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Correlation and regression coefficient between milk yield and skin fold thickness in different region in Murrah buffaloes

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Abstract

The experiment was conducted with the duration of six months at ABIS (Aamir Bahadur Sultan Ali) Buffalo Dairy Farm, Gormara, Rajnandgaon (Chhattisgarh) to investigate the variability of skin thickness in relation to milk production. A total of 120 milking Murrah buffaloes were selected for the experiment. The Murrah buffaloes were selected in a range of first to sixth parity and each parity containing 20 buffaloes. All the selected Murrah buffaloes of the present investigation were kept under similar housing system i.e. loose housing system with one shelter along one side of the paddock and provided green fodder and total mix ration as per their requirement. Drinking water was made available ad lib to whole day. The milking was done by milking machine in milk parlour in morning and evening. Daily milk yield and total milk yield were recorded from the records. The correlation between skin thickness of neck, chest, abdomen, rump, hind quarter, udder and flank and total milk yield were -0.377, -0.498, -0.355, -0.282, -0.207, 0.073 and -0.072 respectively. Correlation between lactation length and different site of skin thickness was found significantly positive. However, negative correlation was observed for daily milk yield. On the other hand, regression coefficient of skin thickness and milk yield indicated that an increase in skin thickness of neck, chest, rump and hind quarter could decrease in average total milk.

Keywords: Skin fold thickness, correlation, regression, milk yields

Introduction

Buffaloes play very important role in Indian agriculture. They are reared mainly for milk, meat and also draft purpose in all over the world. Total 73.77% of world buffaloes population present in Asia. Out of 16 recognized breeds of buffalo, the Murrah breed is the most important breed that is known for its high milk yield potential. The home tract of this breed stretches around southern parts of Haryana. Murrah breed has been used extensively to improve the milk production of dairy buffalo in other countries like Brazil, Italy, Bulgaria and Egypt. Average milk production in Murrah buffalo varies from 1360 to 2270 kg in a lactation period of 310 days (Sastry and Thomas, 2015) [15]. The average milk yield is reported to be 6.5 kg/day while a few individual animals yield as much as 19.1 kg/day. Milk yield is an important selection criterion in buffalo breeding programme. Some morphological features like body length, chest girth, abdominal girth, body depth, hip bone distance, pin bone distance, height at wither, muzzle width, tail length, udder dimension and skin thickness are considered important for selection of dairy buffaloes.

Murrah buffaloes being a well defined animal genetic resource, show great variation in number of external morphometric characters with other economic traits under field conditions (Charlini and Sinniah, 2015) [3]. However, such type of information is insufficient especially the concepts of body parts measurements and milk yield relationship in dairy buffaloes is very recent (Dhillod *et al.*, 2017) [4]. Physical features of Murrah breed such as body size, coat colour, horn shape, udder shape and size, and skin thickness are said to be related with milk production (Mondal and Pandey, 1995; Bhuiyan *et al.*, 2004) [14, 3]. One of the important traits, skin thickness may be associated with selection and judging of dairy buffaloes for their economic characters (Barati *et al.*, 2017) [1]. The black colour skin of buffalo is thin, soft and pliable. The density of black or brown colour pigments is proportional to the exposure of the skin to sun light. The epidermis layer of skin consists of 1.5 to 2% of the total skin thickness.

It is reported that the skin thickness of buffalo is about twice that of cattle. The skin of an animal in good condition is relatively thick and skin thickness may indicate an animal's ability to thrive in a given area. The plane of nutrition, however, influences the thickness of adipose tissue layer.

It is generally stated that on an average large animals having soft and thin skin produce more milk and vice-versa. It has been reported that the tropical breeds of cattle generally have thinner skin than those breeds which are originated in temperate climate. The thickness of skin is an important factor to determine performance of cow (Hamid *et al.*, 2000) ^[10]. Skin thickness of cattle and buffalo has been measured by various workers (Dowling 1955; Walker, 1957; Hossain *et al.*, 2016; Barati *et.al.*, 2017) ^[7, 17, 11, 1].

Material and Methods

The experiment was conducted with the duration of six month at ABIS (Aamir Bahadur Sultan Ali) Buffalo Dairy Farm, Gormara, Rajnandgaon (Chhattisgarh) to investigate the variability of skin thickness in relation to milk production. A total of one hundred and twenty milking Murrah buffaloes were selected for the experiment. The Murrah buffalo cows were selected in a range of first to sixth parity (lactation period) and each parity containing twenty buffalo cows. Daily milk yield and total milk yield were recorded from the records over an average period of 238- 271 days lactation length.

Feeding and management practices: In ABIS Buffalo Dairy Farm, all the selected Murrah buffaloes of the present investigation were kept under similar housing system i.e. loose housing system with one shelter along one side of the paddock. The animals were given green fodder and total mix ration based feeding as per their requirements. The green fodder given to the animal include berseem, MP chari and maize. The total mixture ration consist of corn, jowar and napier fresh cuts, corn silage, paddy straw, whole cotton seed, grind corn plain, wheat bran, soya DOC, rape seed, soya hull, milking premix M1, ca-carbonate, salt, urea premix and toxin binder. Drinking water was made available ad lib to whole day. The milking was done by milking machine in milk parlour and capacity of milk parlour was about 48 animals in single time. Milking done was in morning and evening.

Measuring skin thickness of Murrah buffalo. The selected animals were properly tied up in order to restrict their movements for easy skin measurement. The area of skin for measurement was carefully folded and lifted up while measuring the skin fold thickness so that it may not be too much stretched and the pressure exerted at the jaws of the Digital Vernier Callipers. For getting the accurate value, all the measurements were recorded three times at different intervals in seven regions or sites of the body in each buffalo. As skin thickness was double the actual thickness, therefore, it was divided by two from such skin fold thickness measurements so as to get actual skin thickness i.e.

$$\text{Skin thickness in mm} = \frac{\text{Skin thickness}}{2}$$

The skin fold thickness measurements at different locations were taken while the animals stood squarely on all four feet and head raised in a normal alert position.

The procedure for measuring skin fold thickness in seven regions of animal body was as under (Dowling, 1964; Barati *et al.* 2017; Dhillod *et al.*, 2017) ^[7, 1, 6].

1) **Neck:** At a point where two imaginary lines passing through length and width of the neck meet

- 2) **Chest:** Where a vertical line at the level of heart meets middle one of three lines drawn horizontally to divide one side of barrel into four horizontal compartments
- 3) **Abdomen:** Posterior to chest at the same level with umbilicus
- 4) **Hind quarter:** Parallel to haunch and about three inches the pin bone
- 5) **Rump:** About six inches below the front attachment of hip joint
- 6) **Udder:** About four inches below the rear attachment of udder
- 7) **Flank:** Midpoint of the triangular flank area.

Statistical analysis: Further to see the relation correlation coefficient and regression between different sites of skin thickness and milk yields were done as per Snedecor and Cochran (1989) ^[16].

Results and Discussion

Correlation between skin thickness and milk yield: The correlation co-efficient (r) between skin thickness of different regions and milk yield is shown in Table 1. The results showed that correlation coefficient between the skin thickness of neck, chest, abdomen, rump, hind quarter, udder and flank and TMY in Murrah buffalo cows were - 0.377, - 0.498, - 0.355, -0.282, -0.207, 0.073 and -0.072 respectively. However, correlation coefficient between skin thickness of different region and DMY were -0.303(neck), -0.404 (chest), - 0.340 (abdomen), -0.200 (rump), -0.256 (hind quarter), -0.210 (udder) and -0.351 (flank). The study indicated that except udder region the correlation coefficients of all other sites of skin thickness with TMY were found negative correlation, whereas skin thickness of all sites with DMY was observed negative correlation. The skin thickness of chest in both DMY (r = -0.498) and TMY (r = -0.404) was found maximum correlation between lactation length.

The present findings are in agreement with earlier workers like Bhatnagar and Kumar (1980) ^[2] who found negative and significant correlation coefficient between skin thickness and average milk yield measured for seven different sites in Sahiwal cows. However, Manik *et al.* (1981) ^[13] reported no correlation between skin thickness and milk production in Murrah buffalo. Fenzi and Canni (1962) ^[9] reported that an overall negative correlation existed between milk yield and the mean skin thickness in Friesian cattle in Italy. Hamid *et al.* (2000) ^[10] revealed that milk yield in 3rd lactation was higher than the 2nd lactation period. The authors also found that the correlation co-efficient (r) between skin thickness of hind quarter, abdomen, chest, dewlap, neck and average skin thickness with average milk yield were -0.562 ± 0.21, -0.383 ± 0.08, -0.409 ± 0.10, -0.304 ± 0.11, 0.545 ± 0.12 and -0.537 ± 0.23 respectively. The study also revealed that cows having low skin thickness were found to have produced higher milk than cows having medium and high skin thickness. Kshatriya *et al.* (2009) ^[12] found significant negative correlation (p<0.01) between skin thickness at three sites i.e. neck, chest and flank with milk yield in Kankrej as well as crossbred cows.

Barati *et al.* (2017) ^[1] was reported that the daily milk yield has negative significant correlations with skin fold thickness of flank (-0.334) and udder (-0.264) regions. However, the daily milk yield was negatively correlated with skin fold thickness of neck (-0.103), chest (-0.111) and abdomen (-0.051). Desai and Sharma (1962) ^[5] observed no correlation between skin thickness and milk production in Haryana cattle.

Table 1: Correlation co-efficient (r) of different skin thickness with total milk yield, daily milk yield and lactation length in Murrah buffaloes

Skin thickness measurement sites	Total milk yield	Daily milk yield	Lactation length
Neck	-0.377**	-0.303**	0.176*
Chest	-0.498**	-0.404**	0.174*
Abdomen	-0.355*	-0.340**	0.192*
Rump	-0.282**	-0.200*	0.194*
Hind quarter	-0.207*	-0.256**	0.249*
Udder	0.0730 ^{NS}	-0.210**	0.275*
Flank	-0.072 ^{NS}	-0.351**	0.142 ^{NS}

** Significant at $p < 0.05$ level* Significant at $p < 0.01$ level

NS = Non significant

Analysis of regression coefficient for skin thickness and milk yield

The regression coefficient for total milk yield and daily milk yield with skin thickness of various sites is given in Table 2. The results indicated that an increase in skin thickness of

neck, chest, rump and hind quarter would decrease in average TMY. However, an increase in skin thickness of chest, abdomen, udder and flank would decrease in DMY. On other hand, decrease in skin thickness of neck, rump, hind quarter would increase in daily milk yields.

Table 2: Regression of different skin fold thickness with total milk yield and daily milk yield

Skin thickness measurement sites	Regression (kg milk/ mm thickness)	
	Intercept 2294.24 ± 260.17	Intercept 13.44 ± 1.32
	TMY	DMY
Neck	-27.22 ± 44.51	0.15 ± 0.22
Chest	-135.24 ± 39.84	-0.67 ± 0.20
Abdomen	0.95 ± 39.84	-0.006 ± 0.20
Rump	-16.22 ± 26.81	0.17 ± 0.13
Hind quarter	-29.58 ± 37.64	0.138 ± 0.18
Udder	88.89 ± 35.64	-0.139 ± 0.18
Flank	32.00 ± 36.87	-0.58 ± 0.18

Hamid *et al.* (2000) [10] observed that the regression equation for average milk yield and the skin thickness of hind quarter, abdomen, chest, dewlap, neck and average thickness were $y = 4.850 - 0.377X$, $4.388 - 0.264 X$, $4.466 - 0.411X$, $4.252 - 0.204X$, $4.775 - 0.458X$ and $5.393 - 0.566X$ respectively. The authors finally concluded that skin thickness of neck, dewlap, and abdominal region had no effect on milk production of the crossbred Sahiwal cows (Indigenous X Sahiwal) and 29% of the variation in milk yield depended on the skin thickness.

Conclusion

it is concluded that the skin fold thickness of neck, chest, abdomen, rump and hind quarter negatively and significantly correlated with total milk yields while, skin thickness of all regions (except flank) were negatively and significantly correlated with daily milk yield.

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