conceive and reproduce. At 18 month of age the females were likely around puberty, and it was possible to identify genetic variation for probability of pregnancy. This trait, PP₁₈, could be used for genetic evaluation with the objective of improving sexual precocity.
Heritability estimates for age at first calving (AFC) was obtained using the same data set as for PP18 (Dias, unpublished). The estimate was lower (0.24) than for PP18. There are advantages in using PP18 instead of AFC for selecting for sexual precocity. With PP18 it is possible to include in the analysis all animals exposed during the breeding season, even those which failure to calve. In this case, genetic differences can be better estimated. Moreover, as all the daughters of a sire can be considered for genetic evaluations, the accuracy of selection will be improved. Age at first calving is an indicator of sexual precocity while PP18 gives the probability of a heifer to get pregnant at 18 months of age.

EVANS et al. (1999) estimated heritability of 0.14 ± 0.09 for probability of pregnancy in Hereford breed animals. DOYLE et al. (2000) found heritability estimate of 0.21 ± 0.11 for this trait in Angus breed. However ELER et al. (2002), in Nelore cattle, reported heritability estimate of 0.57 ± 0.01 for probability of pregnancy at 14 months of age (PP14). The authors attributed that high estimate to the adoption of adequate procedure of analysis for categorical data and also to the genetic variability of the PP14 in Nelore heifers.

CONCLUSIONS
The estimate of heritability for PP18 indicate that this trait could contribute to increase fertility of Nelore heifers.

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REFERENCES