FACTORS AFFECTING THE LACTATION LENGTH AND MILK YIELD IN NILI-RAVI BUFFALOES

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Summary

The effect of certain factors such as sex of calf, status of buffalo, season of calving, parity and sire on lactation length and total lactation yield was studied in 391 Nili-Ravi buffaloes. The average lactation length was 301.73 ± 1.87 (mean ± SE) days with a range of 181 to 505 days whereas the average lactation yield was 2031.08 ± 19.16 kg and ranged from 1023 to 6535 kg for 984 lactations.

The differences in the means of lactation length and lactation yield due to the sex of calf were significant ($p < 0.05$). The status of buffaloes had a significant ($p < 0.05$) effect on lactation length but its effect on lactation yield was non-significant. The season of calving had no effect on lactation length but it influenced the lactation yield significantly. The milk yield was highest (2150.81 ± 43.52 kg) in buffaloes which calved in spring and lowest (1959.92 ± 30.83 kg) in autumn. The effect of parity on both traits under study was significant ($p < 0.01$). The maximum and minimum lactation lengths of 309.82 ± 3.96 and 284.16 + 7.17 days were observed in the first and sixth lactations, respectively. The milk yield was maximum (2150.38 + 58.79 kg) in the seventh lactation and minimum (1818.31 ± 60.04 kg) in the sixth lactation. The influence of sire was significant on lactation length ($p < 0.05$) and milk yield ($p < 0.01$).

(**Key Words** : Nili-Ravi Buffaloes, Lactation Length, Lactation Yield, Status of Buffalo, Sire)

Introduction

The Nili-Ravi is the most prized dairy breed of buffalo in Pakistan because of its high milk production, butter fat content and ability to use roughages efficiently as compared to cattle.

Lactation milk yield is the most improtant parameter of dairy buffalo. The total amount of milk produced by a buffalo in a lactation is subject to the influence of large number of genetic and non-genetic factors. Factors which affect the lactation yield would also influence the lactation lenth in buffaloes. Garcha and Tiwana (1980), Umbrikar and Deshpande (1985[a]) and Sharma and Basu (1985) reported in Murrah and Nili buffaloes that lactation length had significant genetic correlations (0.53 ± 0.03, 1.03 ± 0.05 and 0.51 ± 0.11), with lactation milk yield. The effect of season of calving on lactation yield in buffalo was studied by Umrikar and Deshpande (1985[b]), and Pandey et al. (1986). Sire was found to be the cause of significant differences in milk yield as reported by Basu and Tomar (1981), Swain and Bhatnagar (1983), Cady et al. (1983), and Sharma and Basu (1985). Factors such as farm, period, season of calving and age at calving were reported by Umrikar and Deshpande (1985[b]) to be the cause of significant variation in the lactation length. Only a few reports about these factors on lactation length and yield are available for Nili-Ravi buffaloes. The present investigation was undertaken to study the effect of sex of the calf, status of buffalo, season of calving and influence of parity and sire on lactation length and lactation yield in Nili-Ravi buffaloes.

Materials and Methods

The data on lactation length and total lactation yield were taken from the history sheets of Nili-Ravi buffalo herd kept at Livestock Production Research Institute, Bahadurnagar, Okara. Records of buffaloes which calved during the year, 1979 to 1986 were used and in all 984 lactations of 391 buffaloes were included in the study. The buffaloes with less than 181 days

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lactation length were excluded from the data. The buffaloes which yield milk for 300 days or less were considered as the full lactation yielders. The milk production was calculated on weekly record day basis. Buffalo cows were milked twice a day by hand at fixed hours. Mostly the calves were weaned and when they were not weaned, not allowed to suckle their dams but they were used only to let down milk.

All the buffaloes were stall fed and kept under loose housing system with half walled pacca sheds. Seasonal green chaffed forages alongwith wheat bhoosa (when needed) were made available to buffaloes throughout the year. The concentrates were fed according to the milk production i. e. 1/3 by weight of milk produced by individual buffalo. The total quantity of the concentrates was divided into two equal parts and offered to each buffalo just before morning and evening milkings. The buffalo herd was usually provided with adequate watering and bathing facilities throughout the year. All the buffaloes were inseminated with frozen semen when they exhibited oestrus.

Buffaloes were catagorised into two status-farm born and purchased. Each year was divided into four seasons on the basis of calving and these seasons were winter (November to January), spring (February to April), summer (May to July) and autumn (August to October). Based on lactations, the data were classified into eight parity groups i. e. 1 to 7 and 8 or above. Analysis of variance techniques and "t" test (Steel and Torri, 1982) were carried out to examine the effect of calf sex, status of buffalo, season of calving, parity and sire on lactation period and lactation yield. Duncan's Multiple Range Test was used to find out the significant differences between means.

Results

Lactation Length

The average lactation length in the present study was 301.73 ± 1.87 (Mean ± SE) days and it ranged from 181 to 505 days. It can be seen from table 1 that 5.08% buffaloes remained in milk upto 210 days (7 months), while 10.87%, 16.77% and 19.21% buffaloes had a lactation period of 211-240, 241-270 and 271-300 days, respectively, which indicated that about 52% buffaloes gave milk upto 300 days and remaining 48% buffaloes remained in milk more than 300 days. It was further observed from this table that lactation length had a significant ($p < 0.01$) effect on lactation yield.

Lactation Milk Yield

The mean of total lactation milk yield was 2031.08 ± 19.16 (Mean ± SE) kg and it ranged from 1023 to 6535 kg. It can be seen from table 2 that the milk production in 6.20% buffaloes was higher than 3000 kg in a lactation period and 12.09% buffaloes produced milk between 2501 to 3000 kg. About 27.85% and 35.26% buffaloes produced milk 2001 to 2500 and 1501

TABLE 1. AVERAGE LACTATION PERIOD AND TOTAL LACTATION YIELD ACCORDING TO DIFFERENT LACTATION LENGTHS IN NILI-RAVI BUFFALOES

Lactation length (days)	Number	Frequency	Cumulative frequency (%)	Lactation period (days)	Total lactation yield (kg)
181-210	50	5.08	5.08	196.96 ± 1.31	1432.52 ± 46.30[a]
211-240	107	10.87	15.95	227.41 ± 0.87	1581.10 ± 37.36[ab]
241-270	165	16.77	32.72	256.25 + 0.66	1786.46 ± 33.63[bc]
271-300	189	19.21	51.93	286.00 ± 0.68	1952.14 ± 31.01[cd]
301-330	172	17.48	69.41	314.78 ± 0.69	2128.89 ± 37.86[d]
331-360	132	13.41	82.82	344.82 ± 0.83	2220.65 + 44.96[d]
≧ 360	169	17.18	100.00	393.64 ± 2.11	2555.17 ± 54.71[e]
Total/Overall	984	100.00	–	301.73 ± 1.87	2031.08 ± 19.16

[a,b,c,d,e] Means with same superscripts did not differ significantly.

TABLE 2. FREQUENCY DISTRIBUTION OF NILI-RAVI BUFFALOES ACCORDING TO DIFFERENT LEVELS OF MILK PRODUCTION

Milk production level (kg)	No. of lactation	Frequency (%)	Cumulative frequency (%)	Lactation yield Mean ± SE
Upto-1500	183	18.60	18.60	1301.73 ± 9.82
1501 -2000	347	35.26	53.86	1767.03 ± 7.43
2001 -2500	274	27.85	81.71	2217.93 ± 8.53
2501 -3000	119	12.09	93.80	2723.42 ± 12.36
3001 -3500	46	4.67	98.47	3212.33 ± 21.81
≧ 3500	15	1.53	100.00	4190.07 ± 243.62
Overall	984	100.00	--	2031.08 ± 19.16

to 2000 kg, respectively, while the remaining 18.60% buffaloes produced less than 1500 kg in a lactation.

Factors Affecting the Lactation Length and Total Lactation Milk Yield.

1) Sex of Calf

The average length of lactation period of 305.72 ± 2.67 days was found in those buffaloes which gave birth to male calves and this period was 297.84 ± 2.51 days in the buffaloes which gave birth to female calves. The difference of 7.88 days between two means was significant ($p < 0.05$). Similarly the calf sex also affected the lactation milk yield (table 3) significantly, ($p < 0.01$). The means of lactation yield of 2077.91 ± 28.20 and 1985.55 + 25.99 kg were observed in those buffaloes which gave birth to male and female calves, respectively.

2) Background of Buffalo

The mean lactation length of purchased buffaloes was 287.74 ± 4.03 days and this period was significantly ($p < 0.05$) shorter when compared with that of farm born buffaloes for which the lactation length was 305.34 ± 2.10 days (table 3). The milk production for purchased and farm born buffaloes was 1986.31 ± 38.04 and 2042.6 4 ± 22.01 kg, respectively, and the difference between two means was not significant.

3) Season of Calving

The season of calving had non-significant influence on lactation length but the total milk production was significantly ($p < 0.01$) affected by season of calving (table 4). The milk yield was lowest (1959.92 ± 30.83 kg) in buffaloes which calved in autumn and it was highest (2150.81 ± 43.52 kg) in spring calvers (table 5). The lactation lengths for the respective seasons

TABLE 3. EFFECT OF SEX OF CALF AND THE BACK GROUND OF BUFFALOES ON LACTATION LENGTH AND LACTATION MILK YELD IN NILI-RAVI BUFFALOES

Parameter	Class	Number	Lactation period	Total lactation milk yield
Sex of calf				
	Male	485	305.72 ± 2.67[a]	2077.91 ± 28.20[a]
	Female	499	297.84 ± 2.51[b]	1985.55 ± 25.99[b]
Background of Buffaloes	Purchased	202	287.74 ± 4.03[a]	1986.31 ± 38.04[a]
	Farm born	782	305.34 ± 2.10[b]	2042.64 ± 22.01[a]

[a,b] Means with a common superscripts within treatment and column do not differ significantly.

TABLE 4. ANALYSIS OF VARIANCE FOR LACTATION LENGTH AND LACTATION YIELD IN NILI-RAVI BUFFALOES

Source of variance	df	Lactation length MS	Lactation length F. Ratio	Total lactation yield MS	Total lactation yield F. Ratio
Season of calving	3	8169.797	2.372^{NS}	1731996.333	4.843**
Error	980	3444.121		357638.825	
Parity number	7	34170.986	8.600**	1371610.143	10.778**
Error	976	3972.782		127257.498	
Sire of buffalo	29	4891.281	1.578*	915081.414	2.060**
Error	674	3099.949		444233.309	
Month of calving	11	4542.353	1.318^{NS}	696647.091	1.946*
Error	972	3446.278		358044.156	

^{NS} = Non-significant.
* $p < 0.05$.
** $p < 0.01$.

TABLE 5. MEAN LACTATION LENGTHS AND TOTAL LACTATION MILK YIELD AS AFFECTED BY SEASON OF CALVING AND LACTATION ORDER IN NILI-RAVI BUFFALOES

Traits		Number	Lactation length (days) Mean ± SE	Total lactation yield (kg) Mean ± SE
Season				
	Winter	250	308.80 ± 3.30^{a}	2089.21 ± 41.47^{ab}
	Spring	155	305.22 ± 4.54^{a}	2150.81 + 43.52^{a}
	Summer	187	299.53 ± 4.46^{a}	2003.30 ± 40.50^{bc}
	Autumn	392	296.88 ± 3.14^{a}	1959.92 ± 30.83^{c}
Parity				
	First	246	309.82 ± 3.96^{a}	1910.22 ± 23.05^{b}
	Second	213	306.02 ± 4.00^{a}	2081.62 ± 24.89^{a}
	Third	186	296.51 + 4.06^{ab}	2098.60 ± 48.06^{a}
	Fourth	128	291.82 ± 5.26^{ab}	2104.41 ± 65.33^{a}
	Fifth	86	301.71 ± 10.42^{a}	2105.00 ± 55.35^{a}
	Sixth	62	284.16 ± 7.17^{b}	1818.31 ± 60.40^{c}
	Seventh	37	306.92 ± 10.63^{a}	2150.38 ± 58.79^{a}
	Seventh	26	304.52 ± 11.40^{a}	1961.42 ± 82.41^{ab}

Season : Winter (November to January); Spring (February to April); Summer (May to July); Autumn (August to October)
^{a,b,c} Means with same superscripts within treatment and column do not differ significantly.

were 296.88 ± 3.14 and 305.22 ± 4.54 days.

4) **Parity**

The lactation period as well as the total milk yield were significantly ($p < 0.01$) affected by parity order (tables 4 & 5). Buffaloes completing their seventh lactation produced maximum (2150.38 ± 58.79 kg) milk in 306.92 ± 10.63 days whereas minimum milk yield (1818.31 ± 60.04 kg) was obtained in 284.16 ± 7.17 days by those buffaloes which were in their sixth lactation. Table 5 further revealed that milk production was ascending from first to fifth lactation, descending in sixth and again ascending in the seventh lactation. The lactation length of 309.82 + 3.96 days became maximum in first parity and minimum 284.16 ± 7.17 days in the sixth lactation. The maximum milk production in seventh lactation may not be reliable as the number of observations were inadequate.

5) Sire

The sire (N-30) had a significant effect on lactation length ($p < 0.05$) and lactation yield ($p < 0.01$). The lactation length ranged from 273.76 ± 19.04 to 350.25 ± 9.80 days for bull No. 10/2.7 and 93/4.8, respectively. Similarly the range of milk yield for the daughters of bull No. 10/2.7 and 64/4.8 was 1719.38 ± 156.18 to 2715.45 ± 265.86 kg, respectively.

Discussion

The lactation length obtained in the present study was close to the findings of Swain and Bhatnagar (1983) and Umrikar and Deshpande (1985[a]) in Murrah buffaloes for which the lactation period was 293 and 302 days, respectively. Similar results were also reported in Nili (308 days) and Jaffrabadi (305 days) buffaloes by Sarma and Basu (1985) and Shukla and Gajbhiye (1986), respectively. A short lactation period was observed by Gurnani et al. (1976), Cady et al. (1983), Shrestha (1985), Osman (1985) and Chaudhry et al. (1985-86) in different breeds of buffaloes where it ranged from 252 to 288 days. However a longer lactation period (320 days) was reported by Garcha and Tiwana (1980) in Murrah buffaloes.

Chaudhry et al. (1985-86) and Khire et al. (1977) reported that 2.73% Nili-Ravi and 2.67% Nagpuri buffaloes gave milk upto 200 days and these frequencies were lower as compare to the frequency (5.08%) of the present study. They further observed, that 59.09% Nili-Ravi and 74.67% Nagpuri buffaloes remained in milk between 201 to 300 days whereas in the present study (table 1) 46.85% buffaloes produced milk from 211 to 300 days. In this study 48.07% buffaloes gave milk for more than 300 days and this frequency is higher than reported by Chaudhry et al. (1985-86) and Khire et al. (1977) in Nili Ravi (38.18%) and Nagpuri (22.66%) buffaloes. Table 1 further revealed, that the lactation period had significant ($p < 0.01$) effect on lactation yield. These findings are in accordance with the findings of Cady et al. (1983), who also found that lactation period had significant effect on lactation yield.

The total lactation milk yield in Nili-Ravi buffalo was found to be 2031.08 ± 19.16 kg and this is in close agreement with the findings of Cady et al. (1983) who found in a herd of Nili-Ravi buffaloes that milk production in a lactation period of 284 days was 2065 kgs. Haipeng and Runpel (1987) and HWA and HSU (1983) reported 1917 and 2120 kg of milk in 269 and 292 days lactation period of Nili Ravi buffaloes imported from Pakistan to South China and Nili-Ravi × (Murrah × Chinese) buffaloes. Similar results were observed by Chaudhry et al. (1988[a]) in Nili-Ravi Primiparous buffaloes. Umrikar and Deshpande (1985[a]) found 2037 kg of milk in Murrah buffaloes. Lower averages for lactation yield in different breeds of buffalo (Egyptian, Nili and Nili-Ravi buffaloes) were reported by Osman (1985), Sharma and Basu (1985) and Cady et al. (1983). However, higher estimates were also reported by Dung (1984), Chaudhry et al. (1985-86) and Shukla and Gajbhiye (1986) in Nili-Ravi and Jaffrabadi buffaloes in China, Pakistan and India, respectively, and the average for lactation milk yield in respective studies were 2500, 2438 and 2239 kg.

Table 2 showed that 6.2% buffaloes yielded milk more than 3000 kg in a lactation. This is very close to the results of Haipeng and Runpel (1987) who found that 6.0% Nili-Ravi buffaloes yielded 3000 kg milk in a lactation. About 12.09% and 27.85% buffaloes of this study produced milk between 2501 to 3000 and 2001 to 2500 kg, in a lactation. Haipeng and Runpel (1987) observed that 16.7% and 20.6% Nili-Ravi buffaloes produced milk 2500 to 3000 and 2000 to 2500 kg, respectively, which is comparable with the findings of the present study. Our study further revealed that 53.86% buffaloes gave milk upto 2000 kg and this frequency is also in agreement with the frequency (56.7%) reported by Haipeng and Runpel (1987) in Nili-Ravi buffaloes maintaining in China.

The sex of the calf had a significant effect ($p < 0.05$) on lactation length and total lac- tation yield. However, the findings of Tomar and Tomar (1962) and Basu and Tomar (1981) did not confirm the findings of this study and they found that there was no influence of calf sex on lactation length and lactation yield in Murrah buffaloes. The significant differences due to calf sex in lactation length and yield might be due to long postpartum oestrus interval as Chaudhry et al. (1988[b]) reported that this interval was

significantly longer in buffaloes which gave birth to male calves as compared to female born buffales. This is further supported by the findings of Basu (1962) who observed that postpartum oestrus interval increased with the increase in milk yield.

Lactation length was affected ($p < 0.05$) by the status of buffaloes but the lactation yield is not influenced by this parameter. The controversy results were reported by Swain and Bhatnagar (1983) in Murrah buffaloes and they found that lactation length was not affected by animal's status but the effect of animal status was highly significant on lactation yield.

Buffaloes calving in September had the shortest (295.05 ± 5.71 days) lactation period whereas those calving in February had the longest (323.40 ± 7.35 days) lactation length (table 6). In Murrah buffaloes the shortest lactation periods were reported by Tomar and Tomar (1960) and Bhatnagar et al. (1961) in the month of July (294 days) and October (271 days) whereas they observed the longest lactation periods in the month of April and August and theduration of these lengths were 428 and 343 days, respectively. In this study the month of calving had no effect on the lactation period. This agrees with the findings of Nunes (1983) who also noted that month of calving had no effect on lactation length. However, significant effect on lactation period due to month of calving was reported by Tomar and Tomar (1960) and Bhatnagar et al. (1961) in Murrah buffaloes.

The average milk yield in various months ranged from 1940.47 ± 52.2 to 2240.04 ± 80.07 kg is shown in table 6. Buffaloes calving in September yielded minimum milk while those calving in February produced maximum milk. Bhatnagar et al. (1961) reported minimum and maximum milk production in the month of August and May for Murrah buffaloes, while Tomar and Tomar (1962) found these productions in September and March, respectively. It can be observed from table 4 that month of calving had significant ($p < 0.05$) effect on milk production. These findings are in agreement with the findings of Tomar and Tomar (1962) and Marques (1985) who also found that month of calving had significant effect on milk yield but Bhatnagar et al. (1961) and Nunes (1983) found that month of calving had no influence on the milk production in Murrah buffaloes.

The season of calving did not account for any significant variation in lactation length in this study (table 5). These findings are in conformity with those of Desai and Kumar (1964) and Swain and Bhatnagar (1983) who also reported that season of calving had no effect on lactation period in buffaloes. Contrary to these findings, Choudhury et al. (1971), Gurnani et

TABLE 6. THE MEANS OF LACTATION LENGTH AND LACTATION MILK YIELD IN BUFFALOES AS AFFECTED BY MONTH OF CALVING

Month of calving	Number	Lactation length (days) Mean ± SE	Lactation milk yield (kg) Mean ± SE
January	71	309.07 ± 6.39[a]	2137.52 ± 92.78[abc]
February	48	323.40 ± 7.35[a]	2240.04 ± 80.07[a]
March	63	299.17 ± 7.50[a]	2162.92 ± 75.17[ab]
April	44	294.04 ± 8.56[a]	2036.14 ± 68.36[abc]
May	39	301.41 ± 9.37[a]	1991.36 ± 88.65[bc]
June	59	300.34 ± 8.01[a]	1951.36 ± 68.06[bc]
July	89	298.17 ± 6.66[a]	2042.98 ± 61.66[abc]
August	146	299.10 ± 5.20[a]	1946.86 ± 53.10[bc]
September	130	295.05 ± 5.71[a]	1940.47 ± 52.21[bc]
October	116	296.02 ± 5.39[a]	1998.16 ± 51.57[bc]
November	101	307.66 ± 4.91[a]	2014.43 ± 62.78[bc]
December	78	310.03 ± 6.28[a]	2142.06 ± 63.45[abc]

[a,b,c] Means with a common superscripts within treatment and column do not differ significantly.

al. (1976) and Umrikar and Deshpande (1985[a]) observed that season had significant effect on lactation period in different type of buffaloes. These differences due to season of calving on lactation length in different studies might be due to differences in the breed of buffaloes, differences in feeding and management.

Differences in lactation yeild due to season of calving are highly significant (tables 4 & 5). The maximum milk yield (2150.81 ± 43.52 kg) recorded in buffaloes which calved during spring and followed by winter, summer, and autumn calvers for which the yields are 2089.21 ± 41.47, 2003.30 ± 40.50 and 1959.92 ± 30.38 kg, respectively. Desai and Kumar (1964), Gurnani et al. (1976), Swain and Bhatnagar (1983), found that the season had significant effect on milk yield in different breeds of buffalo, which is in agreement with my findings, whereas Venkayyah and Anantakrishnan (1957) in Murrah buffaloes reported contrary results to these investigations. The increase of milk production in spring season possible due to favourable climatic conditions and supply of good quality of green fodders like berseem and Oats.

Significant differences due to periods in lactation length and yield may be due to the addition of purchased. buffaloes from second period onward and the differences in nutritional and managerial practices during different periods. This may also be due to change in genetic constitution of the herd over different times.

Parity had a significant ($p < 0.01$) effect on lactation length and total lactation yield. The first lactation period was the longest (309.82 ± 3.96) and the shortest lactation period (284.16 ± 7.17 days) was found in buffaloes which calved for sixth time. Cady et al. (1983) reported maximum (288 days) and minimum (276 days) length of lactation period in Nili-Ravi buffaloes which calved for first and fifth time, respectively. Similarly Swain and Bhatnagar (1983) reported the respective length in first and eighth lactations. However, Bhatnagar et al. (1961) and Sekhon and Gehlon (1966) observed that maximum length of lactation period was in second calvers and minimum in sixth and fifth lactation in respective study. Swain and Bhatnagar (1983), and Bhatnagar et al. (1961) reported significant effects of parity on lactation length which agrees with the findings of this study. However non-significant effects due to parity on lactation length were reported in Murrah buffaloes by Das and Balaine (1985).

The findings of significant effect on lactation yield due to parity are in agreement with the findings of Bhatnagar et al. (1961), Basu and Tomar (1981), Swain and Bhatnagar (1983), Caddy et al. (1983), Das and Balaine (1985) and Pandey et al. (1986).

Sire had a significant effect on lactation length ($p < 0.05$) and lactation yield ($p < 0.01$). These findings are in agreement with the results of Basu and Tomar (1981) who also reported that sire had significant effect on lactation length and lactation yield. Similarly, significant effects of sire on lactation yield were reported in Murrah and Nili-Ravi buffaloes by Jowarkar and Johar (1975), Cady et al. (1983) and Sharma and Basu (1985). On the other hand, a non-significant effect of sire on lactation length was reported by Sharma and Basu (1985).

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