RESEARCH ARTICLE

EFFECT OF GENETIC AND ENVIRONMENTAL FACTORS ON GESTATION LENGTH DANGI CATTLE IN FIELD CONDITION

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ABSTRACT

Gestation length (GL), the period from effective fertilization until calving, is a reproductive trait that significantly affects cattle breeding and production. The cow's age is the key environmental factor influencing gestation length. The objective of this study was to study the factors affecting the Gestation length indangi cattle. Dangi cattle is well known for its hardy nature and its ability to work hard under heavy rainfall conditions. The study was carried out during the period from June 2010 to May 2015 in Nashik and Jalgaon regions of Maharashtra. In total, 1093 dangi cattle calving were studied. Overall least square mean of gestation period of Dangi cattle maintained under field conditions was 282.18 ± 1.5days. Analysis of data suggested that Body score condition, sire and year of calving accounted for significant variation (P<0.01) in the gestation length whereas the effect of sex of calf, parity number, season of calving was not significant (P>0.01).Rainy& summer season, body condition of animals are factors contributed to prolonged gestation length. Optimal gestation length was determined in the rang eoffrom 268 to 300 days.

INTRODUCTION

Gestation length (GL), the period from effective fertilization until calving, is a reproductive trait that significantly affects cattle breeding and production. The cow's age is the key environmental factor influencing gestation length. Gestation length is shorter in heifers than in older cows (Przysucha and Grodzki, 2009). High temperatures in the summer speed up calving and shorten gestation length (McClintock *et al.,* 2003). High milk yield prolongs gestation, as suggested by a positive genetic correlation between GL and milk production levels (Silva et al. 1992). Both longer and shorter gestation periods contribute to a higher number of stillbirths (Norman *et al.,* 2009). GL values should be analyzed in conjunction with calving ease (CE), stillbirth rates (SB) and placental expulsion (PE) (Hansen *et al.,* 2004; Przysucha and Grodzki, The objective of this study was to determine the effect of selected factors on gestation length in dairy cattle and the correlations between gestation length and other reproductive traits.

MATERIAL AND METHOD

The present study is based on calving data collected from Maharashtra Nashik district where Dangi cattle population is there. The data consisting of 1031calvingswere studied. The period covered was from June, 2010 to May 2015. To evaluate the effect of various genetic and non-genetic factorson GL, the data were grouped into different classes to be used as fixed effects. The data were classified as shown in Table-1. The GL of heifers was assigned first parity in this study. Only those gestations which terminated in single births of normal calves were considered in the study. Moreover, animals with abortion, stillbirth, or premature birth records were not included in the present study. Data were classified on the basis of body score condition of animal, season of calving, period of calving, lactation order, sex of the calf. Inseminated bull. Body condition score (BCS) were categorized from 1 to 4, where BCS1 being physically poor and BCS4 being over-condition. Animal with BCS1 would have prominent hips, shoulders, backbone with all ribs clearly visible, recessed tai-head area and skeleton body outline. Animal of BCS2 meant almost similar condition except ribs were faintly visible and tail head area slightly recessed. Animals with BCS3, were having good overall appearance with hip bones visible faintly, ribs not generally visible and well covered, tail and head areas not recessed and body outline almost smooth. An over-conditioned cow (BCS4) is smooth and boxy with bone structure hidden from sight or touch. Such animals have fat deposits (pones) around the tail head and on the pin bones. The number was an indicator of comparative body condition score in ascending order.

Statistical analysis: Gestation period was subjected to multiple analysis of variance by using general linear model. The following model was used for the analysis.

$$Y_{ijklmn} = \mu + ZN_i + L_j + BS_k + AS_l + CS_m + e_{ijklmn}$$

Yijklmn= Gestation period of nth Dangi Cattle in i[th] order of lactation, in j[th] body score condition in k[th] season of calving , l[th] inseminated bull and carrying m[th] sex of the calf.

μ =Overall mean
ZN= effect of ith order of lactation,
L= effect of jth body score condition
BS= effect of kth season of calving
AS= effect of lth inseminated bull
CS= effect of mth sex of the calf.
eijklm= residual effect

All data were analyzed The effect of GL was evaluated using dbstat version 1.0

Table 1

Classification of data for genetic and environmental factors

Parity
Heifer, 1, 2, 3, 4, 5

Period of calving (5 classes)
2011, 2012, 2013, 2014, 2015

Season of calving (3 classes)
Winter (November-February), summer (March-June), Rainy (July-October)

Body condition score (4 class)
No ribs, one rib exposed, two rib exposed, three rib exposed,

Inseminated Bull (5 class)
Pandit, Pankaj, Pawan, Popat, Pramod

Sex of calf born (2 classes)
Male, Female

RESULTS AND DISCUSSION

Frequency distribution of the GL is presented inFigure-1 - The curve is skewed toward a length of gestation of over 280 days. The mean GL recorded in Dangi cattle was 282.18±1.5days (Table-2), with a range of 268-300 days. Overall least square mean of gestation length (GL) period of Dangi cattle was 282.18±1.5days. The least-square means with standard errors are in Table-1 and 2. Purbey and Sane (1978) estimated the gestation length was 284.70 ± 0.70 days in Dangi cattle.In present study sire,body score condition, year of calving have significant variation (P<0.01) in the length of gestation while effect of order of lactation, season of calving and calf sex was not having significant effect. It was as equal as reported by Purbey and Sane (1978). Potdar *et al.* (2017) reported gestation period in Holstein Friesian Cross was279.5±0.06, in Jersey Cross 280.03±0.02. Non Descript cattle 279.30±0.05 and in Sahiwal cross was 279.32±0.24 days. Gestation length was ranges from262 to 295 days.

Effect of parity: In the present study, GL of animals was not influenced by parity of animal (Table-1). Animals in 4th parity had the longest GL (282.76± 0.79 days), whereas heifers and cows of 5th parity had the lowest GL. This study was similar to the study of Petrović *et al.* (2010) and Nogalskiand Piwczyński (2012) who reported a longer gestation period in

older cows with a significant difference of 1 day between 1st and 3rd calving. Results of the present study were also consistent with earlier studies on crossbred cattle, who observed that parity of dam significantly affects GL in cattle with heifers having shorter GL than cows. Moreover, older cows carried their calves for longer days than younger cows because of the relatively large uterus. However, Messine e*t al.* (2007) and Menon *et al.* (2014) reported no difference in GL between heifers and cows.

Effect of season of calving: Season of calving was not having significant effect over gestation length of dangi cattle. Cows calved in summer and rainy season had shorter GL than those calved in the winter season (Tables- 1 and 2). Similar findings were reported by Potdar *et al.* (2017) GL in Jersey Cross was shortest in rainy season 279.81±0.41 than in winter 279.84±0.33 and summer season 280.29±0.31. In Non-Descript cattle gestation length was shortest in rainy season 279.22±0.10 than in winter 279.25±0.08 and summer season 279.43 ±0.09. In Sahiwal GL was shortest in winter season 279.09±0.46 than in rainy 279.31±0.46 and summer season 279.50±0.36. Petrović *et al.* (2010), Bakir *et al.* (2009), and Melaku *et al.* (2011) who reported that shorter GL were associated with high summer temperature. In contrast, Silva et al. found no difference in GL between warm and cool seasons in Florida.

Effect of sex of calf: The present study revealed the non-significant effect of sex of calf on GL of the dam. Gestation length in Dangi born male calves was 282.29±0.73 days while in dangi female calves born was 282.07±0.74. Similar non-significant effects of sex of calf on GL were noticed by Melaku *et al.* (2011). However, several published reports were in disagreement with the present study, which showed that sex of calf significantly affects GL, with male calves gestated 1-3 days longer than females.

Effect of Inseminated Bull: Inseminated bull semen had highly significant (p<0.01) effect on length of gestation length of dangi cattle. Sire Pramod was having lowest GL 281.09±0.64 than others like Popat 281.87±1.40, Pawan 282.56±0.84, Pankaj 282.65±0.91, P and it 282.72±0.75 respectively.

Effect of period of calving: The period of calving of animal had no significant influence on GL in this study (Table-2). GL in year 2012 was found to be lowest i.e. 281.46±0.77 days as compare to others as in year 2013 GL was 281.82±0.82 days, In year 2014 it was 281.86±0.83 days, in year 2015 it was 282.31±0.85 days whille GL washighest in year2011 i.e. 283.44±0.74 days.The present results were in agreement with Turkyilmaz (2005), who reported the non-significant difference between GLs of Holstein cows calved in different years. However, there was a total linear change of 3.28 days over 39 years. This finding is quite similar to Silva et al. who noticed a significant increase of 4 days over a period of 50 years in GL of Guernsey, Holstein, and Jersey cows at several Florida-based farms. Bhutkar et al. (2014) also reported a significant effect of period on GL in crossbred cattle. This gradual increase in GL over the years could be attributed to the sharp rise in production level. Potdar *et al.* (2017) showed calving year was significant in Holstein Friesian Cross only there was no significant difference in other breeds. Year of artificial insemination was significant in Holstein Friesian Cross and Non-descript cattle breed.
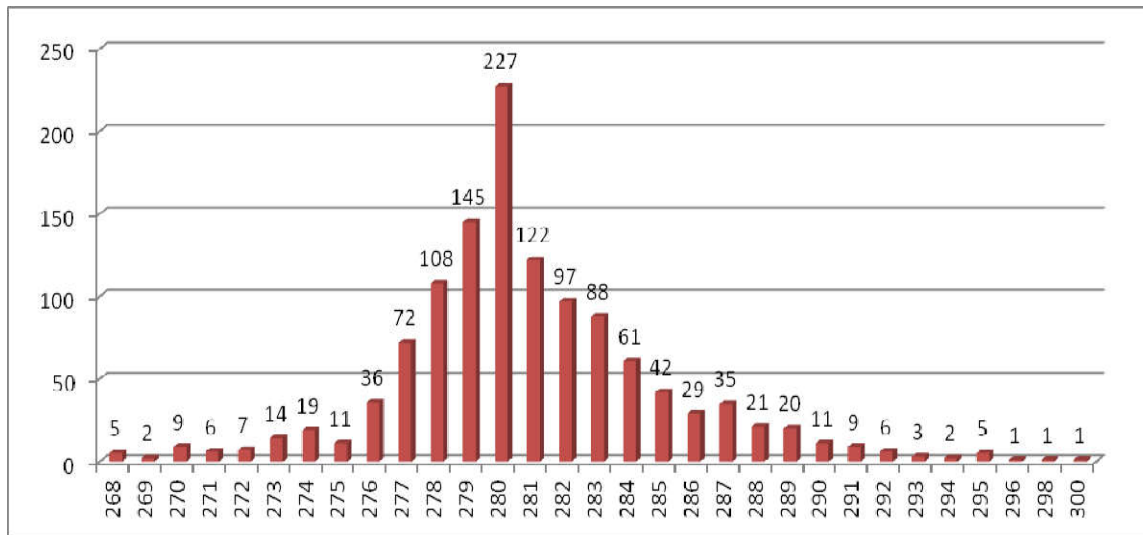
Figure 1. Frequency distribution of gestation length in Dangi cattle

Table 2. Degrees of freedom, mean squares, F values and significance of sources of variation affecting gestation length in Dangi cattle

Source of variation	DF	MS	F value
Order of lactation	5	15.927	1.1285 (NS)
Body score condition	3	423.3578	29.998***
Sex of calf	1	12.0593	0.8545 (NS)
Year of calving	4	60.7648	4.3056 ***
Sire	4	35.073	2.4852 *
Season of calving	2	17.4985	1.2399 (NS)

Table 3. Least squares means (±SE) for GL of Dangi cattle

Sr. No.	Parameters	No. of Observations	Gestation period **(days)**
1	Overall mean	1031	282.18 ± 1.5
2	Order of lactation (NS)		
	0 (Heifer)	233	282.05 ± 0.77
	1	214	282.38 ± 0.76
	2	217	282.24 ± 0.75
	3	149	281.85 ± 0.78
	4	105	282.76 ± 0.79
	5	113	281.79 ± 0.79
3	Body score condition ***		
	No rib exposed	231	279.91±0.76
	one rib exposed	162	282.39±0.76
	Two rib exposed	588	282.83±0.72
	three rib exposed	50	283.59±0.89
4	Season of Calving (NS)		
	Rainy	368	282.22±0.74
	Winter	333	282.13±0.77
	Summer	330	282.19±0.73
5	Sex of calf (NS)		
	Male	563	282.29±0.73
	Female	468	282.07±0.74
6	Year of calving ***		
	2011	132	283.44±0.74
	2012	240	281.46±0.77
	2013	253	281.82±0.82
	2014	182	281.86±0.83
	2015	224	282.31±0.85
7	sire*		
	Pandit	102	282.72±0.75
	Pankaj	48	282.65±0.91
	Pawan	73	282.56±0.84
	Popat	11	281.87±1.40
	Pramod	797	281.09±0.64

(Significance codes: 0 „***‟, 0.001 „**‟, 0.01, NS- Non significant)

Effect of body score condition: body score condition had highly significant (p<0.01) effect on length of gestation length of dangi cattle. animal with No rib exposed were having lowest gestation length 279.91±0.76 followed by animals with one rib exposed 282.39±0.76 then animals with two rib exposed 283.59±0.89 and highest gestation length was in animals with three rib exposed 282.83±0.72

Conclusion

Overall least square mean of gestation period of Dangicattle maintained under field conditions in India was 282.18 ± 1.5days. Analysis of data suggested that Body score condition, sire and year of calving accounted for significant variation (P<0.01) in the gestation length whereas the effect of sex of calf, parity number, season of calving was not significant (P>0.01). Rainy and summer season, body condition of animals are factors contributed to prolonged gestation length. Optimal gestation length was determined in the range of from 268 to 300 days.

REFERENCES

Bakir, G. and Cilek, M. 2009. A research on reproductivetraits of Holstein cattle reared at tahirova state farmin Balikesir province in *Turkey. J. Anim. Vet. Adv.*, 8(11):2383-2387.

Bhutkar, S.S., Thombre, B.M. and Bainwad, D.V. 2014. Studies on effect of non–genetic factors on reproduction traits in Holstein friesian x deoni cows. IOSR. *J. Agric. Vet. Sci.,* 7(12): 15-19

Goyache, F., Fernández, I., Alvarez, I., Royo, L.J. andGutiérrez, J.P. 2002. Gestation length in the Asturianadelos valles beef cattle breed and its relationship with birthweight and calving ease. *Arch. Zootec.*, 51: 431-439.

Hansen, M., M. S. Lund, J. Pedersen and L. G. Christensen. 2004. Gestation length in Danish Holsteins has weak genetic associations with stillbirth, calving difficulty, and calf size. *Livest. Prod. Sci.*, 91:23-33.

McClintock, S., Beard, K., Gilmour, A. and Goddard. M. 2003. Relationships between calving traits in heifers andmature cows in Australia. Interbull. Bull., 31: 102-106.

Melaku, M., Zeleke., M. Getinate, M. and Mengistie, T. 2011. Reproductive performances of fogera cattle at metekelcattle breeding and multiplication ranch, North *West Ethiopia. Online J. Anim. Feed. Res.,* 1(3): 99-106.

Menon, K., Rojan, P.M., Kumar, N.S. and Prasad, V. 2014. Factors affecting birth weight and gestation period of crossbredcattle and relationship between them in intensive farmingsystem. Indian. J. Dairy Sci., 67(2): 158-161.

Messine, O., Schwalbach, L.J.M., Mbah, D.A. andEbangi, A.L. 2007. Non-genetic factors affecting gestationlength and postpartum intervals in gudali zebu cattleof adamawa highlands of Cameroon. Tropicaltura, 25(3):129-133.

Nogalski, Z. and Piwczyński, D. 2012. Association oflength of pregnancy with other reproductive traits in dairycattle. Asian*. Aust. J. Anim.*, 25(1): 22-27.

Petrović, M.D., Bogdanowić, V., Bogosavljević-Bošković, S.and Dokovoć, R. 2010. Effect of systematic factors ongestation length in simmental cows. *Acta. Agric. Serb.*, XV(29): 31-37.

Przysucha, T. and H. Grodzki. 2009. The influence of selected factors on beef breed cows pregnancy length (in Polish). Rocz. Nauk. Pol. Tow. Zoot. 5:65-72.

Silva, H.M., Wilcox, C.J., Thatcher, W.W., Becker, R.B. and Morse, D. 1992. Factors affecting days open, gestationlength, and calving interval in Florida dairy cattle. J. Dairy Sci., 75(1): 288-293.

Turkyilmaz, M.K. 2005. Reproduction characteristics of Holstein cattle reared in a private dairy cattle enterprise in Aydin. Turk. J. Vet. Anim. Sci., 29: 1049-1052.

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