B-5078
[1-4]

SHORT COMMUNICATION Indian Journal of Animal Research

Effect of Non Genetic Factors and Sire on Lactation Length in Frieswal Cattle

M.M. Chopade[1], Shrinivas Jahageerdar[2], R.S. Deshmukh[2], B.S. Katkade[2], M.P. Sawane[2] 10.18805/IJAR.B-5078

ABSTRACT

Lactation length is a very important trait of dairy animals directly affecting the milk yield. Shorter or extended lactation lengths are not desirable as it affects the milk yield. Therefore the study of factors affecting lactation length is of most important. The present study was conducted on data of 9094 lactations collected from 3425 Frieswal lactating cattle (Holstein Friesian × Sahiwal cattle) born to 239 sires maintained at Military Farm, Pimpri, Pune, Maharashtra from the year 1983 to 2018 to quantify effect of certain non genetic factors on lactation length. The normalized data were analyzed using *PROC GLM* procedure of SAS to study the effect of various genetic (sire) and non genetic (period, season and parity) factors on lactation length. The age at first calving was used as a covariate. The effect of period of calving was found to be highly significant (<0.001) on lactation length. The season, parity and age at first calving were significantly affecting the lactation length. Parity two to six does not differ significantly in lactation length. Among the genetic factors effect of sire was significant on lactation length.

Key words: Frieswal cattle, Genetic and non genetic factors, Lactation length.

India is predominantly an agricultural country and livestock sector is an important allied sector of the agriculture contributing to about 25.6% of total agricultural GDP. The major contribution in livestock sector is from dairy farming. India has a livestock population of about 535.78 million which includes 192.49 millions of cattle and 109.85 millions of buffaloes (20th Livestock Census of India). India rank at the top in the milk production with total milk production of 209.96 million tons in 2020-21. However, the average milk production per animal is still lower as compared to global average. The milk yield variation is attributed to considerable variability in lactation length which is greatly affected by non genetic factors, which includes direct climate effect, managemental and nutritional aspects, age of animal, year and season of calving *etc*. Studies have been conducted to understand the impact of various genetic and non-genetic factors on lactation length. The selection program can be made effective over time by segregating the factors like period, season and parity and their effect on lactation length. It will enable the design of appropriate breeding strategies to maximize the genetic gain and suggest modification, if required, in the managemental standards. The targeted improvement towards these non genetic factors may be helpful substantially to increase the performance of dairy cattle in terms of milk yield traits within the standard duration of lactation. Similarly, the genetically determined variations can be useful for improvement of characteristics and to study the associations existing between the characters. Thus, considering the above fact, an attempt is made to quantify the effect of various non-genetic factors and sire on lactation length in Frieswal cattle.

The data for the present study were collected on Frieswal cattle maintained at Military Dairy Farm, Pimpri, Pune (India) for the period of 1983 to 2018. A total of 9094 lactation records belonging to 3425 Frieswal cows born to 239 sires were recorded. The further analysis was carried out using SAS 9.13 version. The data collected from 1983-2018 was classified into four periods P_1 (1983-2003), P_2 (2004-2008), P_3 (2009-2013), P_4 (2014-2018),and three seasons winter (October to January), Summer (Feb- May) and Rainy (June to September). The first period was prolonged from 1983 to 2003 because very few records were available in that period. The total parities were numbered from first to the last parity. The cows which were affected with disease or debilited or died before completion of first three lactations and the sires with less than five progenies were omitted from the study. Further, the data were standardized by removing the records for the cows having age at first calving above 1250 days, lactation length below 100 days and above 365 days, lactation milk yield below 1000 kg and inter-calving period below 250 days. Normalized

[1]Department of Animal Genetics and Breeding, College of Veterinary and Animal Sciences, Parbhani-431 402, Maharashtra, India.
[2]Department of Animal Genetics and Breeding, Mumbai Veterinary College, Parel, Mumbai-400 012, Maharashtra, India.

Corresponding Author: M.M. Chopade, Department of Animal Genetics and Breeding, College of Veterinary and Animal Sciences, Parbhani-431 402, Maharashtra, India.
Email: drmmchopade@gmail.com

How to cite this article: Chopade, M.M., Jahageerdar, S., Deshmukh, R.S., Katkade, B.S. and Sawane, M.P. (2023). Effect of Non Genetic Factors and Sire on Lactation Length in Frieswal Cattle. Indian Journal of Animal Research. doi:10.18805/IJAR.B-5078.

Submitted: 26-12-2022 **Accepted:** 22-04-2023 **Online:** 06-06-2023

data were utilized to find out the effect of non genetic factors on lactation length using *PROC GLM* procedure of SAS. The means of different levels within a class factor were compared using DMRT. All non genetic effects were considered fixed effects.

The effect of non genetic factors on lactation length were analyzed by adopting the following model.

$$Y_{ijkl} = \mu + b\ (AFC_{ijkl} - AFC) + S_i + P_j + A_k + e_{ijkl}$$

Where,

Y_{ijkl} = Observation on the l^{th} individual in i^{th} season/month, j^{th} period and k^{th} parity.

μ = Overall population mean.

$b\ (AFC_{ijkl} - AFC)$ = The regression of the trait on age at first calving.

S_i = Effect of i^{th} season where i =1,2 and 3.

P_j = Effect of j^{th} period where j = 1, 2, ... 4.

A_k = Effect of k^{th} parity k = 1,2.....11.

e_{ijkl} = Random error, NID (0, σ2e).

The sire effect on lactation length was estimated using PROC GLM procedures of SAS by fitting the linear regression model to the data using lactation length as dependent variable and sire as independent variable.

The effect of period of calving was found to be highly significant (p<0.001) on lactation length (Table 1). The average lactation length during the second (302.30±1.22) and third (304.46±0.89) periods did not differed significantly from one another; however, they were significantly different from the mean lactation length of the first period. The lowest mean lactation length was observed in period one (292.52±1.31 days) while the highest was in the third period (304.460.89± days) as shown in Table 2. The variation in lactation length observed during different periods might be due to the level of management practices introduced from one year to another and the variations caused due to the environmental factors like fluctuations in temperature and humidity and also due to some genetic factors like herd genetic levels, changes in the age of the animals etc. The significant effect of the period of calving on lactation length was found by Chopade *et al*. (2002) in crossbred cattle, Das *et al*. (2011) in crossbred dairy cows and Beneberu *et al*. (2020) in pure Jersey cattle in Central Highland Ethiopia. Highly significant effect of period of calving on first lactation length was observed by Eid (2012) in Friesian cattle, Hussain *et al*. (2015) in Tharparkar cattle. However, Kumar *et al*. (2016) in Ongole cattle and Dongre *et al*. (2017) in Deoni cattle reported the non significant effect of period of calving on lactation length.

The least squares means of lactation length of rainy, summer and winter seasons was found to be 301.66±1.00, 300.68±0.86 and 299.44±0.77 days, respectively (Table 2). The season of calving had a significant effect on lactation length. The lactation length of winter season differed significantly from lactation length of rainy and summer season. Cows calved during the rainy season had the highest lactation length (301.66 ±1.00 days) and that of the cows calved during the winter season had the lowest lactation length (299.44±0.77 days). The season-wise differences in lactation length may be attributed to a different production setup and variation in managemental conditions during these seasons. Singh *et al*. (2015) reported the significant effect of season on the lactation length in crossbred cattle. Choudhary *et al*. (2019) reported a significant effect of calving seasons on lactation length in Tharparkar cattle. However, the contradictory result of a season of calving was reported by Lakshmi *et al*. (2010) in Frieswal cattle, Wondifraw *et al*. (2013) in Holstein Friesian × Deoni crossbred cows and Rokade *et al*. (2021) in Phule Triveni cattle.

The parity had a highly significant (P<0.001) effect on the lactation length (Table 1). The DMRT showed that the lactation length from second (305.77±1.20) to sixth (305.48±2.14) parity did not differ significantly from each other. Similarly, parity numbers eight (304.02±3.25), nine (305.32±4.29) and eleven (304.81±1.30) were also showing non-significant differences between them. However, the lactation length in first (288.19±0.86) and tenth (308.40±5.42) parities differ from all other lactation lengths, as shown in Table 2. The minimum lactation length was observed during the first parity and the maximum lactation length was observed during the tenth parity. The short lactation length during the first parity may be due to the fact that the reproductive organs and mammary glands were not fully developed during this period. The non-significant difference in lactation length from the second to sixth parities indicates the stability of lactations and milk yield (Table 2).Similar results were also obtained by Kumar *et al*. (2016) in Ongole cattle, Alex *et al*. (2017) in

Table 1: Analysis of variance for the effect of various non-genetic factors on lactation length.

Source	DF	Type III SS	Mean sum of square
Anova 1 (Non-genetic factors)			
AFC	1	106753.3500	106753.35**
Period	3	111898.4420	37299.48**
Season	2	17061.9735	8530.98*
Parity	10	593178.8116	59317.88**
Period*Season	6	76327.4159	12721.23**
Anova 2 (Genetic factors)			
Sire	238	1079787.339	4756.772**

*P≤0.05 (significant) and **P≤0.01 (highly significant).

Table 2: Least squares mean for various non-genetic factors affecting lactation length.

Source of variation	N	Mean±SE
Overall	8923	300.45±0.50
AFC	8923	961.06±1.51
P1	1396	292.52±1.31[a]
P2	1580	302.30±1.22[b]
P3	2595	304.46±0.89[b]
P4	3352	299.76±0.81[ab]
Rainy	2394	301.66±1.00[a]
Summer	2978	300.68±0.86[a]
Winter	3551	299.44±0.77[b]
Parity1	2288	288.19±0.86[a]
Parity2	1853	305.77±1.20[bc]
Parity3	1554	304.28±1.18[bc]
Parity4	1127	306.48±1.48[bc]
Parity5	833	303.46±1.58[bc]
Parity6	509	305.48±2.14[bc]
Parity7	330	295.52±2.38[ab]
Parity8	213	304.02±3.25[bc]
Parity9	121	305.32±4.29[bc]
Parity10	62	308.40±5.42[c]
Parity11	33	304.81±1.30[bc]

(Note: Different superscript within a group differ significantly from each other).

Frieswal cows in the northern zone of India and Beneberu *et al*. (2020) in pure Jersey cattle. Whereas, the non-significant effect of parity was reported by Dongre *et al*. (2017) in Deoni cattle of Marathwada region and Rokade *et al*. (2021) in Phule Triveni cattle.

The least squares mean for age at first calving was found to be 961.06±1.51 days (Table 2). Age at first calving had highly significant effect on lactation length in Frieswal cattle. Heravi *et al*. (2008) reported the significant effect of age at first calving on lactation length however, Gatchearle *et al*. (2009) and Naceur *et al*. (2012) found the non-significant effect of age at first calving on lactation length in Holstein Friesian × Deoni (HF × D) and Tunisian Holstein cows, respectively.

The genetic factor considered for the present study was the effect of sire. It was observed that the sire effect was found to be highly significant ($p<0.001$) on lactation length (Table 1). Thus, the proper selection of sire may bring about an improvement in lactation length. Mishra (2016) and Choudhary *et al*. (2019) reported the highly significant effect of sire on lactation length in Tharparkar cattle. The significant effect of sire on lactation length was also reported by Abbas *et al*. (2010), Kumar *et al*. (2016), Jadhav *et al*. (2019) and Kuchekar *et al*. (2021) in Sahiwal cattle, Ongole cattle, HF × Gir Cattle and Phule Triveni cattle, respectively. However, Kharat *et al*. (2008) reported the non significant effect of sire lactation length in Holstein Friesian crossbred cows.

CONCLUSION

The highly significant effect of period, season and parity on lactation length indicated that the trait is mostly under the influence of non genetic factors like nutrition, managemental practices, age of animal *etc.* However, the sire also has a significant effect on lactation length, indicating that equal importance may be given to the nutrition, managemental practices and selection of sire for further improvement in this trait. A combination of genetic and non-genetic factors can be used to improve lactation length in cows. Selective breeding programs and management practices can all contribute to longer lactation periods and increased milk production.

ACKNOWLEDGEMENT

We thank Lt.Col, Military Dairy Farm, Pimpri, Pune, Maharashtra for providing facilities and data on various production parameters for the present study. We also thanks to the Director of ICAR-CIFE and Principal Scientist, Department of Fish Genetics and Biotechnology, ICAR-Central Institute of Fishery Education, Versova, Mumbai for providing computer laboratory facilities and technical assistance. I am also thankful to Mr Nitin Patil for his help to develop the software for data collection.

Conflict of interest: None.

REFERENCES

Abbas, S., Singh, C.V., Barwal, R.S., Singh, C.B. (2010). Genetic and phenotypic parameters of first lactation and lifetime traits in Sahiwal cows. Journal of Livestock Biodiversity. 2(2): 67-70.

Alex, R., Kumar, S., Singh, U., Deb, R., Alyethodi, R. R., Prakash, B., Singh, G. (2017). Evaluation of non-genetic factors affecting lactation traits of frieswal cows in Northern zone of India. Indian Journal of Animal Science. 87(4): 520-522.

Beneberu, N., Shibabaw, W. and Getahun, A.K. (2020). Effect of non-genetic factors on milk production traits of pure Jersey Dairy Cattle in Central Highland Ethiopia. Food Science and Quality Management. 103: 7-12.

Chopade, M.M., Ali, S.Z., Kuralkar, S.V. (2002). Comparative study of F1 and F2 crossbred cows with reference to productive traits. Indian Journal of Animal Science. 72(10): 916-917.

Choudhary, G., Urmila, P., Gahlot, G.C., Kumar,A., Poonia, N.K. (2019). Influence of genetic and non-genetic factors on production traits of tharparkar cattle at organized farm. International Journal of Livestock Research. 9(3): 148-156.

Das, A., Das Gupta, M., Khan, M.K.I., Miah, G. (2011). Effect of non-genetic factors on the productive and reproductive traits of Friesian crossbred dairy cows. Wayamba Journal of Animal Science. 14: 62-64.

Dongre, V.B., Kokate, L.S., Jadhav, P.V., Salunke, V.M., Khandait, V.N., Durge, S.M., Patil, P.V. (2017). Effect of non-genetic factors on production and reproduction traits in Deoni Cattle. International Journal of Livestock Research. 7(9): 220-225.

Eid, I.I. (2012). Estimation of genetic and non-genetic parameters of friesian cattle under hot climate. Journal of Agricultural Science. 4(4): 95-102.

Gatchearle, P.L., Mitkari, K.R., Mule, R.S., Baswade, S.V., Adangale, S.B. (2009). Effect of age at first calving on lactation milk yield and lactation length. Indian Journal of Animal Research. 43(3): 228-229.

Heravi, A. and Mesgaran, M.D. (2008). Impact of age at first calving on lactation and reproduction of first parity Iranian holstein dairy cows. Journal of Animal and Veterinary Advances. 7(2): 190-195.

Hussain, A., Gupta, A.K., Dash, S.K., Manoj, M., Ahmad, S. (2015). Effect of non genetic factors on first lactation production and reproduction traits in tharparkar cattle. Indian Journal of Animal Research. 49**(4)**: 438-441.

Jadhav, S.S., Deokar, D.K., Fulpagare, Y.G., Bhoite, U.Y., Mandkmale, S.D., Nimbalker, C.V. (2019). Effect of genetic and non-genetic factors on first lactation production and reproduction traits in HF × Gir Cattle. International. Journal of Current Microbiology and Applied Science. 8(1): 45-51.

Kharat, A.S., Kuralkar, S.V., Ali, S.Z. (2008). Relationship between sires estimated breeding values for first lactation and lifetime traits in Holstein Friesian crossbred cows. Indian Journal of Animal Research. 42(4): 261-263.

Kuchekar, H.D., Bhoite, U. Y., Bhoite, S.U., Gaikwad, U. S., Shinde, K.P. (2021). Effect of genetic and non-genetic factors on first lactation reproduction and production traits in Phule Triveni cattle. Journal of Pharmacognosy and Phytochemistry. 10(2): 13-16.

Kumar, A., Singh, U., Singh, R., Vinoo, R. (2016). Genetic studies on production and reproduction traits of Ongole cattle at organized farms. Indian Journal of Animal Sciences. 86(7): 826-830.

Lakshmi, S.B., Gupta, B.R., Prakash, M.G., Sudhakar, K., Sharma, S. (2010). Genetic analysis of the production performance of frieswal cattle. Tamil Nadu Journal of Veterinary and Animal Sciences. 6(5): 215-222.

Mishra, G. (2016). Studies on production and reproduction performance of tharparkar cattle at organized farm. M.V.Sc thesis submitted to MAFSU, Nagpur.

Naceur, M., Bouallegue, M., Frouja, S., Ressaissi, Y., Brar, S.K., Hamouda, M.B. (2012). Effects of environmental factors on milk yield, lactation length and dry period in Tunisian Holstein cows. Intech Open Book Series. 153-164.

Rokade, S.U., Deokar, D.K., Hingonekar, G.S., Sonawane, H.S. (2021). Effect of non-genetic factors on production traits of Phule Triveni cattle. International Journal of Current Microbiology and Applied Sciences. 10(1): 147-154.

Singh, A., Dubey, P.P., Kaur, S., Malhotra, S.P., Kumar, A., Dash, S.K. (2015). Genetic analysis of first lactation traits in cattle. Progressive Research-An International Journal. 10 (Special-IV**)**: 2243-2246.

Wondifraw, Z., Thombre, B.M., Bainwad, D.V. (2013). Effect of non-genetic factors on milk production of Holstein Friesian × Deoni crossbred cows. African Journal of Dairy Farming and Milk Production. 1(4): 79-84.