SHORT COMMUNICATION

Factors Affecting Lactation Length and Peak Milk Yield in Gir Cattle

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Abstract

The production records of 228 Gir cows with 680 lactations sired by 52 bulls, maintained at Cattle Breeding Farm, Junagadh, were studied for 24 years (1987-2010). The data were analyzed to study the effect of period of calving, season of calving and parity as fixed effect on the production traits, *viz.,* lactation length and peak milk yield. The least squares means of lactation length and peak milk yield in Gir cows were found to be 328.27 ± 12.99 days and 12.31 ± 0.51 kg, respectively. The variance analysis revealed that the period of calving and parity had a highly significant ($p < 0.01$) influence on average lactation length and peak milk yield in Gir cows. Effect of season of calving was non- significant on these traits, indicating breed characteristic to adopt with tropical environment. There was precise decreasing trend in the lactation length due to parity or sequence of calving, indicating decrease of lactation length as the age advances, whereas peak milk yield increased gradually till 5th parity and then declined with advancing age/parity till 11th lactation. Lactation length ranged from 408.78 to 268.93 days in 1st to 12th parity, while peak milk yield in 1st, 5th and 10th lactation was 9.48, 13.65 11.17 kg, respectively.

Keywords: Gir cattle, Lactation length, Peak milk yield, Factors influencing.

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Introduction

The economy of dairy industry mainly rely upon the performance parameters of dairy animals, therefore, it becomes more relevant to find out the means for ameliorating the performance efficiencies by developing certain guidelines for selection. Lactation length and peak milk yield may mark the cow's productive life. Lactation length is closely related to generation interval, while peak milk yield is closely related to overall milk production, and therefore influence the response to selection (Zafar *et al.,* 2008; Subha Lakshmi *et al.,* 2010). Thus, segregation of factors like season, years and parity and their effect on traits like lactation length and peak milk yield will enable the breeder in assessing the effectiveness of the selection program and management conditions over time. This helps design more appropriate breeding strategies to maximize genetic gain and suggest amendments in management standards if desired (Rehman *et al*., 2008; Gadariya *et al*., 2017). Therefore the present investigation was planned with a view to study the factors affecting lactation length and peak milk yield in Gir cattle in its home track.

Materials and Methods

To achieve the objective, the data pertinent to production traits of 680 lactations of 228 Gir cows calved over a period from 1987 to 2010 (24 years), sired by 52 bulls maintained at Cattle Breeding Farm, Junagadh, Gujarat, India, were considered. The duration of 24 years was divided into 6 periods of four years each. The three seasons were delineated as winter (November-February), summer (March-June) and monsoon (July-October) based on geo-climatic conditions prevailing in the region. The parity was considered up to 12th lactation. Records of cows with some specific or non-specific diseases, reproductive disorders and physical injury were excluded from the present investigation.

The data were analyzed using Mixed Model Least-Squares Maximum Likelihood programme of Harvey (1990). Effect of sire was taken as random, whereas period, season and parity were estimated as fixed effect. Duncan's multiple range test was employed for making all possible pair-wise comparison of means. The mixed model used was-

$$Y_{ijkmn} = \mu + P_i + C_j + L_k + S_m + e_{ijkmn}$$

Where, Y_{ijkmn}-Performance trait of the individual animal (n), calved in (i)th period and (j)th season, of the (k)th parity, born to (m)th sire, μ-overall population mean, P_i fixed effect of

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period of calving (i = 1 to 6), C_j-fixed effect of season of calving (j = 1 to 3), L_k-fixed effect of parity (k = 1 to 12), S_m-random effect of sire (m = 1 to 52), $_{ijkmn}$-random error with mean zero and variance σ^2E.

Results and Discussion

The least-squares means of lactation length and peak milk yield with standard errors for different periods, seasons and parity together with their statistical significance are presented in Table 1. The average values of lactation length and peak milk yield in Gir cows were 328.27 ± 12.99 days and 12.31 ± 0.51 kg. Gadariya *et al.* (2017) however, reported lower lactation length of 281.02 ± 4.56 days in Gir cows.

Effect of Period of Calving

The period of calving had highly significant ($p < 0.01$) effect on lactation length and peak milk yield in Gir cows (Table 1). There was a periodic trend in these traits due to period of calving. The highest lactation length of 375.96 days was found in period 6 (2007-2010) and the lowest of 308.10±17.74 days in period 5 (2003-2006), which might be due to some period specific policy of farm or due to change in management practices over the periods. Peak milk yield however decreased from period 1 (1987-1990) with 13.35 kg to period 4 (1999-2002) with 10.4 kg and it increased thereafter with 13.82 kg in period 6 (2007-2010). The fluctuations in lactation length and peak milk yield observed during different study periods may be due to change in management strategy/period specific policy, herd size, feed & fodder availability, culling of certain animals as well as local climatic factors.

Khatri *et al.* (2004) and Muhammad *et al.* (2002) reported a significant effect of period of calving on lactation length in Red Sindhi cattle. Like present findings, Yari *et al.* (2011) reported a significant effect of year of calving on peak milk yield in Girolando cattle. The effect of period of calving was also reported to be statistically significant ($p < 0.05$) on peak milk yield in Hariana (Dhaka *et al.,*2002) and Sahiwal cattle (Singh *et al.,* 2001). As per a recent report, the herd performance traits in the same Gir herd were significantly influenced by the year (Gadariya *et al.,* 2018).

Effect of Season of Calving

Data in Table1 indicate that the season of calving had a non-significant effect on lactation length and peak milk yield. There was no precise seasonal trend in the lactation lengthor peak milk yield due to season of calving. Pandey *et al.* (2001) and Muhammad *et al.* (2002) also reported a non-significant effect of season of calving on lactation length in Hariana and Red Sindhi cattle. However, Khatri *et al.* (2004)reported a significant effect of season of calving on lactation length in Red Sindhi, while Javed *et al.* (2000), Bajwa *et al.* (2004), and Zafar *et al.* (2008) reported a significant effect of season of calving on lactation length in Sahiwal cattle. Singh *et al.* (2001) found a significant effect of calving season on peak milk yield in Sahiwal cattle.

Effect of Parity

There was highly significant ($p < 0.01$) effect of parity or sequence of calving on the lactation length and peak milk yield in Gir cattle under study (Table 1). A precise trend in the lactation length and peak milk yield due to sequence of calving was noted. The highest lactation length was observed in first lactation (408.78 ± 15.95 days),it then gradually decreased to 12th lactation (268.93 ± 68.62 days). The results indicate that as the age advances the lactation length decreases in Gir cows.

In a recent study, the lactation period of Gir cows varied significantly ($p < 0.05$) from 230 days to 335 days showing an increasing trend with increase in the number of parity (Gadariya *et al.,* 2017). Further, Bajwa *et al.* (2004), Zafar *et al.* (2008) and Muhammad *et al.* (2002) also reported a significant

Table 1: Factors affecting lactation length and peak milk yield in Gir cattle

	LSM ± SE	
Factors	*Lactation length (days)*	*Peak milk yield (kg)*
μ (n)	328.27 ± 12.99 (680)	12.31 ± 0.51 (680)
Period	**	**
1987-90 (36)	311.94 ± 28.08^{cd}	13.35 ± 0.91^{ab}
1991-94 (81)	336.89 ± 18.96^{a}	12.46 ± 0.66^{ab}
1995-98 (129)	317.75 ± 15.76^{bc}	10.78 ± 0.58^{bc}
1999-02 (166)	318.98 ± 14.90^{b}	10.40 ± 0.56^{c}
2003-06 (189)	308.10 ± 17.74^{d}	13.04 ± 0.63^{ab}
2007-10 (79)	375.96 ± 22.89^{a}	13.82 ± 0.76^{a}
Season	*NS*	*NS*
March – June (191)	322.25 ± 14.52	12.18 ± 0.55
July – Oct. (202)	332.59 ± 14.41	12.47 ± 0.55
Nov. – Feb. (287)	329.98 ± 13.47	12.28 ± 0.52
Parity	**	**
First (152)	408.78 ± 15.95^{a}	9.48 ± 0.58^{c}
Second (145)	375.89 ± 14.40^{a}	11.19 ± 0.55^{abc}
Third (105)	348.72 ± 14.56^{ab}	12.75 ± 0.55^{ab}
Fourth (86)	348.10 ± 14.54^{ab}	12.61 ± 0.55^{ab}
Fifth (63)	341.65 ± 15.47^{ab}	13.65 ± 0.57^{a}
Sixth (51)	340.44 ± 16.55^{ab}	13.43 ± 0.60^{a}
Seventh (35)	342.50 ± 19.17^{ab}	13.06 ± 0.66^{ab}
Eighth (25)	314.02 ± 21.99^{ab}	12.29 ± 0.74^{ab}
Ninth (8)	272.19 ± 35.49^{ab}	11.79 ± 1.12^{abc}
Tenth (4)	285.66 ± 49.10^{ab}	11.17 ± 1.51^{bc}
Eleventh(4)	292.35 ± 49.02^{ab}	11.69 ± 1.51^{abc}
Twelfth(2)	268.93 ± 68.62^{b}	14.58 ± 2.09^{a}

**$p < 0.01$, Mean of a trait bearing different superscript differ significantly ($p < 0.05$)
Figures in parentheses indicate number of observations.

effect of parity on lactation length in Sahiwal and Red Sindhi cattle. Rehman *et al.* (2006) however, found non-significant effect of parity on lactation length in Sahiwal cattle, although in another study, Rehman *et al.* (2008) recorded the significant effect of parity on lactation length in Sahiwal cattle. Shubha Lakshmi *et al.* (2010) reported a significant parity effect on peak milk yield in Holstein Friesian × Sahiwal crossbreed cattle.

Conclusion

The present findings from the data of 680 lactation of 228 Gir cows over 24 years under tropical climate revealed that the lactation length and peak milk yield were significantly influenced by period of calving and parity, but not by the season of calving, indicating breed characteristic to adopt with tropical environment.

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