

## ORIGINAL ARTICLE

# Evaluation of Least Square Means and Non- Genetic factors on Reproduction traits in Murrah buffaloes

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### ABSTRACT

*The relevant data of 396 Buffaloes to performance traits of various first lactation milk records were collected from history cum pedigree sheets over a period of 24 years (1995-2018) maintained at Buffalo Research Centre, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar. Traits under study are Service Period, Dry Period, Calving interval, Number of services required for first service and number of services required for second service. The overall least-squares mean of first service period (SP), first dry period (DP), first calving interval (CI), Number of AI for first Conception (FNI) and number of AI for second conception (SCI) in Murrah buffalo for present investigation was 165.41 days, 151.04±5.29 days, 473.76±6.83 days, 1.96±0.07 and 2.63±0.14, respectively. The effect of calving period on was non-significant on all the traits under study except SCI. The effect of season of calving was significant on SP, DP and CI in Murrah buffalo. While non-significant effect of season of calving on FNI and SCI was obtained under the present study. Patil et al.(2011) in Murrah buffalo reported similar non-significant effect of calving season on FNI. In Murrah buffalo, the effect of the linear and quadratic regression of age at first calving on SP, DP, CI and SCI was not significant in the present investigation. However, FNI have shown significant effect by age at first calving on it.*

**Key words:** Murrah buffalo, Reproduction Traits and Non-genetic factors and Genetic parameter

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### INTRODUCTION

Murrah is one of the best breeds of buffaloes in the world by its milk-producing capacity with high potential for further genetic improvement. This breed is predominantly found in Haryana and adjoining states of Punjab, UP and Delhi. India with its 107 million heads of buffalo as reported in 18th livestock census has the largest buffalo population in world, owing to its potential, it has short productive period in terms of milk and high unproductive life with longer inter calving period and age at first calving. The situation gets more complicated when environment become harsh and non-supportive for the exploitation of animal fullest potential in term of milk production. Genetic Evaluations of reproduction traits require knowledge of several none genetic factors so that suitable breeding schemes can be developed for the improvement of this species [1-4]. The present study was planned to determine the influence Period of calving, Season of calving and Age at first calving on several performance traits of Murrah buffaloes maintained at an organised farm.

### MATERIAL AND METHODS

The relevant data of 396 Buffaloes to performance traits of various first lactation milk records were collected from history cum pedigree sheets over a period of 24 years (1995-2018) maintained at Buffalo Research Centre, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar. Traits under study are Service Period, Dry Period, Calving interval, Number of services required for first service and number of services required for second service. Data pertaining to animals having abnormal records, abortions, lactation length less than 150, chronic illness, and mastitis etc. was excluded from the present study.

#### **Classification of the data:**

Entire period of twenty-four years was divided into six periods by assuming that there is not much variation in adjacent years, each consisting of four consecutive years. Each year was further delineated into four seasons of calving according to the geo-climatic conditions in the area.

Period 1 (P1): 1995 to 1998, Period 2 (P2): 1999 to 2002, Period 3 (P3): 2003 to 2006, Period 4 (P4): 2007 to 2010, Period 5 (P5): 2011 to 2014 and Period 6 (P6): 2015 to 2018

Summer (S1): April to June, Monsoon (S2): July to September, Autumn (S3): October to November and Winter (S4): December to March

**Statistical analysis:** Considering the non-orthogonality of the data due to unequal subclass frequencies, least squares maximum likelihood computer program of Harvey (1990) using Henderson's Method III were utilized to estimate the effect of various non-genetic factors on performance traits and to estimate genetic and phenotypic parameters. The following mixed mathematical model were used: -

$$Y_{ijkl} = \mu \pm S_i \pm h_j + c_k + b_1(A_{ijkl} - \bar{A}) + b_2(A_{ijkl} - \bar{A})^2 + e_{ijkl}$$

Where

$Y_{ijkl}$  =  $i_{th}$  record of individual pertaining to  $i_{th}$  sire calved in  $j_{th}$  period and  $k_{th}$  season.  $\mu$  = is the overall population mean.  $S_i$  = is the random effect of  $i_{th}$  sire.  $h_j$  = is the fixed effect of  $j_{th}$  period of calving.  $c_k$  = is the fixed effect of  $k_{th}$  season of calving.  $b_1$  &  $b_2$  = are linear and quadratic partial regression coefficients of age at first calving on trait(s), respectively.  $A_{ijkl}$  = is the age at first calving.  $\bar{A}$  = is the mean for age at first calving.  $e_{ijkl}$  = is the random error associated with each and every observation and assumed to be normally and independently distributed with mean zero and variance  $\sigma^2_e$ .

## RESULTS AND DISCUSSIONS

### Least square means

The overall least-squares mean of first service period (SP), first dry period (DP), first calving interval (CI), Number of AI for first Conception (FNI) and number of AI for second conception (SCI) in Murrah buffalo for present investigation was 165.41 days, 151.04±5.29 days, 473.76±6.83 days, 1.96±0.07 and 2.63±0.14, respectively. Similar results for the least-squares means of SP Murrah buffaloes were also reported by Singh and Barwal [9]. However, higher estimates for first serve period in Murrah buffaloes were reported by Gupta *et al.* [2] and Thiruvankadan *et al.* [10]. Whereas, lower values of SP were reported by Dev *et al.* [1] and Jamuna *et al.* [5] in Murrah buffaloes. However, higher estimates for DP in Murrah buffaloes were reported in the literature by many workers like Singh and Barwal [9], Thiruvankadan *et al.* [10] and Jakhar *et al.* (2016). The averages of CI for present investigation for Murrah buffalo were in agreement with the findings of Singh and Barwal (2012) and Dev *et al.* [1]. However, higher estimates were reported by Gupta *et al.* [2] and Thiruvankadan *et al.* [10] in Murrah buffaloes. Similar findings to number of services per conception was also obtained by Patil *et al.* (2011) in Murrah buffalo. Results obtained in present investigation were remarkably more than the number of services required for conception obtained by Thiruvankadan *et al.* [10] in Murrah buffaloes.

**Table 1. Least Squares Means with standard errors for various reproduction performance traits (buffalo)**

Effects	Obs	Least Sq. Means with std. error				
		SP (days)	DP (days)	CI (days)	FNI	SCI
<b>Overall means</b>	396	165.41 ±6.62	151.04 ±5.29	473.76 ±6.83	1.96 ±0.07	2.63 ±0.14
<b>Period of calving</b>						
1995-1998	33	143.88 ±23.98	141.09 ±16.95	453.69 ±24.30	1.84 ±0.28	2.87a ±0.46
1999-2002	51	179.52 ±15.75	139.60 ±11.30	488.82 ±15.99	1.76 ±0.18	3.69a ±0.31
2003-2006	79	150.48 ±14.85	140.99 ±10.69	457.68 ±15.08	1.90 ±0.17	1.45b ±0.29
2007-2010	83	158.11 ±14.27	146.97 ±10.30	463.45 ±14.50	2.04 ±0.17	1.76b ±0.28
2011-2014	82	177.64 ±15.76	176.11 ±11.31	484.27 ±15.50	1.98 ±0.18	3.03a ±0.31
2015-2018	68	182.86 ±23.92	161.51 ±16.91	494.62 ±24.24	2.21 ±0.28	2.99a ±0.46
<b>Season of calving</b>						
Summer (Apr-June)	109	181.47a ±9.66	155.70a ±7.22	489.11a ±9.87	2.11 ±0.11	2.90 ±0.29
Monsoon (July-Sept)	134	139.12b ±8.94	132.20b ±6.75	448.05b ±9.14	1.97 ±0.10	2.42 ±0.28
Autumn (Oct-Nov)	67	153.63b ±11.44	147.80b ±8.40	462.33b ±11.65	1.86 ±0.13	2.63 ±0.23
Winter (Dec-March)	86	187.44a ±10.61	168.50a ±7.85	495.54a ±10.82	1.89 ±0.12	2.58 ±0.21
<b>AFC(linear)</b>		0.03 ±0.027	0.0041 ±0.019	-0.029 ±0.028	0.0043 ±0.00032	-0.00081 ±0.00052
<b>AFC(Quad)</b>		-0.0000064 ±0.000070	-0.000035 ±0.000049	-0.0000056 ±0.000071	0.0000042 ±0.0000083	0.00000064 ±0.0000013

Mean with different superscripts differ significantly among themselves

DMRT as modified by Kramer (1957) is used to find significant difference among various performance traits

**Table 2 Analysis of variance for various production performance traits (Buffalo)**

Source of variance	D.F.	Mean Squares				
		SP	DP	CI	FNI	SCI
Sire	81	8314.16	5025.61	8768.60	1.01	3.49
Period	5	5881.05	3884.69	6587.47	0.31	22.06**
Season	3	42772.21**	18614.67**	40770.50**	0.81	3.57
Regressions						
AFC (Linear)	1	6305.24	123.10	6108.14	135.13**	4.92
AFC (Quad)	1	46.86	1410.04	35.05	19.93**	0.46
Remainder	304	5511.69	2692.09	5642.18	0.78	2.01

\*p&lt;0.01

**Effect of period of calving**

The effect of calving period on was non-significant on all the traits under study except SCI. Likewise, Gupta *et al.*[2] and Dev *et al.* [1] also reported non-significant effect of period of calving on SP in Murrah buffaloes. Whereas, Thiruvankadan *et al.* (2014), Jakhar *et al.* (2017) and Jamuna *et al.* (2015) reported significant effect of period of calving on SP in Murrah buffaloes. The period wise least-squares means for SP indicated that it was the maximum (182.86 days) for sixth-period calvers (2015-2018) and the minimum (143.88 days) for Murrah buffaloes calved during the first period (1995-1998). An increasing trend in service period was obtained for buffaloes calved from first to sixth period except that in second period indicating that comparatively more effort is needed to improve this vital trait. Similar non-significant effect in Murrah buffaloes was reported by Jakhar *et al.* [3], respectively. However, Thiruvankadan *et al.* [10] found significant effect of calving period on DP in Murrah buffaloes. The period wise least-squares mean for DP indicated that it was the maximum (176.11 days) for Murrah buffalo calved during fifth-period (2011-2014) and the minimum (139.60 days) for buffalo calved during second-period (1999-2002). Moreover, neither significant difference nor definite trend was obtained for means of DP in Murrah buffaloes over different periods. Similar non-significant effect of period of calving-on-calving interval in Murrah buffaloes was reported by Gupta *et al.* [2], Dev *et al.*[1] and Jakhar *et al.* [4]. Contrarily, significant effect of period of calving-on-calving interval was reported by Thiruvankadan *et al.* [10] in Murrah buffaloes. The period wise least-squares mean for CI indicated that it was maximum (494.62 days) for buffaloes calved during sixth-period (2015-2018) and the minimum (453.69 days) for buffaloes calved during first-period (1995-1998). No definite trend was obtained for means of CI over different periods in Murrah buffaloes. Similarly, non-significant effect of period of calving on number of AI per conception in Murrah buffaloes was reported by Patil *et al.* [6]. While, Thiruvankadan *et al.* [10] reported significant effect of period of calving on number of services per conception in Murrah buffalo. The period wise least squares mean for FNI indicated that it was maximum (2.21) for buffaloes calved during sixth period (2015-2018) and minimum (1.76) for buffaloes calved during second period (1999-2002). However, no definite trend was obtained for means of FNI over different periods. Increase in FNI over periods may be due to reduction in age at first service and possible early service attempting. The period wise least squares mean for SCI indicated that it was the maximum (3.69) for buffaloes calved during second period (1999-2002) and minimum (1.45) for buffaloes calved during third period (2003-2006). However, no definite trend was obtained for means of SCI over different periods in Murrah buffalo.

**Effect of season of calving**

The effect of season of calving was significant on SP, DP and CI in Murrah buffalo. While non-significant effect of season of calving on FNI and SCI was obtained under the present study. Patil *et al.* [6] in Murrah buffalo reported similar non-significant effect of calving season on FNI. Similarly, significant effect of season of calving on SP was reported by Thiruvankadan *et al.*[10], Dev *et al.* [1], Jamuna *et al.* [5] and Jakhar *et al.* [4] in Murrah buffaloes. However, non-significant effect of season of calving on FSP was reported by Gupta *et al.* [2] in Murrah buffaloes. The season-wise means for SP indicated that it was the maximum (187.44 days) during winter season calvers (Dec. to Mar.) and the lowest (139.12 days) in Murrah buffaloes calved during monsoon season (Jul. to Sep.). The better performance of monsoon and autumn season calvers (July to Nov.) might be due to ample availability of palatable lush green fodders to these animals during an advanced stage of pregnancy and early lactation leading to availability of required minerals for early heat and conception. Likewise, significant effect of season of calving on DP was also reported in the literature by other workers in Hardhenu cattle [11] and Murrah buffaloes [10]. The season-wise averages for means of DP indicated that it was the maximum (168.50 days) for Murrah buffalo calved during the winter (Dec.-March) season and the minimum (132.20 days) for monsoon (July-Sept) season calvers. Least-square means of DP in Murrah buffaloes calved during monsoon and autumn

season (July to Nov.) was significantly lower than buffaloes calved during summer and winter season (Dec. to June). The results of the study in Murrah buffaloes were in unison with those reported by Thiruvankadan *et al.* [10], Dev *et al.* [1] and Jakhar *et al.* [3] who also obtained a significant effect of season of calving on CI. Further, However, non-significant effect of season of calving on FCI was reported by Gupta *et al.* [2] in Murrah buffalo. The season-wise averages for FCI indicated that it was the maximum (495.54 days) for buffaloes calved during winter-season (Dec-March) and the lowest for monsoon-season (July-Sept.) calvers. Moreover, the averages for monsoon and autumn calvers differed significantly with summer and winter calvers However, the contrary results (significant effect of calving season on FNI) were reported by Thiruvankadan *et al.* [10] in Murrah buffalo. The season wise averages for FNI indicated that it was the maximum (2.11) for buffaloes calved during summer season and the minimum (1.86) for autumn season calvers. The season wise averages for SCI indicated that it was maximum (2.90) for buffaloes calved during summer season (Apr.-June) and minimum (2.42) for monsoon season calvers.

#### Effect of age at first calving

In Murrah buffalo, the effect of the linear and quadratic regression of age at first calving on SP, DP, CI and SCI was not significant in the present investigation. Dev *et al.* [1] also reported a non-significant effect of age at first calving on SP in Murrah buffaloes. Similar findings of non-significant effect of age at first calving on DP was obtained in Frieswal [8] and Sahiwal [7]. Dev *et al.*[1] also reported a non-significant effect of age at first calving on CI in Murrah buffaloes. The results revealed that the effect of the linear regression of age at first calving was significant on FNI. Similarly, reports of significant effect of age at first calving was reported by Patil *et al.* [6] on number of services per conception in Murrah buffaloes. The results revealed that the effect of linear and quadratic regression of age at first calving was not significant on SCI in animals under study.

#### CONCLUSIONS

The overall least-squares mean of first service period (SP), first dry period (DP), first calving interval (CI), Number of AI for first Conception (FNI) and number of AI for second conception (SCI) in Murrah buffalo for present investigation was 165.41 days, 151.04±5.29 days, 473.76±6.83 days, 1.96±0.07 and 2.63±0.14, respectively. The effect of calving period on was non-significant on all the traits under study except SCI. The effect of season of calving was significant on SP, DP and CI in Murrah buffalo. While non-significant effect of season of calving on FNI and SCI was obtained under the present study. Patil *et al.* (2011) in Murrah buffalo reported similar non-significant effect of calving season on FNI. In Murrah buffalo, the effect of the linear and quadratic regression of age at first calving on SP, DP, CI and SCI was not significant in the present investigation. However, FNI have shown significant effect by age at first calving on it.

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