Research Article

# Genetic and Phenotypic Correlation of Some Body Measurements with Milk Yield in Nili Ravi Buffaloes of Pakistan

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**Abstract** | Genetic correlations between any two traits indicate that some of the same genes are controlling them and in case of positive genetic correlation, selection for improvement in one trait will result in improvement in the other trait as a correlated response. In case of absence of any milk recording system under field conditions, farmers generally select animals on the basis of phenotype. Information on genetic correlation of body measurements with milk yield can be used for indirect selection for improved milk yield. Objective of this study was to record different body measurements in Nili Ravi buffaloes and estimation of phenotypic and genetic correlations with milk yield. These correlations were estimated in 437 Nili Ravi buffaloes maintained at 5 Livestock Experiment Stations in Punjab and few private breeders. Data included 1180 records of milking buffaloes. Correlations were estimated using BLUP techniques. Age of the buffalo at scoring, stage of lactation, parity, herd and season of scoring were included in the model. Data were analysed using the mixed model procedure of the SAS. Fixed effects observed to be significant in the initial analysis were included in the model for estimation of genetic and phenotypic correlation of each trait with milk yield using bivariate analysis in ASREML computer program. Buffaloes in the data were the progeny of 88 sires and 303 dams with 119 base animals. The least squares means for height at withers, diagonal body length and heart girth were found as 132.04±4.56, 154.01±7.60 and 194.46±10.31cm, respectively. Phenotypic correlations of 305 days milk yield with body measurements were low. Positive genetic correlations were observed as 0.16±0.0003 for diagonal body length, 0.08±0.00 for height at withers and 0.14±0.0005 for heart girth. Diagonal body length has shown a low but positive genetic correlation with milk yield and this trait might be considered in the selection program for Nili Ravi buffaloes. Genetic correlation of heart girth with milk yield can be considered for indirect selection for milk yield.

**Keywords** | Nili Ravi buffalo, Genetic correlations, Body measurements, Milk yield, Phenotypic correlations

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# INTRODUCTION

Each breed has some special physical attributes which are important for appropriate performance and functional survival. Some of the body measurements are considered very important from milk production point of view and they have been reported to be correlated with milk yield. Rehman (1996) and Khalid (2011) have reported positive phenotypic correlation of body length with milk yield. Alphonsus et al. (2010) has reported a very high genetic correlation of height at withers with milk yield in crossbred cows. Jaayid et al. (2011) has reported significant positive phenotypic correlation of heart girth with milk yield.

Genetic correlations between any two traits indicate that some of the same genes are controlling these traits and in case of positive genetic correlation between them selection for improvement in any of these traits will result in the improvement in the other trait as a correlated response. In case of absence of any milk recording system under field conditions, farmers generally select animals on the basis of phenotype. Information on genetic correlation of body measurements with milk yield can be used for indirect selection for improved milk yield in this breed. Keeping in view the importance of body measurements and their correlation with milk yield as reported in the literature, the present study was planned with the objectives to record different body measurements in Nili Ravi buffaloes and estimation of phenotypic and genetic correlations with milk yield.

# MATERIALS AND METHODS

Nili Ravi buffalo herds maintained at 5 Livestock Experiment Stations in Punjab and few private breeders were utilized in the present study. The data included 227, 297, 172, 165, 269 and 50 records at Pattoki, Chack Katora, Haroonabad, Khushab, Rakh Ghulaman and private breeder's herds, respectively.

General management and feeding practices at these stations were almost similar and have been more or less the same. Adult animals were being maintained in open enclosures with sufficient covered area for shade and shelter during extreme weather conditions. Routine practice was to allow animals to graze on available fodders for 4-6 hours daily early in the morning after the end of milking depending on season. The lactating buffaloes were fed concentrate at the rate of one kg for every three kg of milk produced. Buffaloes were milked twice daily with an approximate interval of 12 hours at all the farms. All the body measurements were recorded for thrice with an approximate interval of three months with the the first measurement taken after about one month of calving.

## Data structure

Data recording on body measurements was started during July, 2010 and continued till June, 2012. Information including tag number of the buffalo, sire and dam number and pedigree records of sire and dam and other such recorded data were collected in addition to recording body conformation traits. Body measurements including heart girth, height at withers and diagonal body length were studied.

## Statistical analysis

Environmental factors such as age of the buffalo at scoring, stage of lactation, parity, herd and season of scoring were included in the model for initial analysis. Data were analyzed by the mixed model procedure of the Statistical Analysis Systems (SAS, 2011).

The following general mathematical model was used (Model 1):

$$Y_{ijklm} = \mu + S_i + H_j + P_k + T_l + b_1 (a_{ijklm}) + b_2 (a_{ijklm})^2 + e_{ijklm}$$

Where

$Y_{ijklm}$ is the record of m$^{th}$ buffalo at l$^{th}$ stage of lactation during k$^{th}$ parity of j$^{th}$ herd in i$^{th}$ season
$\mu$ is the overall population mean
$S_i$ is the effect due to i$^{th}$ season
$H_j$ is the effect due to j$^{th}$ herd
$P_k$ is the effect due to k$^{th}$ parity
$T_l$ is the effect due to l$^{th}$ stage of lactation
$a_{ijklm}$ is the age of buffalo at classification
$b_1$ and $b_2$ is the linear and quadratic regression coefficient of age at classification
$e_{ijklm}$ is the random error associated with the observation on m$^{th}$ buffalo at l$^{th}$ stage of lactation during k$^{th}$ parity of j$^{th}$ herd in i$^{th}$ season.

Phenotypic and genetic correlations were estimated using Best Linear Unbiased Prediction (BLUP) evaluation techniques. Fixed effects observed to be significant in the initial analysis using the above model were included in the model for estimation of genetic and phenotypic correlations of body measurements with milk yield. Individual Animal Model was fitted under Restricted Maximum Likelihood (REML) Procedure outlined by Patterson and Thompson (1971). Bivariate analysis fitting animal model in ASREML computer program (Gilmour, 2009) was used for estimation of correlations which were calculated by applying the following formulas:

Phenotypic correlation ($r_p$)= Cov $_{pi.\,pj}$ / $\sigma^2$ $_{pi.\,\sigma^2\,pj}$

Genetic correlation ($r_G$)= Cov $_{Ai.\,Aj}$ / $\sigma^2$ $_{Ai}$. $\sigma^2$ $_{Aj}$

Environmental correlation ($r_E$)= Cov $_{Ei.\,Ej}$ / $\sigma^2$ $_{Ei.}$ $\sigma^2$ $_{Ej}$

Where,

$\sigma^2_{Ai}$ = additive genetic variance for the $i^{th}$ trait

$\sigma^2_{Aj}$ = additive genetic variance for the $j^{th}$ trait

$\sigma^2_{pi}$ = phenotypic variance for $i^{th}$ trait

$\sigma^2_{p}$ = phenotypic variance for $j^{th}$ trait

$\sigma^2_{Ei}$ = residual variance for the $i^{th}$ trait

$\sigma^2_{Ej}$ = residual variance for the $j^{th}$ trait

Cov $_{pi.\,pj}$ = phenotypic covariance for the traits i and j

Cov $_{Ai.\,Aj}$ = additive genetic covariance for the traits i and j

Cov $_{Ei.\,Ej}$ = residual covariance for the traits i and j

## RESULTS

Separate data and pedigree files were prepared in excel sheets and analysis was performed in ASREML computer program (Gilmour, 2009). Pedigree records of buffaloes were traced back up to five available generations and these buffaloes were the progeny of 88 sires and 303 dams. Number of base animals were 119 with no pedigree records. Most of the phenotypic correlations of 305 days milk yield with body measurements were in low range. Body measurements have shown very low positive phenotypic correlation values with 305 days milk yield. Negative phenotypic correlations with 305 days milk yield were not observed. Positive genetic correlation values were observed for diagonal body length, height at withers and for heart girth. The results are presented in table 1 and 2.

## DISCUSSION

Phenotypic correlation of diagonal body length with milk yield was very low in the current study (<0.05). Sieber et al. (1988) reported a significant phenotypic correlation of body length with milk yield as 0.21. Bayram et al. (2006) has also reported a significant positive phenotypic correlation of body length with milk yield as 0.28. Alphonsus et al. (2010) has reported this correlation as 0.25 in crossbred cows. Jaayid et al. (2011) has reported significant positive phenotypic correlation of body length with milk yield as 0.32 in Iraqi buffaloes. Musa et al. (2011) has reported this correlation highly significant as 0.54 in Kenana cattle. The very low phenotypic correlation in the current study might be due to relatively small data set or due to species differences.

Genetic correlation of diagonal body length with 305 days milk yield has been observed considerable as 0.16±0.0003. Khan (2009) has reported almost similar genetic correlation of diagonal body length with 305 days milk yield as 0.13±0.00 in Sahiwal cows. Alphonsus et al. (2010) has reported this correlation as 0.048 in crossbred cows. Diagonal body length in the current study has shown a low but positive genetic correlation with milk yield and this trait might be considered in the selection program for Nili Ravi buffaloes.

Phenotypic correlation of height at withers with 305 days milk yield was found as 0.04±0.02. Jaayid et al. (2011) has reported a similar phenotypic correlation of height at withers with milk yield as 0.03 in Iraqi buffaloes. Slightly higher phenotypic correlation of height at withers with milk yield was reported by Lin et al. (1987) as 0.12 in Holstein cows and Khan (2009) as 0.09±0.06 in Sahiwal cows. Sieber et al. (1988) reported a significant phenotypic correlation of height at withers with milk yield as 0.22. Bayram et al. (2006) has also reported a significant positive phenotypic correlation of 0.30 in Holstein Friesian cows. Alphonsus et al. (2010) has reported this correlation as 0.23 in crossbred cows. Khalid (2011) has reported

**Table 1:** Least squares means for body measurements in Nili Ravi buffaloes

| Trait | N | Mean±Std Dev | Coefficient of Variation (%) | Range |
|---|---|---|---|---|
| Diagonal body length (cm) | 1155 | 154.01±7.60 | 4.94 | 127-185 |
| Height at withers (cm) | 1170 | 132.04±4.56 | 3.46 | 117-146 |
| Heart girth (cm) | 1179 | 194.46±10.31 | 5.30 | 121-226 |

**Table 2:** Phenotypic and genetic correlation of some body measurements with 305 days milk yield in Nili Ravi Buffaloes

| Trait | N | Phenotypic correlation | Genetic correlation |
|---|---|---|---|
| Height at withers | 1170 | 0.04±0.02 | 0.08±0.0000 |
| Diagonal body length | 1155 | 0.04±0.04 | 0.16±0.0003 |
| Heart girth | 1179 | 0.04±0.04 | 0.14±0.0005 |

this correlation as 0.20 in Nili Ravi buffaloes. Musa et al. (2011) has reported this correlation highly significant as 0.28 in Kenana cattle.

Genetic correlation of height at withers with 305 days milk yield was observed as 0.08±0.00. Lin et al. (1987) and Van Niekerk et al. (2000) have reported higher estimates as 0.35±0.13 and 0.33, respectively. Khan (2009) has reported this correlation as 0.17± 0.00. Alphonsus et al. (2010) has reported a very high genetic correlation as 0.59 in crossbred cows. These reports are not in agreement with the findings of current study. Lower genetic correlation of height at withers with milk yield suggested that this trait is not much important, however further research is needed to investigate this relationship in Nili Ravi buffaloes. The findings of current study indicated a phenotypic correlation of heart girth with 305 days milk yield as 0.04±0.04. Sieber et al. (1988) reported a positive but non significant phenotypic correlation of heart girth with milk yield as 0.18. Rehman (1996) has reported phenotypic correlation of heart girth with milk yield as 0.14±0.02. Bayram et al. (2006) have reported a highly significant positive phenotypic correlation of 0.30 in Holstein Friesian cows. Alphonsus et al. (2010) has reported this correlation as 0.17 in crossbred cows. Khalid (2011) and Yakubu (2011) have reported a very high phenotypic correlation of heart girth with milk yield as 0.63 and 0.53 respectively. Jaayid et al. (2011) has reported significant positive phenotypic correlation of heart girth with milk yield as 0.36 in Iraqi buffaloes. Musa et al. (2011) has reported this correlation highly significant as 0.36 in Kenana cattle. The findings of the current study do not agree with most of the above reports. The reason might be relatively small data set or some genetic or environmental differences.

Genetic correlation of heart girth with 305 days milk yield was found as 0.14±0.00. Khan (2009) has reported corresponding value as 0.22±0.00 in Sahiwal cows. Lin et al. (1987) and De Haas et al. (2007) have also reported higher genetic correlation of heart girth with milk production as 0.30 and 0.39, respectively. Alphonsus et al. (2010) has reported a very high genetic correlation as 0.82 in crossbred cows. These reported values are high and do not agree with the findings of current study. Genetic correlation of heart girth with milk yield although not very high but seems to be important and can be considered for indirect selection for milk yield through heart girth measurement.

Diagonal body length in the current study has shown a low but positive genetic correlation with milk yield and this trait might be considered in the selection program for Nili Ravi buffaloes. Genetic correlation of heart girth with milk yield although not very high but seems to be important and can be considered for indirect selection for milk yield through heart girth measurement.

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## CONFLICT OF INTEREST

We want to make it clear that there is no conflict of interest with any of the financial organization regarding the material discussed in the current manuscript.

## REFERENCES


- Alphonsus C, Apka GN, Oni OO, Rekwot PI, Barje PP, Yashim SM (2010). Relationship of linear conformation traits with body weight, body condition score and milk yield in Friesian x Bunaji cows. J. Appl. Anim. Res. 38(1): 97-100.
- Bayram B, Güler O, Yacndc M, Akbulut Ö (2006). Relationships among body weight, body measurements and estimated feed efficiency characteristics in Holstein Friesian cows. J. Tekirdag Agri. Fac. 3(1): 64-67.
- Gilmour AR, Gujel BJ, Cullis BR, Thompson R (2009). ASReml user guide (version 3.0), VSN International Ltd, Hemel Hempstead, HP1 1ES, UK.
- De Haas Y, Janss LLG, Kadarmideen HN (2007). Genetic and phenotypic parameters for conformation and yield traits in three Swiss dairy cattle breeds. J. Anim. Breed. Genet. 124 (1): 12-19.
- Jaayid TA, Yousief MY, Hamed FH, Owaid JM (2011). Body and udder measurements and heritability and their relationship to the production of milk in the Iraqi Buffalo. Int. J. Biotech. Biochem. 7(5): 553-564.
- Khan MA (2009). Characterization of Sahiwal cattle for linear type traits. Ph.D. thesis, University of Agriculture, Faisalabad, Pakistan.
- Khalid MS (2011). Correlation response of udder and body measurements as affected by age and parity on milk contents and yield in Nili Ravi buffaloes in peri urban areas of Lahore. M. Phil. Thesis University of Veterinary and Animal Sciences Lahore, Pakistan.
- Lin CY, Lee AJ, Mcallister AJ, Batra TR, Roy GL, Vesely JA, Wauthy JM, Winter KA (1987). Intercorrelations among milk production traits and body and udder measurements in Holstein heifers. J. Dairy Sci. 70(11): 2385-2393.
- Rehman M (1996). Studies on phenotypic characteristics and body conformation of Nili Ravi buffaloes and their relationship with milk production. M.Sc. thesis, University of Agriculture, Faisalabad, Pakistan.
- Musa AM, Mohammed AO, Abdalla, Elamin1 KM (2011). Linear body measurements as an indicator of Kenana cattle milk production. Online J. Anim. Feed Res. 1(6): 259-262.
- Patterson HD, Thompson R (1971). Recovery of inter-block information when block size are unequal. Biometrika. 58(3): 545-554.
- SAS Instt. Inc. (2011). SAS/STAT user's guide, Release 9.3. Carry, North Carolina, USA.
- Sieber M, Freeman AE, Kelley DH (1988). Relationships between body measurements, body weight and productivity in Holstein dairy cows. J. Dairy Sci. 71(12): 3437-3445.
- Van Niekerk DJ, Neser FWC, Erasmus GJ (2000). Genetic parameter estimates for type traits in the South African Jersey breed. South Afric. J. Anim. Sci. 30(3): 186-192.
- Yakubu A (2011). Path analysis of conformation traits and milk yield of Bunaji cows in smallholder's herds in Nigeria. Agri. Trop. Subtrop. 44 (3): 152-157.