Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.7085

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **6 (6):** 449-454 (2018)

Research Article

International Journal of Pure & Applied Bioscience

OPEN ACCESS

Effect of Genetic and Environmental Factors on Gestation Length of Graded Murrah Buffaloes in Field Condition

K. G. Bhave*, J. R. Khadse, B. R. Mangurkar, Y. S. Gaundare, N. L. Phadke and V. V. Potdar

Central research Station, BAIF Development and Research Foundation, Uruli Kanchan, Pune, Maharashtra

*Corresponding Author E-mail: tejashreeshirsath@baif.org.in

Received: 27.10.2018 | Revised: 26.11.2018 | Accepted: 2.12.2018

ABSTRACT

Gestation length, the period from effective fertilization until calving, is a reproductive trait that significantly affects buffalo's breeding and production. The objective of this study was to determine the effect of genetic and environmental factors affecting gestation length. Data included information from June 2010 to December, 2014 on 5214 graded Murrah buffalo. Heritability was estimated on sire of live born calves. The least square mean of gestation period of Graded Murrah buffaloes maintained under field conditions in India was 308.68 ± 0.16 days. Analysis of data suggested that Agro climatic zones, season of breeding, body score condition of buffaloes and order of lactation accounted for significant variation (P<0.01) in the length of gestation period, of sex of calf was not significant (P>0.01). The low heritability estimate (0·07±0·003) calculated from the sire of live born calf, suggestive of the non-genetic sources contributed a major share to variation. More accurate prediction of calving dates can help dairy producers to meet management requirements of pregnant animals and to administer better health care during high-risk phases of animals' lives.

Key words: *Gestation length, Heritability, Graded Murrah buffalo, Least square mean.*

INTRODUCTION

Water buffalo (*Bubalus bubalis*) is an integral part of farming system and plays very important role in agricultural economy. It contributes milk production of about 12.1% to the world, 38.0% in Asia, 66.6% in Pakistan, 55.0% in India, 16.4% in China, 50.8% in Egypt and 65.2% in Nepal.[7]. The share of meat production of buffalo in the above mentioned countries is reported to be around 1.3, 2.8 and 26.9 percent of the total.[22].

Gestation length (GL), the interval from conception to parturition in farm animal, is of critical importance for nourishment, growth and development of its fetus, so that the calf is born alive and able to cope up with the extra-uterine environment successfully. Any deviation in gestation length may prove detrimental to either or both the dam and the fetus/calf.

Cite this article: Bhave, K.G., Khadse, J.R., Mangurkar, B.R., Gaundare, Y.S., Phadke, N.L. and Potdar, V. V., Effect of Genetic and Environmental Factors on Gestation Length of Graded Murrah Buffaloes in Field Condition, *Int. J. Pure App. Biosci.* **6(6):** 449-454 (2018). doi: http://dx.doi.org/10.18782/2320-7051.7085

Within a range the gestation length however may vary for various reasons. Such as calving age and parity of dam[2,18]. The average gestation period for buffaloes in Sri Lanka and India ranged from 301 to 319 days[10,25]. However, some researchers have reported much wider ranges (287 to 356 days) in gestation lengths of various breeds of buffaloes[4]. Some of the studies of Egyptian and Indian buffaloes indicated that breed, parity and season of calving accounted for significant amounts of variation in gestation period[6,4,19]. However, the effects of some factors such as service-sire, sex of calf, season of breeding and overall health status on gestation period of domestic buffaloes from unorganized farm field conditions appeared to have received little attention. The present study therefore has the objective to examine and evaluate significance of various factors on gestation period of Graded Murrah females bred with Murrah bull (service sire) semen in different field conditions.

MATERIAL AND METHODS

The present study is based on calving data collected from 5 different agro climatic zones of India viz. Scarcity zone of Maharashtra, North West alluvial plain of Bihar, Central plain of Uttar Pradesh, Mid-western plain of Uttar Pradesh and Western plain zone Uttar Pradesh.

The data consisting of 5777 calvings pertained to 5214 buffaloes that were inseminated artificially at BAIF's field AI centers which provide door-step AI service at villages. In the absence of pedigree or breeding history of the animals presented for AI at village conditions, the physical appearance was considered for identification of the breed and Murrah and similar looking buffaloes were collectively considered as Graded Murrah. The period covered was from June, 2010 to December, 2014. Data were classified on the basis of agro climatic zones, body score condition of buffalo, season of breeding, lactation order of buffalo and sex of the calf. Breeding season was classified into 2 categories as "favorable" and "off" seasons based on the distribution of inseminations. Favorable season includes months from July to December, while off-season includes months from January to June. The lactation sequence ranged from 1st to 5th. Calf sex was divided into 2 groups (male and female). 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.

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

Where,

Y_{ijklmn}= Gestation period of n^{th} Murrah buffalo in i^{th} agro climatic zone, in j^{th} order of lactation in k^{th} body score condition of buffalo, conceived in l^{th} season of breeding carrying m^{th} sex of the calf.

μ =Overall mean

ZN= effect of i^{th} agro climatic zone,

L= effect of j^{th}order of lactation

BS= effect of k^{th} body score condition

AS= effect of l^{th} season of breeding

CS= effect of m^{th} sex of the calf.

e_{ijklm}= residual effect

All data were analyzed in R (version 3.2.3.) software.

The heritability of the gestation period was estimated adopting intra-sire half sib correlation method (Swiger *et al*, 1964):

$$\text{Heritability} = 4\,\sigma^2s / \sigma^2s + \sigma^2w$$

$$= 4\,(MSs - MSw) / (MSs + (r - 1)\,MSw$$

RESULT AND DISCUSSION

Overall least square mean of gestation period of Murrah buffalo was 308.68 ± 0.27 days. The present finding was in close agreement with that from other studies of dairy-type buffaloes[12,17,4,1,24]. The least-square means with standard errors are in Table 2. Agro-climatic zones, season of breeding, body score condition of buffaloes and order of lactation accounted for significant variation (P<0.01) in the length of gestation period, while effect of calf sex was not significant (P>0.01) (Table 3).

Effect of agro climatic zones:

The effect of zones was significant (P<0.01) on gestation period. Buffaloes in Western plain zone of UP exhibited highest gestation period while those under Scarcity zone of Maharashtra had lowest gestation length. The difference could be attributed to variation of agro climatic conditions and even likelihood of variation of characteristics of the locally adapted strains of the Murrah grades across different zones.

Effect of order of lactation

Lactation order had significant effect on gestation period of buffalo. The third gestation length was shorter than the rest. The first gestation tended to be marginally but significantly longer than that in subsequent two pregnancies. This result is in contrast to that observed and reported for cattle[2] and in variance to most of the studies elsewhere where the gestation period tended to increase with the parity.

Effect of body score condition of buffalo

Body score condition had significant effect (P<0.01) on gestation period of Murrah buffalo. Animal with body score condition BCS1 (poor) and BCS 2 (Thin), which are considered as below average conditions, had longer gestation period than that of BCS3 and BCS4. There was a clear trend of close association of body condition score and the gestational length. Animals with good body score condition had comparatively short gestation length than others. The observation of such an association is supported by the fact that Body condition scoring (BCS) is a useful management tool for distinguishing differences in nutritional and overall health status of buffaloes. This system uses a numeric score to estimate body energy reserves in the buffalo and research indicated that there is a strong link between the body condition of a cow and her reproductive performance.

Effect of season of breeding

The season of breeding had significant effect (P<0.01) on gestation period as evident from Tables 2 and 3. Gestation period was comparatively longer for the buffaloes AI bred in favorable season. It meant that the buffaloes inseminated during cooler months of the year generally had longer gestation length than those inseminated at other times of the year.

Our results are similar with findings reported by Usman *et al.* 1987; Andersen and Plum, 1965; Singh *et al.* 1973; and Hansen *et al*. 2004. However, Jafar *et al.* 1950; Foote, 1981 and Gianol *et al.* 1972 found no significant difference in gestation period due to season of breeding.

Effect of calf sex

Sex of calf apparently did not affect the gestation period, which was similar irrespective of the sex of calf carried. This finding was in close agreement to number of other researchers [15,20,16] while findings of few others[5,19,26] were in variant to our present study.

Effect of genetic factors

Analysis of variance of gestation period with service-sire as a source of variation (Table 3) indicated significant difference between sires (P<0.01). It meant that the bulls exerted influence on the gestation period of buffaloes through the fetus. The estimate of heritability calculated by intra-sire correlation method was 0·07±0·003 which, although of lower magnitude, was significant. However, there appeared to be little scope for improvement in the trait through selection. The results are in close agreement with those of Basu *et al*. 1981. The variability (coefficient of variation) of characters like gestation length, which are considered to be one of the 'fitness traits', is usually of lower order. With the present data-set, it was not feasible and possible to partition the variance of gestation length into different

components. However, it may be inferred that the factors contributing to variability would be service-sires, the genetic variability of the female stock that was inseminated and non-genetic sources as indicated from analysis of variance (Table -3). The non-genetic sources contributed a major share to variation. It needs to be mentioned here that there is likely to be genetic differences between the base populations of females in different agro-climatic zones. Their genetic contribution to variation might be confounded in the effect of Agro-climatic zones which show significant differences. Heritability of gestation length reported from literature varied from 0.25 – 0.50[2,5]. The difference in various estimates could be attributed to differences in populations under study, sample size, estimation methods used and accuracy of estimates.

Table 1. Least square means of Gestation Length along with standard error

Sr. No.	Parameters	No. of Observations	Gestation period
1	**Overall mean**	5777	308.68 ± 0.27
2	**Agro climatic zones*** **		
	Scarcity zone of MH	2648	308.32 ± 0.08
	North west alluvial plain of Bihar	693	308.36 ± 0.16
	Central plain of UP	1885	308.77 ± 0.10
	Mid-Western plain of UP	318	308.82 ± 0.23
	Western plain zone of UP	233	309.12 ± 0.27
3	**Order of lactation****		
	1	1806	308.89 ± 0.11
	2	821	308.70 ± 0.15
	3	1189	308.33 ± 0.14
	4	1124	308.82 ± 0.14
	5	837	308.66 ± 0.16
4	**Body score condition of buffalo*** **		
	1 (Three ribs exposed)	926	309.06± 0.15
	2 (Two ribs exposed)	2885	309.06± 0.09
	3 (One ribs exposed)	1007	308.71± 0.14
	4 (No ribs exposed)	959	307.89± 0.15
5	**Season of breeding****		
	Favorable season	3524	308.84 ± 0.09
	Off season	2253	308.52 ± 0.11
6	**Sex of calf (NS)**		
	Male	2912	308.64 ± 0.10
	Female	2865	308.72 ± 0.10

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

Table 2. Analysis of variance for Gestation Length of Graded Murrah buffalo

Source of variation	DF	MS	F value
Agro climatic zone	4	165.53	9.65***
Order of lactation	4	59.15	3.45**
Body score condition of buffalo	3	325.13	18.96***
Season of breeding	1	134.99	7.87**
Sex of the calf	1	7.76	0.45 (NS)
Residual effect	5763	17.15	

(Significance codes: 0 '***', 0.001 '**', 0.01 '*', NS- Non significant, DF- Degree of freedom, MS- mean sum of square)

Table 3. One way ANOVA of Gestation Length of Graded Murrah Buffalo with Sire as random variable

Gestation Period				
Source of Variation	**Sum of Squares**	**DF**	**MS**	**F value**
Between Sire	2485.213	42	59.172	3.457***
Within Sire	93836.67	5483	17.114	
Total	96321.88	5525		

(Significance codes: 0 '***', DF - Degree of freedom, MS- mean sum of square)

CONCLUSION

Overall least square mean of gestation period of Graded Murrah buffaloes maintained under field conditions in India was 308.68 ± 0.27 days. Analysis of data suggested that Agro climatic zones, season of breeding, body score condition of buffaloes and order of lactation accounted for significant variation (P<0.01) in the length of gestation period, whereas the effect of sex of calf was not significant (P>0.01).Low heritability estimate calculated from the sire of calf suggestive of major influence of non-genetic parameters on gestation length. This study underlines the importance of body score condition and indirectly the overall health of buffalo that might influence the fitness trait like gestation length.

Acknowledgement

The authors are grateful for the support provided by the senior Vice president, colleagues BAIF Development Research Foundation, field team and the encouragement by President of BAIF for this study is acknowledged.

REFERENCES

1. Ahmad, M., Saji, M. A. and Usmani, R. H., Physiology of parturition in buffalo heifers. I. Gestation length and symptoms of approaching parturition. FAO/SIDA Seminar on Animal Reproduction. Faisalabad, Pakistan. L - 8 (1978).
2. Andersen, H. and Plum, M., Gestation length and birth weight in cattle and buffaloes: a review. *Journal of Dairy Science*, **48:** 1224-1235 (1965).
3. Basu, S. B., Sarma, P. A. and Nagarcenkar, R., Gestation period and birth weight in murrah buffaloes. Krishikosh Short Communcation. 297-299 (1981).
4. Bhalla, R. C., Soni, B. K. and Sengar, D. P. S., Physiological factors associated with gestation length in Murrah buffaloes and in Sahiwal cows. *Indian Veterinary Journal*, **45:** 655-659 (1968).
5. Das, A., Das, D., Goswami, R. N., Das, G. C. and Bhuyan, D., Performance of swamp buffaloes of Assam in respect of some economically important traits of reproduction under farm condition. *Buffalo Bulletin*. **24:** 2 (2005).
6. EI-Sheikh, A. S. and Mohamed, A. A., The reproductive performance of Egyptian buffaloes. *Journal of Animal Reproduction*. **5:** 99-117 (1967).
7. FAO. STAT, Statistical Division, Food and Agriculture Organization, UNO, Rome, Italy (2007).
8. Foote, R. H., Factors affecting gestation in dairy cattle length. *Theriogenology*. **15(6):** 553-559 (1981).
9. Funston, R. N., Larson, D. M. and Vonnahme, K. A., Effects of maternal nutrition on conceptus growth and offspring performance: Implications for beef cattle production. *Journal of Animal Science*. **88:** 205–215 (2010).
10. Ghamem, Y. S., Fadl, A. A., Zaher, A. and Soliman, F. A. Environmental causes of variation in the length of gestation of buffaloes. *Indian Journal of Veterinary Sciences*, **25:** 301-307 (1955).
11. Gianola, D., Shook, G. E. and Tyler, W. J., Variation in gestational traits of Holsteins. *Journal of Animal Science*, **35:** 1087-1088 (1972).
12. Hadi, M. A., A preliminary study of certain productive and reproductive characters of Marathwada buffaloes of

Maharashtra state. *Indian Veterinary Journal*, **42(9):** 692-699 (1965).

13. Hansen, M., Lund, M. S., Pedersen, J. and Christensen, L. G., Gestation length in Danish Holsteins has weak genetic associations with stillbirth, calving difficulty, and calf size. *Livestock. Production Science*. **91:** 23-33 (2004).
14. Jafar, S. M., Chapman, A. B. and Casida, L. E., Causes of variation in length of gestation in dairy cattle. *Journal of animal Science*. **2:** 593-601 (1950).
15. Jalatge, E. F. A. and Bhuvanendran, V., Statistical studies on the characters associated with reproduction in Murrah buffaloes in Ceylon. *Tropical animal health production*. **3:** 114-124 (1971).
16. Jainudeen, M. R. and Hafez, E. S. E., Gestation, prenatal physiology and parturition. *Reproduction in farm animals*. Lea and Febiger, Philadelphia. 247-383 (1980).
17. Joshi, S. C., Tomar, S. P. S. and Desai, R. N., Relative importance of maternal and environmental influences on pregnancy in buffaloes on military farm in the north India. *Journal of Dairy Sciences*, **21(1):** 37-42 (1968).
18. King, K. K., Seidel Jr., G. E. and Elsden, R. P., Bovine embryo transfer pregnancies. II. Lengths of gestation. *Journal of animal Science*. **61:** 758–762 (1985).
19. Misra, B. S., Raizada, B. C. and Tewari, R. B., Gestation length, birth weight of calves and body weight changes during pregnancy in buffaloes bred during summer. *Indian Journal of Animal Sciences*. **40:** 103-109 (1970).
20. Sarvaiya, N. P., Mehta, V. M., Pathak, M. M. and Janakiraman, K., Gestation period and birth weight as affected by season of calving, parity and sex of calf in Surti buffaloes. *Indian Journal of Animal Sciences*. **26:** 58-60 (1992).
21. Singh, G., Taneja, V. K., Bajpai, L. D. and Bhat, P. N., Studies on Gestation length Murrah buffaloes (*Bubalus bubalis*). *Indian Journal of Animal Reproduction*. **4:** 88-90 (1973).
22. Suhail, S. M., Qureshi, M. S., Khan, S. and Durrani, F. R., Inheritance of economic traits of dairy buffaloes in Pakistan. *Sarhad Journal of Agriculture*. **25(1):** 87-93 (2009).
23. Swiger, L. A., Harvey, W. R., Everson, D. O. and Giregory, K. E., The variance of intra class correlation involving groups with one observation. *Biometrics*. **20:** 818-26 (1964).
24. Usmani, R. H., Lewis, G. S. and Naz, N. A., Factors Affecting Length of Gestation and Birth Weight of Nili-Ravi Buffaloes. *Animal Reproduction Science*. **14:** 195-203 (1987).
25. Wijeratne, M. V. S., Some of the production statistics of the Ceylon buffalo. *Ceylon Veterinary Journal*. **10:** 48-53 (1962).
26. Zaman, G. U., Goswami, R. N., Das, D. and Aziz, A., Studies on some reproductive traits of swamp buffaloes of Assam. Proceedings of National Symposium on "Veterinary Immunology and Biochemistry in the New Millennium. 16 (2000).