PREDICTION OF TOTAL MILK YIELD FROM HOOF CIRCUMFERENCE IN BUFFALOES

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ABSTRACT

Buffalo is the most popular milk yielding large ruminant of the Bovidae family containing more than 34 million heads in the agricultural systems of Pakistan. The present study comprising of small fresh data set (n=44 buffalo heads) indicated average total milk yield (LMY) of 1968.00±403.82 liters per lactation where lactation period averaged. 273.34±63.68 days. It was hypothesized that LMY could be virtually predicted from hoof circumference (HC) in buffaloes. The front and rear hoof circumferences averaged 19.003±1.140 and 17.740±1.033 inches, respectively. The correlation coefficient between TMY and HC was computed to find the strength of relationship between TMY and HC for predicting the former variable from the later. Meager correlation coefficients (0.077 and 0.084) revealed small amount of relationship that ascertained poor prediction. Hence it was suggested that HC could not be reliably used for predicting milk production in Nili-Ravi buffaloes.

Keywords: *Bubalus bubalis*, buffalo, milk yield, hoof circumference, prediction, correlations

INTRODUCTION

Generally body measurement of animals are used to predicted their live weight as in many instances but some of the researchers have tried to relate them to milk production as they are certain about the associations existing between these variables and statistical tools have made them easy. Such effort are not uncommon where heart girth, heights (rump, wither), lengths (body head, neck, tail) have been utilized as predictors of weights. Naturally, these physical measurements that are indicators of animal's production performance but explain the phenotypic to how extent needed thorough enquiry. The targets of such studies remained the indirect measurement of live weight and milk production where it could not be feasible in direct manner. Hence tools have been devised based on relationships among these variables.

Prediction equations certainly provided efficient tools for indirect measurement of some traits that are physically related to other ones. Although correlations represent amount of relationships between variables yet regression models provide mathematical form of relationships and calibrated tools can be devised based on these

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formulas. Dairy buffalo is quite large animal weighing above 500 kg on the average and with this large body mass, it becomes too difficult to measure some major body measurements on one hand and longer measuring tapes and personnel's support is required on the other hand. Whereas, among several body measurements, hoof circumference is easily determined in case of buffaloes with lesser effort and support by direct measurement with tailor's tape or embossed/engraved foot print on the ground. Certain body measurements (body length, wither height, rump height, chest girth) have been extensively used in prediction of live weight in animals and their relationship with milk production. The hoof circumferences of different feet when averaged could serve as a predictor of body weight and/or milk production in buffaloes. As population of buffalo is exceeding 41 million (GOP, 2019-2020), newer and easier tools and methods are needed for quicker prediction and phenotypic selection of animals. Therefore, the present study was designed to use this body measurement (hoof circumference) to make prediction equations for milk yield in Nili-Ravi buffaloes.

MATERIALS AND METHODS

The breed of buffalo under our study was Nili-Ravi and data were recorded on lactating buffaloes of this breed maintained at Government Livestock Experiment Station, Chak Katora in district Bahawalpur, Pakistan. Data about hoof circumferences (front/ back and left/right) were recorded along with their milk production. The linear regression model was applied for estimation of regression lines in order to make predictions about milk yield through hoof circumference. The form of model applied was:

$$Yi = \alpha + \beta Xi + \varepsilon i$$

Yi presented milk yield, α and β regression parameters (intercept and slope) and εi the error associated with each observation.

RESULTS AND DISCUSSION

The hoof circumference for front and back hooves averaged 18.1±1.10 and 17.8±1.04 respectively with overall average of 17.9±0.90 showing that front hooves had somewhat larger circumference as compared to back. Similarly right hooves were larger in circumference than left ones. The daily milk yield averaged 8.0±1.74 liters whereas 305-day milk yield averaged 2438.0±529.20 liters and length of lactation averaged 200.5±125.34 days. The Pearson coefficient of correlations between average daily milk yield and overall average hoof circumference, rear hoof average circumference and front hoof average circumference was found to be 0.0767, 0.0840 and 0.0466, respectively. The 305-day milk yield had correlations with hoof average circumference, rear hoof average circumference and front hoof average circumference in the range of 0.015, 0.017 and 0.008 and lactation length showed 0.012, 0.015 and 0.005, respectively. Prediction equations for estimating LMY, MY-305 and LL from hoof circumferences are presented in Table 1 while comparisons of prediction lines of ADMY, MY-305 and LL as predicted from hoof circumferences of Nili-Ravi buffaloes belonging to various parities are shown in Tables 2 to 4 providing competent predictions about the traits and showed that they predicted the milk production traits with poor results and very minutes coefficient determination (lower than 10% in most of the cases). The Bartlett's test for

Table 1. Regression lines for milk traits and hoof circumferences.

Trait	Av. HC	Front HC	Back HC
ADMY	5.7037+0.1436HC	6.9285+0.0746HCF	5.9148+0.1332HCR
MY-305	1751.530+43.2450HC	2137.95+21.4856HCF	1795.64+41.1996HCR
LL	263.4630-4.2250HC	240.549-2.9183HCF	242.69-3.0981HCR

Table 2. Comparison of regression lines for average daily milk yield (ADMY) and hoof circumferences during various lactations.

Traits	Lactation	N	α	β	MSE
ADMY and HC	1	35	9.5182	-0.0902	3.2338
	2	12	-0.8922	0.5307	0.5791
	3	3	20.9165	-0.5873	5.2367
	4	3	-21.9871	1.7936	0.0237
ADMY and HCF	1	35	9.8608	-0.1085	3.2232
	2	12	-3.4178	0.6666	0.5292
	3	3	49.5841	-2.1151	0.0707
	4	3	-7.7266	0.9342	0.2674
ADMY and HCR	1	35	7.8069	0.0054	3.2409
	2	12	2.3683	0.3518	0.6631
	3	3	0.1113	0.5450	4.4511
	4	3	-2.9077	0.7385	2.8446

Table 3. Comparison of regression lines for 305-day milk yield (MY305) and hoof circumferences during various lactations.

Traits	Lactation	N	α	β	MSE
MY305 and HC	1	35	2904.21	-27.4172	302129.0
	2	12	-197.940	157.757	52710.2
	3	3	6211.69	-169.614	487199.0
	4	3	-6617.93	541.778	3375.5
MY305 and HCF	1	35	3026.99	-34.0041	301045.0
	2	12	-953.293	198.391	48228.8
	3	3	15121.0	-644.582	5436.1
	4	3	-2354.02	284.575	21158.0
MY305 and HCR	1	35	2354.54	3.29321	302780.0
	2	12	773.308	104.463	60178.2
	3	3	-17.9145	169.488	408431.0
	4	3	-612.811	208.560	264165.0

Table 4. Comparison of regression lines for lactation length (LL) and hoof circumferences during various lactations.

Traits	Lactation	N	α	β	MSE
LL and HC	1	35	-58.3796	15.0122	16922.10
	2	12	1082.91	-50.1919	8469.82
	3	3	161.533	-6.0369	5671.81
	4	3	-133.957	12.6452	20359.80
LL and HCF	1	35	-101.047	17.2585	16670.70
	2	12	1466.630	-71.0407	7213.10
	3	3	1335.810	-68.8211	2.49653
	4	3	509.696	-23.0380	18767.60
LL and HCR	1	35	203.842	0.3771	17120.10
	2	12	708.358	-29.565	9601.70
	3	3	-360.659	22.481	4000.03
	4	3	-2999.850	185.231	1929.85

equality of variances has shown non-significant differences in regression lines of various lactations for all of the plausible trait combinations shown in this study. Conclusively, it was observed that hoof circumferences although related yet were poor predictors of average daily milk yield, 305-day milk yield and length of lactation.

Studies regarding hoof circumferences, foot angle and other related body measurements are frequently quoted in literature but such study that interpret relationship between hoof circumference and milk traits were scanty in the literature. Perhaps this is the first relating such type of associations. Khan and Khan (2016) have determined genetic parameters of hoof traits in Sahiwal cattle. Another study is found in literature where Parish *et al*. (2009) has estimated birth weight in calves using hoof circumference measuring tape.

CONCLUSION

As such studies are based on different ideas regarding body dimensions and milk yield relationships, therefore, this study would be the leading study in this field. Moreover, the relationship between the two when explored on mass scale data would definitely provide larger ground for testing the significance of relationships between the two phenotypically different traits where one is economically important.

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