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INTERDEPENDENCE OF LACTATION MILK YIELD AND LACTATION LENGTH IN *Nili-Ravi* BUFFALOES OF PAKISTAN

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ABSTRACT

Nili-Ravi buffaloes are precious black gold of Pakistan yield lot of milk with pleasant attributes (Mirza *et al*., 2023). The period of milk production has strong ties to milk yield in the whole lactation (Bashir *et al*., 2025). The present study on four buffalo herds underlined interdependence of the two traits. The Least Square Linear Regression of total milk yield per lactation (LMY) with lactation length (LL) exhibited significant (P<0.001) interrelationship between LMY and LL where LL predicted LMY through 124.56+0.7402×LL. The regression lines for four herds presented similar prediction equations of LL for LMY (1119.04+0.9423×LL, 1375.08+0.0258×LL 1252.67+1.2790×LL, and 2665.35-0.0755×LL, respectively). Regression lines for buffaloes in various parities appeared to have variable regression coefficients and intercepts being typical and atypical in nature. Bartlett's test for equality of variances showed differences of significant nature. In overall, it was profound to know the behavior of these two variables was nearly the same in different situations with slight differentiation. It would suggest that linear relationship can be applied in fitting regression lines for prediction purposes without considering the homogeneity in this animal genetic resource.

Keywords: *Bubalus bubalis*, buffaloes, *Nili-Ravi* buffalo, lactation milk yield, regression lines, lactation period

INTRODUCTION

Variables (traits) have relationships with one another naturally that can be depicted by applying different statistical tools like correlation and regression analyses. Some of these relationships are interesting and important from selection viewpoint. As buffalo is a precious livestock species of Pakistan providing ample amounts of delicious and fat rich milk, its improvement is inevitable, and exploitation of production potential need special emphasis. The milk production status and rapidly growing number of *Nili-Ravi* breed has made it much more important and a national asset of worth of million dollars that can fetch more foreign exchange if wisely planned selection programs are launched. Both live animals as

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well as their germplasm (in the form of semen, embryos) could easily add higher amounts in national income through foreign exchange. A multimillion livestock industry is awaiting special attention and exploitation through wise estimation and efficient management. Mass scale solid footed selection program for *Nili-Ravi* could be launched after having true information about its population size, traits of economic importance (milk and meat related) and predictable associations among the traits.

As *Nili-Ravi* is famous for milk production, emphasis is needed on selection programs to enhance its productivity. The traits related to milk production such as lactation milk yield (LMY) and lactation period (LL) is of special importance as they are quite strongly related and interdependent. The magnitude of interdependence of traits could be explored by applying least square regression technique. This interdependence would yield predictions about performance traits reducing the futuristic cost and enhancing the efficiency of selection programs. The present study highlighted the use of Least Square Regression in finding the interdependence of lactation milk yield and length of lactation in *Nili Ravi* buffaloes in Pakistan.

MATERIALS AND METHODS

The livestock species of interest under our study was *Nili-Ravi* breed of buffalo found in Pakistan and found in large number in the Punjab province and widely distributed throughout the country. Some official herds are kept on government livestock farms with proper record keeping. The data used in current study was a part of the data collected in Bull mother scheme run by the Livestock Production Research Institute, district Okara, Pakistan where work was done at four of buffaloes. Milk production traits (LMY and LL) of bull mothers from four were analyzed and subjected to Least Square Regression to find out their interdependence and formulate prediction equations by taking lactation milk yield (LMY) as dependent and lactation length as independent variables. Following form of linear regression was applied:

$$LMY = \alpha + \beta LL + \varepsilon i$$

Where, LMY corresponded to lactation milk yield, α as intercept and β as regression coefficient and Ɛi as random error. The fitted lines were obtained through Statistic software for the four.

RESULTS AND DISCUSSIONS

Regression lines for prediction of 305-day (MY-305) milk yield and lactation milk yield from length of lactation (LP) have been given in Table 1. Although these equations fitted well for the traits but had lower R^2 values. The regression equations about prediction of MY-305 and LMY from LP for various parities in four herds are presented in Tables 2 to 9. Intercepts are typical in all the herds for all lactations but slope (rates of change) is atypical as well in some of the parities in a few herds. Bartlett's test for homogeneity of variance showed significant results in most cases depicting significant difference in regression lines for parities within herds. It is concluded that lactation period would predict the lactation yields and can serve as a useful tool for making selection decisions in selection programs. Prediction equations are commonly used statistical tools applied by

Table 1. Prediction equation for MY-305 and LMY from lactation period in four herds.

Herd	Trait	Equation
1	MY-305	2156.06+1.7427LP
	LMY	965.55+5.8585LL
2	MY-305	1319.63+3.9786LP
	LMY	543.63+7.1462LP
3	MY-305	1938.12+2.4065LP
	LMY	552.68+7.1015LP
4	MY-305	2665.35-0.0755LP
	LMY	1748.24+3.5208LP

Table 2. Regression lines for prediction of MY305 from lactation period in herd 1.

Lactation No.	N	Intercept	Slope	MSE
1	138	1983.99	2.00162	199679
2	132	1963.49	2.17495	266663
3	254	1615.95	3.18932	191923
4	225	2256.64	1.63132	172143
5	122	2702.95	0.48715	109619
6	72	2114.76	1.91379	144125
7	30	2743.33	0.03709	179614
8	11	2077.33	1.76713	521560
9	5	4908.28	-4.25491	231443
10	3	12336.5	-17.0645	53792.0

Table 3. Regression lines for prediction of TY from lactation period in herd 1.

Lactation No.	N	Intercept	Slope	MSE
1	138	893.624	5.80229	263301
2	132	961.156	5.73446	335407
3	254	607.836	6.81574	310759
4	225	913.555	6.16463	288350
5	122	1138.42	5.68406	130586
6	72	1029.31	5.85830	178079
7	30	1388.16	4.56236	250158
8	11	1469.16	4.54973	608069
9	5	4437.50	-1.58196	188351
10	3	15604.0	-20.5000	88620.5

Table 4. Regression lines for prediction of MY305 from lactation period in herd 2.

Lactation No.	N	Intercept	Slope	MSE
1	49	1397.56	3.35907	308247
2	89	1562.39	3.48997	349465
3	94	1233.31	4.21185	177092
4	105	1357.21	3.84432	236301
5	64	1393.97	3.81003	184685
6	35	783.869	5.55418	223015
7	13	2445.04	1.60638	120765
8	6	931.161	5.64574	99808.3

Table 5. Regression Lines for prediction of TY from Lactation Period in herd 2.

Lactation No.	N	Intercept	Slope	MSE
1	49	533.011	6.80546	452304
2	89	462.629	7.52387	330712
3	94	459.648	7.44299	175095
4	105	579.489	7.03314	200344
5	64	649.294	6.72997	196286
6	35	386.429	7.56489	154300
7	13	1019.39	6.48442	144508
8	6	553.879	7.70792	40189.7

Table 6. Regression Lines for prediction of MY305 from Lactation Period in herd 3.

Lactation No.	N	Intercept	Slope	MSE
1	120	1902.18	2.26879	171808
2	117	2125.06	2.17497	200219
3	133	1953.43	2.72752	210406
4	89	1937.96	2.31324	178962
5	63	2482.30	1.01796	214239
6	43	2597.97	0.68980	149056
7	20	1907.31	2.54646	225505
8	15	679.114	5.21982	207289
9	9	1439.81	2.85229	158493
10	6	616.622	4.84915	129220
11	10	1310.62	2.24376	111981
12	4	993.105	3.39571	139257

Table 7. Regression lines for prediction of TY from lactation period in herd 3.

Lactation No.	N	Intercept	Slope	MSE
1	120	261.928	7.63205	262732
2	117	329.986	7.92741	248316
3	133	450.066	7.76187	292562
4	89	617.912	6.81203	232785
5	63	1518.71	4.54658	318921
6	43	1696.70	4.28930	785007
7	20	763.857	6.37366	260416
8	15	-976.194	10.3467	270604
9	9	1063.67	4.47753	156276
10	6	494.063	5.81018	135347
11	10	-1110.18	9.25022	132459
12	4	827.986	4.42691	80507.8

Table 8. Regression Lines for prediction of MY305 from Lactation Period in herd 4.

Lactation No.	N	Intercept	Slope	MSE
1	44	1415.43	3.27733	160962
2	83	1816.35	1.89233	358196
3	109	3515.75	-2.25391	217237
4	126	3430.70	-1.99146	182108
5	68	2824.03	-0.36124	196583
6	47	1585.90	3.34093	129860
7	30	1174.26	4.57971	95800.7
8	14	445.253	6.66420	27511.9
9	5	3228.46	-1.35252	67991.0
10	3	-3596.89	20.9643	33540.5

Table 9. Regression Lines for prediction of TY from Lactation Period in herd 4.

Lactation No.	N	Intercept	Slope	MSE
1	44	633.287	6.40420	164030
2	83	1270.27	4.38744	298523
3	109	2234.06	2.16134	215662
4	126	2293.78	2.02036	185613
5	68	1697.65	3.69494	193513
6	47	821.231	6.24065	103794
7	30	-9691.80	43.4862	3.635E+07
8	14	11.7780	8.25058	29973.3
9	5	2563.39	0.93446	52235.6
10	3	-3596.89	20.9643	33540.5

researchers for making suitable predictions as first lactation milk yield was used to predict mil yield in later lactation and test day yield for total lactation yield (Catillo *et al*., 2002; Kaygısız *et al*., 2003; Dimauro *et al*., 2005; Cervantes *et al*., 2006; Gantner, 2008; Jinger, 2014). Most prediction equations are useful in determining invaluable of findings.

CONCLUSION

It would suggest that linear relationship can be applied in fitting regression lines for prediction purposes without considering the homogeneity in this animal genetic resource. Thus, linear regression is a useful tool in predicting valuable traits in animal genetic resources.

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