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Genetic and Phenotypic Parameters of First Lactation and Life Time Traits in Sahiwal Cows

Jaswant Singh and CV Singh*

Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, India

Abstract

The data for the present study was collected on first lactation milk and life time performance traits of 1367 Sahiwal cows born to 112 sires spread over a period of 71 years from 1944-2014 maintained at Government Livestock Farm, Chakganjaria, Lucknow. The overall least squares mean of first lactation traits viz. first lactation milk yield, life time lactation length, life time milk yield and average daily milk yield were estimated to be 1941.16 ± 27.66 kg, 1534.28 ± 36.84 days, 9262.50 ± 272.92 kg and 5.94 ± 0.10 kg respectively. Season effect was non-significant on all the traits. The periods of calving were found to have significant influence on first lactation milk yield and average daily milk yield, the sire effect was found significant on all the traits. The heritability estimates of different first lactation and life time traits were observed low to medium. The genetic and phenotypic correlations among all the traits were observed very low to high.

Keywords: Sahiwal; Genetic phenotypic; Heritability; Life time milk yield; Productive life

Introduction

The Sahiwal is one of the few best milch breeds of our country, known for its quality milk production, disease resistance, heat tolerance, feed conversion efficiency etc. Considering its genetic superiority, the breed has been imported by many countries for upgrading or crossbreeding of their local cattle [1]. The Government of India has also realized the importance of our indigenous cattle breeds and implemented various programmes for their genetic improvement. The genetic parameters such as heritability and genetic correlations are helpful in determining the selection strategy for a single or multiple selection objectives. The influence of non-genetic factors on various economic traits is required to be evaluated to adjust the data for significant non genetic factors to estimate genetic parameters of the population.

The accurate estimates of genetic and phenotypic parameters viz. heritability, genetic and phenotypic correlations amongst different traits are importance for any breed improvement programme. Selection for traits having higher heritability estimates will give higher response in these traits in subsequently generations under progeny testing scheme for evaluating the sires.

Information on first lactation traits enables the breeder to predict the later lactation performance of the animals as it is highly correlated with the future performance traits [2]. Besides, performance of first lactation traits will help in early selection of the superior animals and thus reduce the generation interval. Estimates of genetic parameters are needed for the prediction of breeding values and planning of selection strategies for desired genetic advancement with this object in view, the present investigation was conducted for estimating the genetic and phenotypic parameters of first lactation and life time performance traits.

Materials and Methods

The data for the present investigation were collected over a period of 71 years (1944-2014) from pedigree sheets of 1367 Sahiwal cows born to 112 sires maintained at Government Livestock Farm, Chakganjaria, Lucknow were utilized. Only the sires having records on at least 5 daughters were included in the present study. The records of only those animals with known pedigree and normal lactation were considered. The lactation records of less than 150 days were considered as abnormal and were not included in the analysis. The total duration of the present study was divided into 8 periods. Out of 8 periods 7 are of nine years each and 8th period of 8 years only. Each year was divided into four seasons namely winter (November -February), Summer (March-June), Rainy (July-October). In order to classify the data for different periods and seasons, year and season of calving was considered for all the traits. The traits considered in the present study were age at first calving, first service period, first dry period, first calving interval, first lactation milk yield, lifetime milk yield, productive life and herd life.

Statistical Analysis

The influence of non-genetic factors on different traits were studied by least squares analysis of variance for non orthogonal data using mixed model least squares and maximum likelihood programme described by Harvey [3]. The model for the least squares analysis of variance to estimate the influence of non genetic factors on different first lactation and lifetime traits included the effect of periods, seasons and sires. Prior to estimation of genetic parameters, the data were adjusted for different significant non genetic factors. The data after adjustment for different significant non genetic factors were utilized for estimation of genetic parameters. Paternal half sib correlation method was used to estimate heritability of different traits [4]. The standard error of heritability was estimated by the formula given by Swiger et al. [5]. The genetic and phenotypic correlations among different traits were estimated from the analysis of variance/covariance using half sib data as suggested by Becker [4]. The standard error of genetic correlation was estimated

***Corresponding author:** CV Singh, Professor, Department of Animal Genetics and Breeding, College of Veterinary and Animal Sciences, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar-263 145, US Nagar, Uttarakhand, India, Tel: +919411223202; Fax: +915944233473; E-mail: cvsingh2010@gmail.com

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according to the formula given by Robertson [6]. The standard error of phenotypic correlation was estimated according to the formula given by Panse and Sukhatme [7].

Results and Discussion

Mean and standard errors for first lactation and life time traits are presented in Table 1. The overall least squares mean of first lactation traits viz. first lactation milk yield, life time lactation length, life time milk yield and average daily milk yield were estimated to be 1941.16 ± 27.66 kg, 1534.28 ± 36.84 days, 9262.50 ± 272.92 kg and 5.94 ± 0.10 kg respectively. These estimates are in close agreement with those reported by Kumar, Kathiravan, Kumar and Singh and Abbas et al. [1,8-10].

The least squares analysis of variance to estimate different non genetic effects are presented in Tables 2 and 3. The effect of season was found to have non significant influence on all the first lactation and life time traits. It was found that cows calved in winter season (Nov-Feb) had higher first lactation yield, life time lactation length and life time milk yield than the cows calved in other seasons. Summer season calves had lowest values for all the traits. While average daily milk yield observed highest in rainy season calves, than the other season calves. Non significant influence of different season on various first lactation production and life time traits had been reported by Kuralkar et al. [11], Kumar [8], Kumar and Singh [10] and Abbas et al. [1] which is in agreement with the findings of present study.

The periods of calving were found to have significant influence on first lactation milk yield and average daily milk yield. The present results are in close agreement with the reports of Khalid et al. [12], Banik et al. [13], Raja and Narula [14] and Abbas et al. [1].

However, no consistent trend was found, with fluctuations being observed over the period of calving for all the traits under study. The variability in all the traits over the periods might be due to differences in managemental practices followed during different periods of time. These findings are in agreement with the reports of Raja and Narula [14], Kumar et al. [15], Kathiravan et al. [9] and Abbas et al. [1].

The least squares analysis of variance showed highly significant effect of sire on all first lactation and life time traits. Which revealed that superior sire could be used effectively for improvement of all the traits. These findings are supported by Haque et al. [16], Kumar [8], Kumar et al. [15] and Abbas et al. [1] in Sahiwal cattle.

In general, the heritability estimates of first lactation milk yield, life time lactation length, life time milk yield and average daily milk yield were observed low to medium. The result indicated that the heritability estimate may vary under models with different sets of combinations

Source of variance	Mean sum of square (MS values)				
	DF	FLMY	LTLL	LTMY	ADMY
Season	2	838557.60	1066129.73	51487170.41	1.06
Period	7	71527710.10**	454766.80	19611866.03	11.75**
Sire	111	4385049.11**	718409.926**	37814386.75**	3.91**
Error	1245	651903.74	527056.50	26256374.11	1.645637

**P<0.01; *P<0.05
FLMY: First Lactation Milk Yield; LTMY: Life Time Milk Yield
LTLL: Life time Lactation Length; ADMY: Average Daily Milk Yield

Table 1: Analysis of variance for the factors affecting first lactation traits.

Source	No. of obs.	FLMY	LTLL	LTMY	ADMY
Overall Mean					
Overall Mean	1367	1941.16 ± 27.66	1534.28 ± 36.84	9262.50 ± 272.92	5.94 ± 0.10
Seasons					
S1-Summer (March-June)	176	1890.94^{b} ± 63.90	1471.19^{b} ± 66.66	8739.68^{b} ± 477.78	5.86^{b} ± 0.14
S2- Rainy (July-Oct)	682	1937.62^{a} ± 33.34	1529.57^{b} ± 41.71	9322.34^{b} ± 305.87	6.00^{a} ± 0.11
S3- Winter (Nov-Feb)	509	1994.92^{a} ± 37.35	1602.08^{a} ± 45.06	9725.48^{c} ± 328.68	5.97^{a} ± 0.11
Periods					
P1 (1944-53)	79	3057.90^{a} ± 95.77	1609.35^{a} ± 223.79	12180.38^{a} ± 1581.73	7.83^{a} ± 0.40
P2 (1954-62)	176	3105.84^{a} ± 66.50	1413.22^{c} ± 166.95	10676.09^{b} ± 1181.30	7.70^{b} ± 0.30
P3 (1963-71)	156	1683.74^{bc} ± 71.36	1492.42^{c} ± 182.91	9922.81^{cd} ± 1293.65	6.82^{c} ± 0.33
P4 (1972-80)	198	1863.28^{b} ± 63.03	1456.05^{b} ± 166.79	1293.65^{c} ± 1180.14	5.51^{d} ± 0.30
P5 (1981-88)	272	1600.08^{bc} ± 53.17	1491.37^{c} ± 112.95	8260.09^{ef} ± 801.52	5.19^{ef} ± 0.21
P6 (1989-1997)	189	1271.91^{d} ± 62.03	1699.03^{c} ± 137.70	8603.04^{ef} ± 975.46	4.77^{f} ± 0.25
P7 (1998-2006)	129	1461.69^{c} ± 74.40	1731.09^{c} ± 162.46	8867.378^{ed} ± 1149.67	4.70^{f} ± 0.30
P8 (2007-2014)	168	1484.85^{c} ± 69.50	1381.72^{d} ± 229.80	7322.22^{f} ± 1624.06	5.04^{e} ± 0.41

Table 2: Least square mean ± S.E. for various traits in sahiwal cattle.

S. No.	Traits	FLMY	LTLL	LTMY	ADMY
1.	FLMY	0.253 ± 0.08	-0.247 ± 0 .35	0.547 ± 0.264	0.003 ± 0.001
2.	LTLL	0.252 ± 0.0272	0.143 ± 0.07	0.771 ± 0 .123	0.219 ± 0.240
3.	LTMY	0.900 ± 0.027	0.44 ± 0.0252	0.171 ± 0.070	0.780 ± 0.150
4.	ADMY	0.153 ± 0.027	0.463 ± 0.024	0.550 ± 0.023	0.490 ± 0.090

Table 3: Heritability (on the diagonal), Genetic correlation (above diagonal) and phenotypic correlation (below diagonal) among life time traits.

of traits depending upon the magnitude of association among the traits being considered. The present results revealed that non-genetic variability for these traits are existing and these traits can be improved through better feeding and management. These findings are in close agreement with those reported by Singh et al. [17], Ahmad et al. [18], Dalal et al. [19], Kumar et al. [15], Tiwari et al. [20] and Abbas et al. [1] in Sahiwal cattle.

First lactation milk yield with other traits

The genetic correlations of first lactation milk yield with life time lactation length, life time milk yield and average daily milk yield were 0.247 ± 0.35, 0.547 ± 0.26 and 0.003 ± 0.001 respectively. The genetic correlations of first lactation milk yield with life time lactation length was negative while with other two traits were positive.

The phenotypic correlations of first lactation milk yield with life time lactation length, life time milk yield and average daily milk yield were 0.250, 0.900 ± 0.027 and 0.150 ± 0.027 respectively The phenotypic correlations between these traits were positive and ranged from low to high. These findings are in close agreement with those reported by Singh et al. [17], Ahmad et al. [18], Dalal et al. [19], Kumar et al. [15], Tiwari et al. [20] and Abbas et al. [1] in Sahiwal cattle.

Life time lactation length with other traits

The genetic correlations of life time lactation length with life time milk yield and average daily milk yield were 0.77 ± 0.12 and 0.219 ± 0.24 respectively. The genetic correlations of life time lactation length with average daily milk yield was found highly positive.

The phenotypic correlations of life time lactation length with life time milk yield and average daily milk yield were 0.44 ± 00 and 0.463 ± 0.02 respectively. The phenotypic correlations of life time milk yield with other traits were observed positive and moderate.

Life time milk yield with

The genetic correlation of life time milk yield with average daily milk yield was 0.78 ± 0.15. In the present study the genetic correlation of life time milk yield with average daily milk yield was observed highly positive [21,22]. These findings are in close agreement with those reported by Singh et al. [17], Ahmad et al. [18], Dalal et al. [20], Kumar et al. [15], Tiwari et al. [20] and Abbas et al. [1] in Sahiwal cattle.

Conclusion

A study was conducted to assess the influence of genetic and non-genetic factors on first lactation yield and lifetime performance traits. In the present results no consistent trend was found, with fluctuations being observed over the period of calving for all the traits under study. The variability in all the traits over the periods might be due to differences in managemental practices followed during different periods of time. The genetic correlations between first lactation milk yield and other traits were generally on higher side, suggesting that all the traits were fairly controlled by similar genes. These correlations indicated that selection on the basis of first lactation milk yield would bring desirable improvement in lifetime milk yield and lifetime lactation length. Since very little opportunity exists for selection of cows for lifetime traits, it is desirable to select the animals on the performance of earlier lactations rather than traits expressed later in life.

References

1. Abbas S, Singh CV, Barwal RS, Singh CB (2010) Genetic and phenotypic parameter on first lactation and life time traits in Sahiwal cows. Journal of Livestock Biodiversity 2: 67-70.
2. Jairath LK, Hayes JF, Cue RI (1995) Correlations between first lactation and lifetime performance traits of Canadian Holsteins. J Dairy Sci 78: 438-448.
3. Harvey WR (1990) User guide for LSMLMW and MIXMDL package. Mixed model least squares and maximum likelihood computer programme. PC-2 Version. Mimeograph, Columbia, Ohio, USA.
4. Becker WA (1975) Manual of quantitative genetics. 3rd edition. Pub. Program in Genetics, Washington State University, Washington, USA.
5. Swiger LA, Harvey WR, Everson DO, Gregory KE (1964) The variance of intra class correlation involving groups with one observation. Biometrics 20: 818-826.
6. Robertson A (1959) The sampling variance of the genetic correlation coefficient. Biometric 15: 469-485.
7. Panse VG, SuKhatme PV (1967) Statistical methods for Agricultural workers. ICAR, Krishi Bhawan, New Delhi, India.
8. Kumar A (2003) Genetic analysis of economic traits of Sahiwal cattle using animal models. PhD Thesis, GB Pant University of Agriculture & Technology, Pantnagar, India.
9. Kathiravan P, Sachdeva GK, Gandhi RS, Raja TV, Singh PK, et al. (2009) Genetic evaluation of first lactation production and reproduction traits in Sahiwal cattle. Journal of livestock Biodiversity 1: 51-55.
10. Kumar A, Singh CV (2010) A genetic study of Sahiwal herds. In: National Symposium on Conventional and modern breeding technologies for genetic improvement of livestock and Poultry in India held at GBPUAT, Pantnagar from Oct 22-23, 2010. p: 121.
11. Kuralkar SV, Kothekar MD, Deshmukh SN, Gore AK (1996) Factors affecting some of the economic traits in Sahiwal cattle. Indian Vet J 73: 234-236.
12. Khalid J, Ghulam M, Abdullah M (2000) Environmental factors affecting various productive traits in Sahiwal cattle. Pakistan Vet J 20: 187-192.
13. Banik S, Gandhi RS (2006) Animal model versus conventional methods of sire evaluation in Sahiwal cattle. Asian Aust J Anim Sci 19: 1225-1228.
14. Raja KN, Narula HK (2008) Non genetic factors influencing reproductive performance traits in Sahiwal cattle. Indian Veterinary Journal 85: 213-214.
15. Kumar A, Singh CV, Kumar D (2009) Effect of genetic and non-genetic factors on reproduction and production traits in Sahiwal cattle. Indian Journal of Animal Production and Management 25: 108-110.
16. Haque MA, Amin MR, Hussen MS (1999) Dairy potential of pabno cows and crossbred with Sahiwal and Friesian and within and between breed sire effects. Asian Aust J Anim Sci 12: 161-164.
17. Singh B, Bhat PN, Kumar S (1980) Factors affecting breeding efficiency in Sahiwal cows. Ind J Anim Sci. 50: 575-529.
18. Ahmad M, van der Werf JHJ, Javed K (2001) Genetic and phenotypic correlations for some economic traits in dairy cattle. Pakistan Vet J 21: 81-86.
19. Dalal DS, Rathi SS, Raheja KL (2002) Estimates of genetic and phenotypic parameters for first lactation and life time performance traits in Hariana cattle. Indian J Anim Sci 72: 398-401.
20. Tiwari M, Kumar D, Singh CV, Singh B, Gupta HP (2010) Estimation of genetic parameters of first lactation and life time traits in Sahiwal and its crossbreds. Indian Vet J 87: 572-574.
21. Reddy KM, Nagarcenkar R (1989) Genetic studies among indigenous milk cattle. Indian Vet J 66: 825-829.
22. Singh N, Dahiya S, Singh B (1999) Phenotypic and genetic parameters of some economic traits in Sahiwal cattle. Indian J Anim Sci 14: 297-300.