NON-GENETIC FACTORS AFFECTING FIRST LACTATION MILK YIELD OF JAFFARABADI BUFFALO IN ORGANIZED FARM OF INDIA

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ABSTRACT

Jaffarabadi buffalo is well known buffalo breed of India for their highest body weight and fat %. As the lactation milk yield is most important parameter of dairy buffalo, it affected by many genetic and non-genetic. During this study to see the effect of non-genetic factors on production records we were collected and analyze 77 complete lactations of Jaffarabadi buffaloes sired by 39 buffalo bulls. Non-genetics factors taken into consideration were; period of birth, season of birth, period of calving, season of calving, age at first calving and lactation length as fixed effect and sire as random effect on First Lactation Milk Yield (FLMY). R software version 9.3.3.0 was used to carry out the various analyses of data. The means of FLMY was found 1745.5±87.72 kg. Analysis revealed that lactation length, period of birth and period of calving were affecting FLMY significantly ($P<0.05$) while age at first calving, season of birth and season of calving to be found with non-significant effect ($P>0.05$). The Jaffarabadi buffaloes refreshing and born during winter season were found to be with high in FLMY as 1962.53±176.73 and 1991.87±179.47 kg., respectively. This buffalo breed was found as long day yielders based on lactation length data analysis.

Keywords: *Bubalus bubalis*, buffalo, non-genetic factors, first lactation milk yield, Jaffarabadi buffalo

INTRODUCTION

Jaffarabadi is the heaviest of all the Indian breeds of buffaloes. It is also called as Bhavnagri, Gir or Jaffari. The breed is named after the town of Jaffarabad. The main native tract of Jaffarabadi buffalo is Saurashtra region of Gujarat state especially areas in and around Gir forest viz., Junagadh, Bhavnagar, Jamnagar, Porbandar, Amreli and Rajkot districts. The breeding tract lies between 20°5' and 22°6' N latitude, and between 70° and 72°E longitude. Jaffarabadi buffaloes are good milkers and thrive well on natural grazing. These buffaloes characteristically differ from other breeds mainly in terms of kilo fat. They are very efficient in the conversion of roughages into milk with a high butter fat content.

Milk production in dairy buffalo animal is mainly affected by genetic and non-genetic factors. As genetic factors enhancement done only by good selection protocols but non-genetic

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factors were mainly related with managmental and surrounding environment. In these non-genetic factors which affect most to milk production were age at calving, lactation length, season of birth and calving, lactation number, availability of feed and water and other managemental practices. Study of these non-genetic factors will help breeder to prepare breeding protocol as to enhance the milk production as well other economic traits.

There were many works done and published of other buffalo breeds like Murrah and Niliravi but very very few records available in publication about Jaffarabadi buffalo. As this breed were not in large organized farms. During present study we try to avail present status and also want to put excellence of this buffalo breed toward research worker to develop this breed as it has much of potential to serve economy of rural peoples. For that, we analyze data to study effect of various non-genetic factors on first lactation milk yield of Jaffarabadi buffalo in present study.

MATERIAL AND METHOD

The data pertaining to first lactation milk yield of Jaffarabadi buffaloes were collected from 1987 to 2010 for all the farm born progenies of Cattle Breeding Farm, Junagadh Agricultural University, Junagadh. The production records of 77 complete lactations of Jaffarabadi buffaloes sired by 39 buffalo bulls were collected.

The data of periods used in the present study were spread over the years 1987 to 2010. The entire period was divided in to five groups of period of birth and period of calving as follows Table 1A and Table 1B.

The data of season in the present study was divided in to three parts. Each year was divided in to three seasons of birth and seasons of calving as follows Table 2A and Table 2B.

The data of lactation length in the present study was divided in to 6 parts each with 50 days difference as follows Table 3A.

The data of age at first calving in the present study was divided in to 13 parts (A1 to A 13) each with 100 days difference. Ages at first calving with 1201 to 2500 days were taken into consideration.

Analysis of non-genetic factors

The records were analyzed using mixed model procedures. R software version 9.3.3.0 was used to estimate effect of various non-genetic factors on first lactation milk yield.

Table 1A. The period of birth.

Period of birth	Year
PB1	1987 - 1990
PB2	1991 - 1994
PB3	1995 - 1998
PB4	1999 - 2002
PB5	2003 - 2006

Table 1B. The period of calving.

Period of calving	Year
PC1	1991 - 1994
PC2	1995 - 1998
PC3	1999 - 2002
PC4	2003 - 2006
PC5	2007 - 2010

Table 2A. The seasons of birth.

Season of birth	Duration
SB1 (Summer)	March - June
SB2 (Monsoon)	July - October
SB3 (Winter)	November - February

Table 2B. The seasons of calving.

Season of calving	Duration
SC1 (Summer)	March - June
SC2 (Monsoon)	July - October
SC3 (Winter)	November - February

Table 3A. The data of lactation length was divided in to 6 parts each with 50 days.

Duration of LL (Days)	201 to 250	251 to 300	301 to 350	351 to 400	401 to 450	451 to 500
LL	LL1	LL2	LL3	LL4	LL5	LL6

Statistical mixed model used for analysis was as follow:

$$Y_{ijkmoqrn} = \mu + A_i + B_j + C_k + D_m + E_o + F_q + G_r + e_{ijkmoqrn}$$

Where,

$Y_{ijkmoqrn}$- Performance trait of individual animal (n), born in $(i)^{th}$ season of $(j)^{th}$ period and calved in $(k)^{th}$ season of $(m)^{th}$ period with $(o)^{th}$ lactation length and $(q)^{th}$ age at first calving, born to $(r)^{th}$ sire

μ - overall population mean

A_i - fixed effect of season of birth (i = 1 to 3)

B_j - fixed effect of period of birth (j = 1 to 5)

C_k - fixed effect of season of calving (k = 1 to 3)

D_m - fixed effect of period of calving (m = 1 to 5)

E_o - fixed effect of lactation length (o = 1 to 6)

F_q - fixed effect of age at first calving (k = 1 to 13)

G_r - random effect of sire (m = 1 to 39)

$e_{ijkmoqrn}$ - random error with mean zero and variance σ^2_E

RESULTS AND DISCUSSION

The first lactation milk yield (FLMY) was found to be significantly affected by non genetic factors i.e. period of birth, period of calving, and lactation length ($P \leq 0.05$) (Table 1). The highest milk yield was obtained in animals calving and born in winter season followed by rainy and summer season. 2100 to 2200 days Age at first calving in Jaffarabadi buffalo produce highest milk during first lactation. Lactation length analysis shows that Jaffarabadi buffaloes were long day yielder as the day of lactation increases yield also increases significantly. Animal born in the years of 1987 to 1990 and calved in 1991 to 1994 found with highest milk production in first lactation which was indicative for better managemental practices and good genetic potential.

Effect of non-genetic factors

Milk yield is influenced by various genetic and non-genetic factors. Some of the important non-genetic factors affecting milk production trait are season of birth, period of birth, season of calving, period of calving, age at first calving and lactation length. The means for first lactation milk yield with respect to season of birth, period of birth, season of calving, period of calving, age at first calving and lactation length are presented in table 2 to 7. The results of analysis of variance for effect of various non genetic factors on first lactation milk yield are presented in Table 1.

Effect of season of birth

The effect of season of birth on first lactation milk yield of Jaffarabadi buffalo was found significant ($P<0.05$) in present study and therefore seasonal trend in the first lactation milk yield due to season of birth (Figure 1). The first lactation milk yield was significantly lower (1418.11±232.98 kg) in cows born in March to June i.e. those born in summer months, while significantly higher (1991.87±179.47 kg) first lactation milk yield found in buffaloes born during winter season. This indicated that Jaffarabadi buffaloes were seasonal performers round the year.

The first lactation milk yield was found to be significantly affected by season of birth ($P \leq 0.05$) in Murrah buffalo (Pawar *et al*., 2012) which support our present study finding. Pawar *et al*., 2012 also find that the highest milk yield was obtained in Murrah animals calving in winter season followed by rainy and summer season. Milk yield of buffaloes in winter was significantly higher than that of animals in summer ($P \leq 0.05$) Bufano *et al.* (2006) and Ahmad *et al.* (2001) found same result in Murrah buffalo.

Effect of period of birth

The effect of period of birth on first lactation milk yield was significant (P<0.05). There was significant (P<0.05) periodic trend found with first lactation milk yield (Figure 2) having a significant drop in first lactation milk yield as 1359.48±203.62 kg during Period 5 (2003 to 2006) over previous period (1999 to 2002) 1722.75±210.13 kg. There was highly significant (P<0.05) rise in lactation milk yield during Period 1 (1987 to 1990) i.e. 2134.00±259.78 kg.

Similar to the present study, in Murrah buffalo Pawar *et al.* (2012) reported non-significant (P>0.05) effect of period of birth, Anderson *et al.* (1985) also reported same trend in Murrah buffalo as non-significant effect of period of birth on first lactation milk yield.

Effect of season of calving

The effect of season of calving on first lactation milk yield of Jaffarabadi buffalo was found non-significant (P>0.05) in present study and therefore no seasonal trend in the first lactation milk yield due to season of calving (Figure 3). However, the first lactation milk yield was significantly (P<0.05) lower (1418.11±232.98) in cows freshening in March to June i.e. those calving in summer months. This indicated that Jaffarabadi buffaloes were non-seasonal year round performers.

Nili-Ravi buffalo calving in spring showed the highest and those calving in summer showed the lowest milk yield (Afzal *et al*., 2007). Chaudhary (1992) also recorded highest milk yield in spring calving (2151 kg) and lowest in autumn calving Nili-Ravi buffaloes (1960 kg) in same breed Ahmad and Shafiq (2002) noted that the maximum and minimum milk production was in winter (2400 kg) and dry hot season (2237 kg). However Raheja *et al.* (1983), Dutt and Yadav (1986) and Ghaffar *et al*. (1991) reported a non-significant effect of season of calving on milk production in Nili-Ravi and Murrah buffaloes. Murrah buffaloes were calving in summer and rainy season was not statistically significant. Buffaloes calving in summer season produced 86.4 kg less milk than those calved in rainy season and 206.4 kg less than those calved in winter season (Pawar *et al.*, 2012).

Effect of period of calving

The effect of period of calving on first lactation milk yield was significant (P<0.05). There was significant (P<0.05) periodic trend found with first lactation milk yield (Figure 4) having a significant drop in first lactation milk yield as 1431.37±184.93 kg during Period 5 (2007 to 2010) over previous period (2003 to 2006) 1780.37±238.20 kg. There was highly significant (P<0.05) rise in lactation milk yield during Period 1 (1991 to 1994) i.e. 2134.00±259.70 kg.

Similar to the present study, in Murrah buffalo Pawar *et al.* (2012) reported non-significant (P>0.05) effect of period of calving, Anderson *et al.* (1985) also reported same trend in Murrah buffalo as non-significant effect of period of calving on first lactation milk yield.

Effect of age at first calving

The effect of age at first calving on first lactation milk yield was non-significant (P>0.05). There was non-significant (P>0.05) periodic trend found with first lactation milk yield (Figure 5). Highest first lactation milk yield found as 2334.45±195.58 to the Jaffarabadi buffalo with 2101 to 2200 days age at first calving and lowest as 1447.00±17.08 to the animal with 2301 to 2400 days age at first calving but the difference was non-significant.

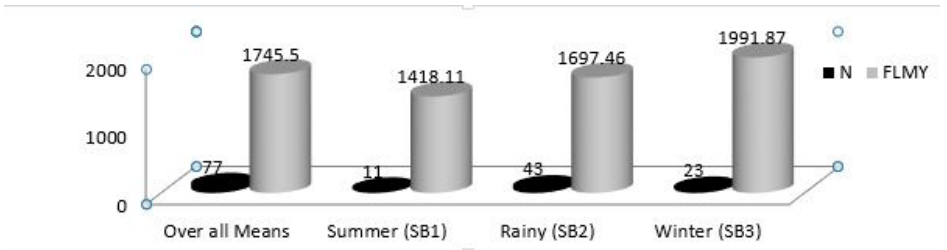

Figure 1. Effect of season of birth on first lactation milk yield in Jaffarabadi buffalo.

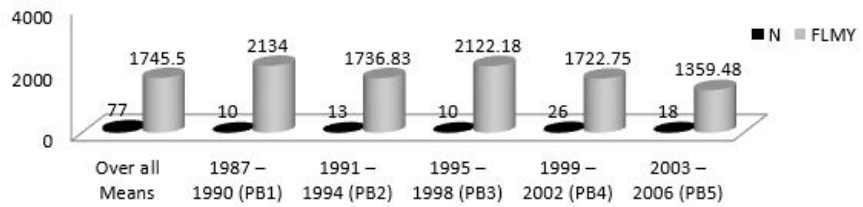

Figure 2. Effect of period of birth on first lactation milk yield in Jaffarabadi buffalo.

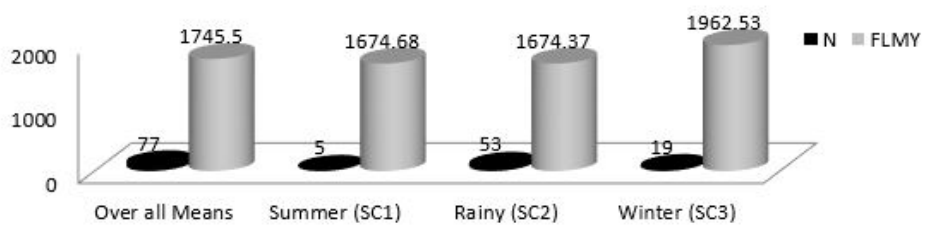

Figure 3. Effect of season of calving on first lactation milk yield in Jaffarabadi buffalo.

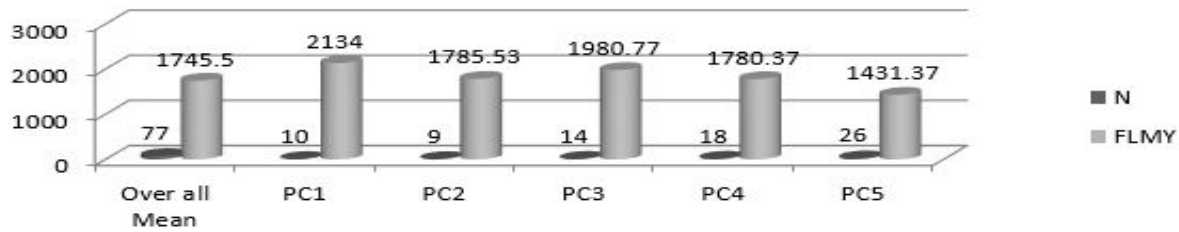

Figure 4. Effect of period of calving on first lactation milk yield in Jaffarabadi buffalo.

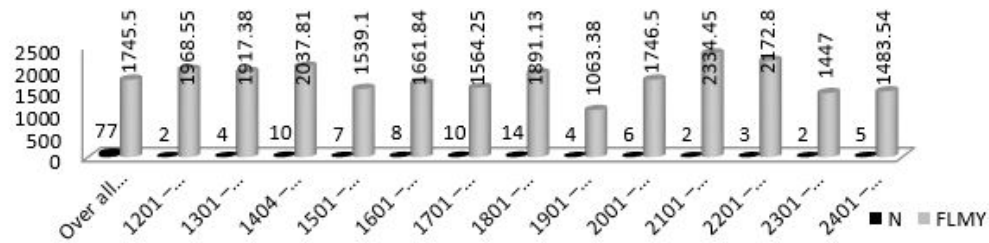

Figure 5. Effect of age at first calving on first lactation milk yield in Jaffarabadi buffalo.

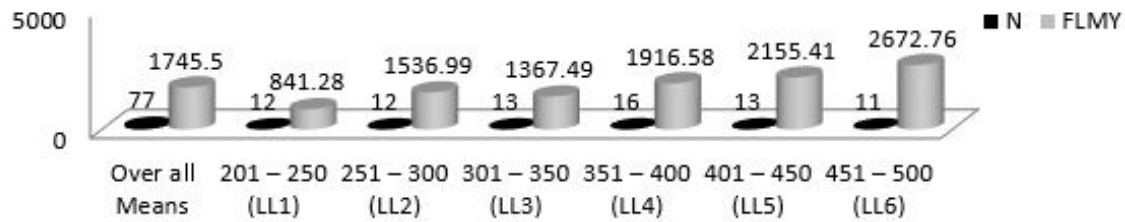

Figure 6. Effect of lactation length on first lactation milk yield in Jaffarabadi buffalo.

Effect of lactation length

The effect of lactation length on first lactation milk yield was highly significant (P<0.0001). There was highly significant (P<0.0001) periodic trend found with first lactation milk yield (Figure 6) having a significant drop in first lactation milk yield as 841.28±112.48 kg during 201 to 250 days lactation length over the others. There was highly significant (P<0.0001) rise in lactation milk yield over the days increases in lactation length i.e. 2672.7636±318.46 kg found with 451 to 500 days lactation length. These results revealed that the Jaffarabadi buffaloes were long day yielder.

First lactation milk yield was the lowest in the lactations of less than 240 days and the highest in lactation lengths of >361 days (P<0.05) in Nili-Ravi buffalo and also found that the lactation milk yield increased with increasing lactation length (Afzal *et al*., 2007) as similar as found in the present study. Khan and Chaudhary (2000) observed that the overall relationship between lactation length and milk yield was quite linear in Nili-Ravi buffaloes except for animals with shorter lactation length.

CONCLUSION

From the findings of the above study, it can be concluded that Jaffarabadi buffalo animals were having no seasonal effect as same as to Murrah and other buffalo animals. Further, as lactation days increase milk yield increases significantly which is one of best finding we get from this study as well there is non-significant effect of age at first calving shows that these animals can perform in all managemental condition with better or as per there capacity to produce. Milk production with significant up and down during various period indicative of better environment can give better production and good economic return.

Table 1. The analysis of variance for FLMY in Jaffarabadi buffalo.

Source	DF	Sum of square	Mean square	F-value	Pr>F
Season of birth	2	2674330.89	1337165.44	2.34	0.04
Period of birth	4	5624789.42	1406197.36	2.57	0.04
Season of calving	2	1188153.29	594076.65	1.01	0.37
Period of calving	4	4886204.48	1221551.12	2.19	0.03
Age at first calving	15	5675727.06	472977.25	0.77	0.68
Lactation length	10	24301299.04	4050217.51	13.67	<0.0001

Table 2. Effect of season of birth on first lactation milk yield in Jaffarabadi buffalo.

Season of birth	N	FLMY
Over all means	77	1745.5±87.72
Summer (SB1)	11	1418.11±232.98[b]
Rainy (SB2)	43	1697.46±266.57[ab]
Winter (SB3)	23	1991.87±179.47[a]

Means with the same letter are not significantly different (P<0.05).

Table 3. Effect of period of birth on first lactation milk yield in Jaffarabadi buffalo.

Period of birth	N	FLMY
Over all means	77	1745.5±87.72
1987-1990 (PB1)	10	2134.00±259.78[a]
1991-1994 (PB2)	13	1736.83±199.55[ab]
1995-1998 (PB3)	10	2122.18±341.06[a]
1999-2002 (PB4)	26	1722.75±210.13[ab]
2003-2006 (PB5)	18	1359.48±203.62[b]

Means with the same letter are not significantly different (P<0.05).

Table 4. Effect of season of calving on first lactation milk yield in Jaffarabadi buffalo.

Season of calving	N	FLMY
Over all means	77	1745.5±87.72
Summer (SC1)	5	1674.68±135.83[a]
Rainy (SC2)	53	1674.37±268.49[a]
Winter (SC3)	19	1962.53±176.73[a]

Means with the same letter are not significantly different (P<0.05).

Table 5. Effect of period of calving on first lactation milk yield in Jaffarabadi buffalo.

Period of calving	N	FLMY
Over all means	77	1745.5±87.72
1991-1994 (PC1)	10	2134.00±259.70[a]
1995-1998 (PC2)	9	1785.53±236.48[ab]
1999-2002 (PC3)	14	1980.77±296.18[ab]
2003-2006 (PC4)	18	1780.37±238.20[ab]
2007-2010 (PC5)	26	1431.37±184.93[b]

Means with the same letter are not significantly different (P<0.05).

Table 6. Effect of age at first calving on first lactation milk yield in Jaffarabadi buffalo.

Age at first calving	N	FLMY
Over all means	77	1745.5±87.72
1201-1300 (AFC 1)	2	1968.55±24.35[a]
1301-1400 (AFC 2)	4	1917.38±206.14[a]
1404-1500 (AFC 3)	10	2037.81±255.54[a]
1501-1600 (AFC 4)	7	1539.10±220.48[a]
1601-1700 (AFC 5)	8	1661.84±233.92[a]
1701-1800 (AFC 6)	10	1564.25±93.63[a]
1801-1900 (AFC 7)	14	1891.13±368.68[a]
1901-2000 (AFC 8)	4	1063.38±197.23[a]
2001-2100 (AFC 9)	6	1746.50±195.03[a]
2101-2200 (AFC 10)	2	2334.45±195.58[a]
2201-2300 (AFC 11)	3	2172.80±155.66[a]
2301-2400 (AFC 12)	2	1447.00±17.08[a]
2401-2500 (AFC 13)	5	1483.54±276.35[a]

Means with the same letter are not significantly different (P<0.05).

Table 7. Effect of lactation length on first lactation milk yield in Jaffarabadi buffalo.

Lactation length	N	FLMY
Over all means	77	1745.5±87.72
201-250 (LL1)	12	841.28±112.48[e]
251-300 (LL2)	12	1536.9917±97.62[cd]
301-350 (LL3)	13	1367.4923±118.79[d]
351-400 (LL4)	16	1916.5875±114.97[bc]
401-450 (LL5)	13	2155.4154±193.12[b]
451-500 (LL6)	11	2672.7636±318.46[a]

Means with the same letter are not significantly different (P<0.05).

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