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GENETIC AND PHENOTYPIC CORRELATIONS FOR SOME SEXUAL MATURITY TRAITS IN NILI RAVI BUFFALO HEIFERS

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ABSTRACT

Data on 202 records of Nili-Ravi buffalo heifers kept at the Livestock Experiment Station Bahadarnagar, Okara, Pakistan for the period 1994 to 2003, were analyzed to study the genetic and phenotypic correlations among four traits including age at maturity, weight at maturity, age at first conception and weight at first conception. The overall means (± SE) for ages at maturity and first conception were 1166 ± 15.60 and 1311 ± 18.42 days, respectively. The corresponding values for weights were 403 ± 4.58 and 439 ± 4.17 kg. The genetic correlations (multivariate analysis) for age at maturity with; weight at maturity, age at first conception and weight at first conception were 0.49, 0.88 and 0.07, respectively. The corresponding values for phenotypic correlations were 0.48, 0.79 and 0.37. The genetic and phenotypic correlations among other traits (weight at maturity with; age at first conception, weight at first conception: age at first conception with weight at first conception) were also estimated from multivariate (tetravariate) analysis.

Key words: Buffalo heifers, sexual maturity, body weight, genetic and phenotypic correlations.

INTRODUCTION

The genetic improvement in a trait depends upon its heritability, repeatability and its genetic and phenotypic correlations with other traits. The degree of association between genes responsible for additive variance of different traits is measured through genetic correlations, while phenotypic correlation is an expression of observed relationship between phenotypic performances of different traits. Knowledge of relationship is valuable when related traits are considered for selection. If genetic correlation among two traits is positive and high, the selection for one trait would result in an improvement of the other trait. Generally, the fertility traits have low genetic variance. The evaluation of farm animals should be based upon multitrait procedures, especially for fertility traits, because these have low heritability estimates and can use additional information from correlated traits. This study presents genetic and phenotypic correlations for some sexual maturity traits in Nili Ravi buffalo heifers.

MATERIALS AND METHODS

Data on 202 records of Nili-Ravi buffalo heifers kept at the Livestock Experiment Station, Bahadarnagar, Okara, Pakistan for the period 1994-2003, were analyzed to compute genetic and phenotypic correlations among four traits of sexual maturity including age at maturity, weight at maturity, age at first conception and weight at first conception. The data were edited carefully as far as the accuracy and reliability of the records were concerned for pedigree information. The records out side a range of 3 standard deviations from the phenotypic mean were removed (Ahmad *et al*., 2001; Ahmad, 2003). The number of observations varied according to the type of trait. The records with maturity age exceeding 1825 days were not included, while the upper limit for age at first conception was 2190 days. A total of 13 records (about 7%) were excluded from the analysis being incomplete due to some abnormality viz. disease, culling etc.

The data were analyzed by Statistical Analyses System (SAS, 1998) for fixed effects and covariate, while genetic parameters were estimated by animal model using pedigree data. The estimates were obtained by multivariate analysis, using Derivative Free Restricted Maximum Likelihood (DFREML) programme (Meyer, 2000). The model contained fixed effect of year-season (interaction) of birth; the weight at one year age was taken as covariate for all the four traits. The additive genetic effect of the animal was also included in the model. Furthermore, the birth years based upon climatic conditions were divided into five seasons (Ahmad, 2003), i.e. winter (December to February), spring (March to April), dry hot (May to June), humid hot (July to September) and autumn (October to November).

RESULTS AND DISCUSSION

The means and coefficients of variation for various sexual maturity traits in Nili - Ravi heifers are presented in Table 1. The coefficient of variation for the four traits ranged from 18.06 to 25.52 percent. Age at first conception had larger variability (25.52%), followed by age at maturity (24.64%), weight at first conception (19.34%) and weight at maturity (18.06%). The age at maturity ranged from 624 to 2029 days with a mean (± SD) of 1166 ± 287.4 days. The first conception age averaged 1311 ± 334.7 days and ranged from 687 to 2339 days. The average weights at maturity and first conception were 403 ± 72.8 and 439 ± 84.0 kg, respectively. The ranges were 260 to 680 and 265 to 710 kg, respectively.

The analysis of variance showed that the fixed effect of year-season (interaction) of birth had highly significant variation for all the four traits. The regression effect of one year weight on all the four traits was also significant. The estimates of Ishaq (1972) for age at maturity in Nili Ravi heifers were lower than the present study. That study was based on 212 records for the period of 1962-1971. The age at maturity ranged from 915 to 970 days. In the same study, the weight at maturity ranged between 451 and 519 kg which were within the range of the present study. In another study, Ishaq and Shah (1975) reported the mean age and weight at first service (puberty) as 960 ± 8.8 days and 468.56 ± 3.11 kg. The study was based on records of 333 Nili-Ravi buffalo heifers. Ahmad and Irfan (1979) analysed data of 491 Nili-Ravi buffaloes for estimating reproductive efficiency. The results showed that age at maturity in 460 Nili Ravi heifers averaged 1064 ± 9.7 days, the range was 530 to 2130 days. It was further indicated that in maximum number (81.94%) of animals the age at maturity ranged between 810 to 1300 days. These estimates were lower than the present investigation.

The study of Asghar and Iqbal (1984) was based on data of 372 buffalo heifers. Their results indicated that 26% of the heifers conceived at the age ranging from 700 to 1000 days, 44.4% between 1001 to 1300 days and 29.6% between 1301 to 1501 days and over. The average weight at first conception revealed that 35.5% of the heifers conceived at a body weight of 300-450 kg, 57.2% at 451 to 600 kg and 7.3% at 601 to 701 kg and above. The average age and weight at first conception were 1178.71 ± 244.01 days and 496.35 ± 76.47 kg, respectively. These estimates for age at first conception are lower and for weight at first conception are higher than the present study. The variation in the estimates of the present study and some earlier studies may be due to differences in the size of data set, the state of nutrition and other managemental conditions. The animals maintained at high state of nutrition mature and conceive earlier than those raised at low state of nutrition (Shah, 1991).

Genetic correlations

The genetic correlations of maturity age with weight at maturity and first conception age were positive and significant (Table 2). The genetic correlation between maturity age and weight at first conception was also very low. The genetic correlations of first conception weight with maturity weight and first conception age were negative but very low. Smith *et al*. (1976) analyzed data on maturing pattern in straight bred and crossbred Hereford, Angus and Shorthorn cattle. Their results indicated that genetic correlation between age and weight at maturity (puberty) was significant (0.67 ± 0.24). Similar results were reported by Basu *et al*. (1984), who made a genetic study on sexual maturity traits in Murrah buffaloes.

Phenotypic correlations

The phenotypic correlation of maturity age with first conception age was 0.79 which was positive and highly significant ($P<0.01$, Table 2). Similarly, the phenotypic correlation between first conception age and first conception weight was also positive (0.63) and highly significant ($P<0.01$). The phenotypic correlation of first conception weight with maturity weight (0.09) was positive, significant but very low. The phenotypic correlations of maturity age with maturity weight (0.48) and first conception age with maturity weight (0.29) were positive and highly significant ($P<0.01$). Comparatively lower phenotypic correlations (0.23 and 0.45, respectively) between age at first conception and weight at first conception were reported in some earlier studies (Asghar and Iqbal, 1984; Jung and Kiracofe, 1985). The investigation of Asghar and Iqbal (1984) was based on data set of 372 Nili Ravi buffalo heifers from Livestock Experiment Station Bahadurnagar / Qadirabad, Pakistan for the period from 1968 to 1984, while the findings of Jung and Kiracofe (1985) were based on data set of 306 Polled Hereford heifers.

The variation in the estimates may be due to the differences in breed type, location, managemental practices, state of nutrition etc. The results of the present study are in accordance with those reported by Gurung and Johar (1982), who analyzed data for correlation of various body weights with growth measures, reproductive and productive traits in Murrah

Table 1: Means, standard deviations (SD) and coefficients of variation (CV) for various sexual maturity traits in Nili Ravi buffalo heifers

Traits	Number	Mean	SD	Range	CV (%)
Age at maturity	202	1166	287.4	624 - 2029	24.64
Weight at maturity	202	403	72.8	260 - 680	18.06
Age at 1st conception	174	1311	334.7	687 - 2339	25.52
weight at 1st conception	174	439	84.0	265 - 710	19.34

Table 2: Genetic and phenotypic correlations for various sexual maturity traits from multivariate analysis in Nili Ravi buffalo heifers

Traits	Age at maturity	Weight at maturity	Age at 1st conception	Weight at 1st conception
Age at maturity		0.48**	0.79**	0.37**
Weight at maturity	0.49		0.29**	0.09*
Age at 1st conception	0.88	0.04		0.63**
Weight at 1st conception	0.07	-0.03	-0.10	

Genetic correlations are below diagonal, while phenotypic correlations are above diagonal.
* Significant (P<0.05) ** highly significant (P<0.001).

buffaloes. Their study was based on the data set of 1295 animals from two different farms. The results showed that the correlations of body weights at 6, 12, 18, 24 and 30 months age with age at first calving were highly significant (ranged from -0.46 ± 0.11 to 0.86 ± 0.04).

Conclusions

It can be concluded that maturity age is a good indicator of fist conception age. Significant and positive relationship was also found between maturity age and maturity weight, indicating that these traits are more influenced by environment. Furthermore, it is useful to analyze sexual maturity traits in a multivariate analysis in an evaluation programme because they are low heritable and can benefit from additional information from correlated traits.

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