Original Article Buffalo Bulletin (September 2014) Vol.33 No.3

EFFECT OF GENETIC AND NON-GENETIC FACTORS ON MORPHOMETRIC TRAITS OF BUFFALOES

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ABSTRACT

The present experiment was conducted on 60 randomly selected dairy units consisting of 116 graded Murrah, 70 Diara type and 121 non-descript type buffalo cows utilizing the procedures of stratified random sampling with proportional allocation (Snedecor and Cochran, 1967) in and around Patna (Bihar). The aim of this investigation was to study the effect of genetic and non-genetic factors on various morphometric traits of buffaloes under farmer's management system. The morphometric traits included in the study were height at wither (haw, cm), body length (bl, cm) and chest girth (cg, cm) as well as body weight of the adult buffalo cows. The genetic factors were the three different genetic groups of buffaloes viz. graded Murrah, Diara and non-descript types prevalent in Bihar (India), whereas the non-genetic factors included in the study were location of herd, farming system and sequence of lactation. The farming system and the order of lactation had significant ($P<0.05$) influence on HAW, BL and CG whereas location of animals did not influence these traits. The animals managed under mixed farming system had significantly ($P<0.05$) higher estimates of morphometric traits than those maintained in the units involved dairying alone. The animals of first order of lactation had the lowest magnitudes of all the morphometric traits and significantly ($P<0.05$) increased upto third parity indicating that the skeletal maturity of the buffaloes might be attained at the age of 3rd parity.

Keywords: morphometric traits, buffaloes, genetic factors, non-genetic factors

INTRODUCTION

Cattle and buffaloes are the main milk producing animals in India. The buffalo forms the backbone of India's dairy industry and is rightly considered as the bearer cheque of the rural folk. Although being less than one third of the total bovine population, the buffalo contributes more than 50% of the total milk production in the country. Although small buffalo herds are distributed throughout the length and breadth of the state, the area under South and North gangetic plains of Bihar is densely populated with clusters of buffaloes. The majority of them are of non-descript type, some are graded Murrah and the rest of the population is phenotypically homogenous in certain distinguishable characteristics. These

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phenotypically homogenous buffaloes are almost true to the breed and have acquired full adoption to the socio-agro-climatic and ecological conditions of Gangetic plains, particularly in the "Tal and Diara" area of the rivers Ganga, Gandak and Sone in the division of Patna, Bhagalpur and Magadh. These true breeding buffalo populations are particularly called as "Diara" by the farmers. It is pertinent to mention here that the true breeding buffalo population (about 1.3 million of the total buffalo population of the state) locally known as Diara/Deshila which contribute about 32% of the State Milk Pool, is almost untouched, so far as their breeding and development programmes are concerned, and hence the present study has been undertaken.

MATERIALS AND METHODS

Buffaloes consisting of three genetic groups namely graded Murrah, Diara and non-descript types maintained in private dairy units at farmer's door located in a radius of 15 km in and around Patna were the experimental animals for the present study. The whole area under study was divided into three distinct zones, which were as follows:

Zone – I	North West Patna
Zone – II	South West Patna
Zone – III	East Patna

The primary survey was conducted in private dairy units popularly known as Khatals located in a radius of 15 km in and around Patna. Those Khatals which consisted of at least two or more buffaloes consisting of graded Murrah, Diara or non-descript buffaloes either alone or in combination were enumerated, utilizing a door to door survey method. Altogether 920 buffaloes consisting of 331 graded Murrah, 221 Diara and 368 non-descript buffaloes were enumerated from 145 dairy units located in and around Patna.

Out of 145 enumerated units, only 120 units were respondent units which provided relevant information. Out of total 120 units, 50% i.e. 60 dairy units, consisting of 430 buffaloes of different genetic groups, were randomly selected utilizing the procedure of stratified random sampling with proportional allocation (Snedecor and Chochran, 1967). Data were recorded from buffaloes of defined genetic groups, which had completed at least one calving interval. The morphometric traits included in the study were height at wither (haw, cm), body length (bl, cm) and chest girth (cg, cm) as well as body weight of the adult buffalo cows. The data were classified on the basis of genetic group of the buffaloes, location of herd (Zone), farming system and lactation order to study the effect of various genetic and non-genetic factors on the morphometric traits.

The experimental animals under study were classified under three genetic groups: (i) graded Murrah, (ii) Diara type (iii) non-descript type.

Performance records of the buffaloes were classified into four groups on the basis of sequence of lactation: 1st parity, 2nd parity, 3rd parity, 4th parity. The enumerated dairy units were grouped according to the farming system adopted by the farmers which were as follows:

i) Mixed farming (animal husbandry integrated with agriculture)
ii) Only animal husbandry.

To quantify the variation due to various genetic and non-genetic factors on different economic traits, the data were subjected to least squares analysis (Harvey, 1966) for which the

following mathematical model was utilized.

$$Y_{iJKlm} = \mu + G_i + Z_j + F_k + P_l + e_{ijklm}$$

where, Yijklm = The value of m^{th} individual under i^{th} genetic group, J^{th} location, K^{th} farming system and l^{th} parity.

μ = The overall population mean.

G_i = The effect of i^{th} genetic group (i = 1,2,3).

Z_j = The effect of j^{th} location of herd (j = 1,2,3).

F_k = The effect of K^{th} farming system (K = 1,2).

P_l = The effect of l^{th} parity (l = 1,2,3,4).

e_{ijklm} = The random error associated with individual which is randomly and independently distributed with mean zero and variance σ_e^2

The statistical significance of various fixed effect was tested by the F test whereas DMRT, as modified by Kramer (1957), was applied to carry out the pair wise comparisons among least squares means at the 0.05 and 0.01 levels of probability.

RESULTS AND DISCUSSION

The average height at wither of graded Murrah was estimated to be 132.113±0.187 cm., which differed significantly ($p<0.01$) from Diara and non-descript buffaloes by 2.295 cm and 3.299 cm, respectively. The mean values obtained in the present investigation for all the three genetic groups viz. graded Murrah, Diara and non-descript types, were lower than those reported elsewhere for Murrah (Jawarkar and johar, 1975; Sreedharan, 1976 and Manik and Iqbalnath, 1981).The average estimate of height of wither for Diara buffaloes reported by Singh *et al*. (2006) was in consonance with the result of the present study. Thus it may be concluded that graded Murrah, Diara and non-descript buffaloes in and around Patna (Bihar) were observed to be smaller and lighter than Murrah but heavier than Mehsana, Surti, Bhadawari and Nagpuri buffaloes.

As evident from Table 1, the average height at wither was highest (130.456±0.183 cm) in the animals located in southwest Patna of the study area followed by northwest (130.180±0.177 cm.) and east Patna (130.109±0.198 cm.).

Farming system had a significant ($p<0.01$) influence on height at wither. The animals reared under a mixed farming system integrated with agriculture had the higher estimate (130.513±0.157 cm) for HAW than those managed in the units exclusively involved in dairying by 0.53 cm (Table 1). The difference was statistically significant ($p<0.05$). Significantly higher estimates of HAW in all the age groups for animals maintained in livestock research stations than those maintained under farmer's management systems as observed by Singh (1995[a]) were in consonance with the findings of the present study. Significant ($p<0.05$) difference for HAW between animals managed under different farming systems might be attributed to the fact that animals managed under better management systems may have better growth.

The average HAW was found to be increased significantly ($p<0.05$) and steadily from first (124.391±0.197 cm) to third lactation (133.952±0.213 cm) by 9.561 cm followed by slight decrease in fourth lactation. However, the difference in HAW between third and fourth parity was not statistically significant. The significant ($p<0.01$) influence of parity on height at wither observed in the present investigation was in accordance with

the findings of many workers (Jawarkar and Johar, 1975; Saini and Gill, 1986; Jogi and Patel, 1990; Singh *et al*., 1995.

Body length

Overall least squares mean for body length pooled over three different genetic groups of buffaloes viz. Diara, graded Murrah and non-descript types included in this study, was reckoned to be 136.478±0.138 cm (Table 1).

Genetic group had a highly significant ($p<0.01$) effect on body length. As revealed from Table 1, the graded Murrah had the longest body length (138.598±0.235 cm) followed by Diara (135.507±0.232 cm), and non-descript had the shortest body length (135.328±0.231 cm). The average body length of graded Murrah differed significantly ($p<0.05$) from Diara and non-descript types. The average estimates for body length in all the three genetic groups obtained in the present study were lower than the body length of Murrah buffaloes as reported elsewhere by Jawarkar and Johar (1975), Sreedharan (1976) and Manik and Iqbalnath (1981). The significant ($p<0.05$) effect of genetic group on body length reported by Sinha (2006) and Singh *et al*. (2006) was in agreement with the findings of the present study.

As evident from Table 1, the average body length was found to be highest (136.796±0.230 cm) in the animals located in southwest Patna of the study area followed by northwest (136.384±0.22 cm) and lowest in east Patna (136.253±0.249 cm). The least squares analysis of variance revealed non-significant effect of zone on body length. The non-significant effect of location on body length as observed in the findings of the present study is in agreement with the results reported by Singh *et al*. (1995) in Mehsana buffaloes.

The farming system was found to have a significant ($p<0.01$) influence on body length. The animals managed in the units integrated with agriculture farming had significantly ($p<0.05$) higher mean body length (137.003±0.197 cm) in comparison to those involved in the dairying alone by 1.151 cm (Table 1). Differences in body length were also observed by Singh *et al.* (1995a) in all the age groups of Mehsana buffaloes managed in LRS herd from those managed in milk union sheds under farmers management systems which supports the finding of the present study.

The lactation order had highly significant ($p<0.01$) effect on body length. The lowest average body length pooled overall the three genetic groups viz. graded Murrah, Diara and non-descript types, was estimated to be 130.947±0.247 cm in the first parity and then increased significantly ($p<0.05$) over the lactations. The highest average body length (140.007±0.268 cm) was observed in third parity, which was significantly ($p<0.05$) longer than the average body length observed during first and second parity by 4.279 and 9.06 cm, respectively. The average body lengths during third and fourth order of lactations were also significantly ($p<0.05$) longer than in second parity by 4.781 and 4.505 cm, respectively. However, though the body length in fourth parity was little bit shorter than in third parity, the two did not differ significantly.

Significant influence of parity on body length as observed in the present study has also been reported in Murrah buffaloes by Jawarkar and Johar (1975), Saini and Gill (1986), Jogi and Patel (1990) and in Mehsana buffaloes by Singh *et al*. (1995) and Singh *et al.* (2000), who stated that body length in buffaloes increased significantly up to third parity.

Chest girth

The overall least squares mean for chest

girth pooled over the three different genetic groups of buffaloes, viz. Diara, graded Murrah and non-descript, included in this study was estimated to be 195.692±0.384 cm (Table 1).

Genetic group had highly significant ($p<0.01$) influence on chest girth.. As evident from Table 1 the graded Murrah had the largest chest girth (199.153±0.653 cm) followed by non-descript (196.640±0.6421 cm) and Diara buffaloes (191.282±0.646 cm). The chest girth in Diara buffaloes was found to be significantly ($p<0.05$) lower than the graded Murrah and non-descript buffaloes by 7.871 and 5.358 cm, respectively.

The findings of the present study were not in agreement the findings of Jawarkar and Johar (1975), Sreedharan (1976) and Manik and Iqbalnath (1981) who reported higher estimates of chest girth in Murrah buffaloes.

As evident from Table 1, the highest average chest girth was found to be 196.953±0.641 cm in the animals located in southwest Patna of the study area followed by northwest Patna (195.257±0.619 cm) and lowest in east Patna (194.866±0.693 cm). The least squares analysis of variance revealed non-significant effect of zone on chest girth. The non-significant effect of location on chest girth reported by Singh *et al.* (1995[a]) in Mehsana buffaloes is in agreement with the results of the present study.

The farming system was found to have highly significant ($p<0.01$) influence on chest girth. The animals managed in the units integrated with agriculture farming had significantly ($p<0.05$) higher average chest girth (197.584±0.549 cm) in comparison to those involved in dairying alone by 3.785 cm (Table 1). Similar findings have also been reported by Singh *et al.* (1995) who observed significant difference in heart girth among all the age groups of Mehsana buffaloes between LRS herd and milk union sheds where animals were under the farmers' management system.

The order of lactation had highly significant ($p<0.01$) influence on chest girth in buffaloes in and around Patna. The average chest girth pooled over all the three genetic groups viz. graded Murrah, Diara and non-descript buffaloes was found to be the lowest (186.467±0.688 cm) at first parity.

The average estimates of chest girth in second, third and fourth parities were observed to increase significantly ($p<0.05$) over the average chest girth at first parity by 7.85, 15.362 and 13.687 cm, respectively. A significant effect of parity on chest girth is also reported by Jawarkar and Johar1975), Saini and Gill (1986), Jogi and Patel (1990) in Murrah and (Singh *et al.* (1995) and Singh *et al.* (2000) in Mehsana buffaloes.

SUMMARY

Graded Murrah had significantly ($P<0.05$) higher estimates of all the morphometric traits (HAW, BL and CG) than the Diara and non-descript types, whereas, Diara buffaloes had superiority over non-descript types for height at wither and chest girth. The average estimates of height at wither, body length and chest girth of graded Murrah were 132.113±0.187, 138.598±0.235 and 199.153±0.0653 cm respectively. Therefore, the size of Diara buffaloes was in between Graded Murrah and Non-descript types. The farming system and the order of lactation had significant ($P<0.05$) influence on HAW, BL and CG whereas location of animals did not influence these traits. The animals managed under mixed farming system had significantly ($P<0.05$) higher estimates of morphometric traits, than those maintained in the units involved dairying alone.

Table 1. Least squares means±SE and CV% of morphometric traits of buffaloes in and around Patna.

Particulars	Morphometric traits (cm)		
	HAW (Mean±S.E.)	**B.L. (Mean±S.E.)**	**C.G. (Mean±S.E.)**
Overall Mean (μ)	130.248±0.110 (1.47)	136.478±0.138 (1.77)	195.692±0.384 (3.43)
Factors			
Genetic group			
Graded Murrah	132.113^{a}±0.187 (1.41)	138.598^{a}±0.235 (1.69)	199.153^{a}±0.653 (3.27)
Diara	129.818^{b}±0.185 (1.42)	135.507^{b}±0.232 (1.71)	191.282^{b}±0.646 (3.41)
Non-descript	128.814^{c}±0.184 (1.42)	135.328^{b}±0.231 (1.70)	196.640^{c}±0.642 (3.34)
Location			
1. Northwest Patna	130.180±0.177 (1.44)	136.384±0.222 (1.72)	195.257±0.619 (3.35)
2. Southwest Patna	130.456±0.183 (1.44)	136.796±0.230 (1.73)	196.953±0.641 (3.35)
3. East Patna	130.109±0.198 (1.44)	136.253±0.249 (1.72)	194.866±0.693 (3.35)
Farming System			
1. Animal Husbandry alone	129.983^{a} ±0.149 (1.45)	135.952^{b}±0.187 (1.73)	193.800^{a}±0.520
2. Mixed Farming	130.513^{b}±0.157 (1.46)	137.003^{a}±0.197 (1.74)	197.584^{b}±0.549
Lactation order			
1st	124.391^{a} ±0.197 (1.49)	130.947^{a}±0.247 (1.77	186.467^{a}±0.688 (3.48)
2nd	128.907^{b} ±0.188 (1.42)	135.226^{b}±0.236 (1.70)	194.317^{b}±0.657 (3.31)
3rd	133.952^{c} ±0.213 (1.38)	140.007^{c}±0.268 (1.66)	201.829^{c}±0.745 (3.31)
4th	133.743^{c}±0.273 (1.38)	139.731^{c}±0.343 (1.66)	200.154^{c}±0.955 (3.23)

Means with different superscripts (column-wise) differed significantly (P<0.05)

Values in parentheses are CV%

CONCLUSION

The animals of first lactation had the lowest magnitudes of all the morphometric traits, and these magnitudes significantly ($P<0.05$) increased upto third parity indicating that the skeletal maturity of the buffaloes might be attained at the age of 3rd parity. On the basis of the findings of the present study it can be concluded that the Diara buffaloes were significantly different from Graded Murrah and non-descript types in respect to morphometric traits;therefore, work of a similar type may be repeated in the entire Tal and Diara areas of the river Ganges, Gandak and Sone pertaining to Bihar to identify and enumerate the number of Diara buffaloes so that a suitable breeding plan can be chalked out for improvement of Diara buffaloes and to improve the livelihood of the dairy farmers in the state.

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