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Pre-partum body condition score as a predictor of post-calving productivity and reproductive efficiency in Murrah buffaloes

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Abstract

For the study, 68 advance pregnant Murrah buffaloes were selected as per the availability from February 2019 to December 2020 and body condition scores were recorded from 35 days before calving and two groups were made based on pre-calving BCS. Peak yield, 90 days milk yield, previous lactation milk yield, previous 305 days milk yield and previous lactation length were higher in ≤ 3.5 BCS buffaloes but means of both groups did not differ significantly. The post-partum interval to estrus, service period, and number of services per conception were slightly lower in buffaloes with BCS <3.5 compared to those with BCS >3.5 ; however, the differences were not statistically significant. The overall conception rate at first service was 62.26%, with similar values observed in both BCS groups. Breeding efficiency, age at first service, age at first successful service, and age at first calving also did not differ significantly between the two groups. Likewise, dry period and calving interval showed non-significant variation between the BCS classes. Overall, the findings indicated that pre-partum BCS had no significant influence on the reproductive performance of Murrah buffaloes, which may be attributed to uniform nutrition, management practices, and the inherent reproductive potential of the animals.

Keywords: Body condition score, Peripartum, Pre-partum, Post-partum, Lactation, reproduction

Introduction

Body condition scoring at different phases of production and reproduction helps to understand the immediate appraisal of animal's condition. Body condition scoring is a very easy technique, economical and produces an estimation of body energy reserves especially during peripartum period that is reasonably practical. Body condition score has high influence on animal health, production and reproduction (Godara *et al.* 2016) ^[14].

Dairy animal health, production and reproduction could be considered as pillars of economic efficiency of the farm. The peripartum period in dairy animals is very critical in terms of their health, efficiency, performance and welfare. Because of the blend of BCS, body weight and milk production, a dairy animal's BCS profiles are considered a mirror for the lactation profile (Roche *et al.* 2006) ^[30]. Therefore, BCS is an indirect tool to analyse the economic status of the dairy business. Cavestany and co-workers (2005) ^[9] observed that milk production was negatively correlated with BCS. Also Patel *et al.* (2018) ^[21] studied the effect of pre-calving BCS on milk production of Murrah buffaloes and reported that milk yield in all the buffaloes with different BCS increased from 45th to 60th day of lactation and highest total milk yield and the maximum BCS loss was seen in buffaloes with more than 4 BCS. Gyorkos *et al.* (2001) ^[15] reported the optimal body condition score before calving in heifers would be 3.5-3.9 to achieve higher milk production during the first lactation. Pramanik and Koul (2002) concluded that BCS at calving was positively correlated to milk yield during early lactation whereas Delfino *et al.* (2018) ^[12] found no difference in milk yield between higher and lower BCS buffaloes. Most of the currently available research reports on the impact of BCS and postpartum BCS are from advanced countries with a temperate climate

and predominantly on Friesian cows. However no enough reports were found regarding pre-partum BCS effect on production and reproduction traits of buffaloes. Hence, a study was carried out with the objective to study the effect of pre-partum BCS on production and reproduction parameters.

Materials and Methods

The present study on Murrah buffaloes was conducted at Cattle and Buffalo Farm (Livestock Production and Management Section), ICAR-Indian Veterinary Research Institute, Izatnagar (Bareilly), Uttar Pradesh, India. For the study 68 advance pregnant Murrah buffaloes as per the availability from February 2019 to December 2020 were considered and body condition scores were recorded from 35 days before calving up to 90 days post-partum at weekly intervals. Body condition score of the buffaloes was recorded using the body condition scoring chart for Murrah buffaloes given by Anitha *et al.* (2011) ^[1] in a 1 to 5 scale using 0.5 increments. Scoring was done at weekly intervals pre-calving (-35, -28, -21, -14, -7), on the day of calving (0d) and post-calving up to 90 days (+7, +14, +21, +28, +35, +42, +49, +56, +63, +70, +77, +84, +91). The obtained data of BCS prior to calving was used to classify buffaloes into groups ($1 \leq 3.5$ BCS and $2 > 3.5$ BCS). All the buffaloes under study were housed under uniform feeding and management conditions. The data pertaining to milk production and reproduction was procured from the milking unit and farm records, respectively. The various reproductive parameters were recorded from the registers obtained from the Buffalo farm of ICAR-IVRI. Data was analyzed, using ANOVA described by Snedecor and Cochran (1994) to study the impact of pre-partum BCS on Production performance.

Results and Discussion

Body Condition Score

The overall mean body condition score (BCS) of buffaloes during the peripartum period ranged from 2.56 ± 0.04 to 3.53 ± 0.04 , with the highest BCS observed one week prior to calving and the lowest on the 56th day postpartum. Buffaloes with >3.5 BCS showed an initial mean of 3.36 ± 0.05 on day -35, reaching a peak of 3.89 ± 0.07 before calving and declining to 2.73 ± 0.08 by the end of the second month of lactation. Significant differences ($P < 0.01$) between <3.5 and >3.5 BCS groups were observed during the pre-partum period and on the day of calving, similar to the findings of Delfino *et al.* (2018) ^[12]. During the postpartum period, significant differences ($P < 0.01/0.05$) were observed only during the second month of lactation (days 42-63), likely due to lactation stress and peak milk production demands. In general, BCS declined during the first two months after calving due to mobilization of body reserves to meet energy requirements for milk production, followed by gradual stabilization and improvement, which agrees with earlier reports in buffaloes and cattle (Rao and Anitha, 2013; Banos *et al.*, 2004; Wankhade *et al.*, 2019) ^[23, 3, 29]. Buffaloes with <3.5 pre-partum BCS recovered their initial body condition by 90 days postpartum, whereas those with >3.5 BCS recovered more slowly and did not reach

their initial BCS within the same period, possibly due to lower feed intake and less efficient energy utilization during early lactation.

Effect of pre-partum BCS on production performance

Table 2 illustrates the data on peak yield, days to attain PY, 90 days milk yield, previous lactation milk yield, previous 305 days milk yield and previous lactation length. It was observed that peak yield (PY) and 90 days milk yield (90DMY) were 9.75 ± 0.41 and 673.06 ± 31.98 kg and 9.47 ± 0.34 and 661.32 ± 23.14 kg in ≤ 3.5 BCS buffaloes and >3.5 BCS buffaloes, respectively but no significant difference was seen. The continuous gain in BCS during the dry period in ≤ 3.5 BCS might have yielded slightly higher PY and 90DMY. Changes in BCS and milk yield are physiologically related as opined by Loker *et al.* (2012) ^[16]. The results of the present study were in agreement with Mouffolk *et al.* (2013) who observed higher MY in cattle with low pre calving BCS than in higher BCS cattle. BCS and milk yield are in negative correlation and high yielding cattle have generally low BCS (Mushtaq *et al.* 2012). The results were also similar to the reports of Bayram *et al.* (2012) ^[4] who observed that actual milk yield and 305 day milk yield of thin cows (BCS <3.00) were significantly higher than those of moderate (BCS ≥ 3.00) cows ($P < 0.01$). Further Mishra *et al.* (2016) ^[18] reported that body condition score during dry period should be 3.25-3.50 and BCS >3.5 was detrimental to milk production. Hence as per the present study the higher pre partum BCS in group 2 could have reduced the milk yield due to higher mobilization and loss of body condition during calving. In contrary Patel *et al.* (2018) ^[21] reported higher 90DMY in buffaloes with higher BCS (>4) than in other lower BCS buffaloes. Peak yield during the study was achieved slightly earlier in >3.5 BCS buffaloes than ≤ 3.5 BCS buffaloes without any significant difference and the findings were similar to that of Bayram *et al.* (2012) ^[4] wherein pre-calving BCS did not have any effect on days to attain peak yield. The lactation milk yield, 305 days milk yield and lactation length of previous lactation was found to be slightly higher in ≤ 3.5 BCS buffaloes (Table 2). However these parameters were not influenced by pre-calving BCS. Buffaloes belonging to ≤ 3.5 pre-partum BCS were milked about 5 days more in their previous lactation than the other group and accordingly higher milk yield was recorded in 305 days and previous lactation, though the difference was not statistically significant. This may be due to high milk yield potential animals are inclined to utilize the body fat reserves and yield higher for a longer period. Hence reduce their body condition during the successive dry period. In parallel to this study, Bouska *et al.* (2008) ^[6] observed highest milk yield (7,345 kg) in cows with low BCS (≤ 3.5) during dry period. Further during the experiment period all the buffaloes were group fed with uniform greens and concentrates during the pre-partum period and individual feeding of higher BCS buffaloes was not possible. Under group feeding system certain buffaloes could be dominant over few docile ones and might have resulted in lower feed intake in higher BCS buffaloes affecting their condition and performance.

Effect of pre-partum BCS on reproductive performance

Post partum interval to estrus (PPIE) for ≤ 3.5 BCS and > 3.5 BCS buffaloes were 121.09 ± 11.16 and 133.79 ± 18.32 days, respectively, without any significant difference (table 3). These results were consistent with Buckley *et al.* (2003) and Contreras *et al.* (2004), who inferred that pre-calving BCS was not associated with PPIE. Mouffok *et al.* (2013) expressed effect of BCS on PPIE and reported higher loss of body condition lead to longer PPIE. The results obtained in the present study were higher than that of Anitha *et al.* (2011)^[1] and Patel *et al.* (2018)^[21], who observed lower PPIE (46 - 80 days) in Murrah buffaloes. It was observed that BCS had no effect on the PPIE in the present study. Numerical increase of PPIE (days) in higher BCS class could be attributed to the higher BCS loss at calving, low energy balance, slow regain of lost body condition after calving, insufficient energy resource, inactive ovum or late ovulation due to lower LH hormone (Butler, 2000)^[8].

It was observed during the post partum period that shorter SP was achieved in buffaloes having ≤ 3.5 pre-partum BCS than higher BCS class, but, the results were non-significant. Service periods were 145.1 ± 17.98 and 146.83 ± 21.43 in ≤ 3.5 BCS and > 3.5 BCS buffaloes, respectively. It has been observed that service period of Murrah buffaloes was 169.22 ± 15.96 days (Mishra *et al.*, 2016)^[18]. Higher service period had been recorded in the present study as compared to previous studies (Anitha *et al.*, 2011 and Patel *et al.*, 2018)^[1, 21] indicating that these buffaloes could have been under physiological stress of parturition or decreased feed intake. Balamurugan (2020)^[2] had reported 131.12 ± 6.24 days of service period in Murrah buffaloes. The service period was not affected by pre-partum BCS in the present study and it was similar to the reports of Selk *et al.* (1988) and Curtis *et al.* (1985)^[26, 11].

It was found that ≤ 3.5 BCS buffaloes had lower number of services per conception (1.43 ± 0.13) as compared to > 3.5 BCS buffaloes (1.58 ± 0.26), but, the values did not differ significantly. Similarly, Mouffok *et al.* (2013) observed 1.66 ± 0.10 and 1.81 ± 0.15 number of services per conception in 2.75-3.5 and > 3.5 BCS Montbeliad cows, respectively, but, no significant variation was seen. Bayram *et al.* (2012)^[4] reported significantly ($P < 0.05$) lower services per conception (1.52 ± 0.16) in cows with lesser BCS (< 3.0) at calving than in ≥ 3.0 BCS (1.89 ± 0.11).

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but, no significant variation was seen. Bayram *et al.* (2012)^[4] reported significantly ($P < 0.05$) lower services per conception (1.52 ± 0.16) in cows with lesser BCS (< 3.0) at calving than in ≥ 3.0 BCS (1.89 ± 0.11). The overall conception to first service was found to be 62.26 percent, while, in ≤ 3.5 BCS and > 3.5 BCS buffaloes, it was 61.76 and 63.16 percent, respectively. It was difficult to relate conception rate with BCS. Markusfeld and co-workers (1997) did not observe any relationship between calving BCS and first service conception rate. Similarly, Wathes *et al.* (2007)^[30] stated a negative association between BCS at calving and probability of conception at first service. The breeding efficiency of buffalo herd were 83.46 ± 2.15 and 86.37 ± 3.34 in ≤ 3.5 BCS and > 3.5 BCS buffaloes, respectively. The values were not statistically significant and, hence, effect of BCS on breeding efficiency could not be determined. As the breeding efficiency calculation involves calving interval, the variation observed could be justified.

The Age at First Service (AFS) was found to be 891.19 ± 52.67 and 817.05 ± 25.85 days in > 3.5 BCS and ≤ 3.5 BCS buffaloes, respectively. Though, AFS was slightly lower in ≤ 3.5 BCS class, there was no significant difference between the two classes. The Age at First Successful Service (AFSS) was also reported to be much earlier in ≤ 3.5 BCS class (905.53 ± 27.63 days) than in > 3.5 BCS class (967.81 ± 68.43), while, statistically significant difference was not observed between the two means. Age at first calving mean $\pm$ SE was 1226.72 ± 27.80 days in ≤ 3.5 BCS class which were lower than 1278.09 ± 65.23 days in > 3.5 BCS class without any significant difference between the two. It was observed that non-significantly higher dry period was recorded in ≤ 3.5 BCS class (160.13 ± 14.49 days) as compared to > 3.5 BCS class (158.75 ± 25.76 days). It was observed that non-significantly higher calving interval was recorded in ≤ 3.5 BCS class (454.94 ± 15.71 days) as compared to > 3.5 BCS class (447.88 ± 26.87 days). The calving interval was reported to be 495.83 ± 18.93 days in Murrah buffaloes (Mishra *et al.*, 2016)^[18]. These observations were comparable to the results already published by Sharma (2012) and Boopathi *et al.* (2019) on Murrah buffaloes.

Non-significant variations in the reproductive parameters may be attributed to their innate reproductive capacity and uniform nutrition and management that was followed during the study period under prevailing environmental conditions. Hence, it was evident that pre-partum BCS did not influence the reproductive traits in Murrah buffaloes during the present study.

Table 1: Weekly body condition score at different stages (days) of peripartum period in Murrah buffaloes

Particulars	N	-35d	-28d	-21d	-14d	-7d	0d (at calving)	+7d	+14d	+21d	+28d	+35d	+42d	+49d	+56d	+63d	+70d	+77d	+84d	+91d
Overall mean (μ)	68	2.90±0.06	3.28±0.06	3.38±0.05	3.49±0.05	3.53±0.04	3.32±0.04	3.13±0.04	3.01±0.03	2.90±0.03	2.80±0.03	2.74±0.04	2.68±0.04	2.64±0.03	2.56±0.04	2.58±0.04	2.62±0.04	2.66±0.05	2.69±0.05	2.71±0.05
Prepartum BCS classes		**	**	**	**	**	**	NS	NS	NS	NS	NS	*	*	**	*	NS	NS	NS	NS
1 (≤ 3.5)	46	2.68±0.06	3.01±0.05	3.20±0.05	3.32±0.04	3.36±0.04	3.24±0.04	3.09±0.04	2.98±0.03	2.87±0.04	2.78±0.04	2.68±0.04	2.62±0.04	2.59±0.04	2.48±0.05	2.51±0.05	2.57±0.05	2.62±0.06	2.65±0.06	2.66±0.06
2 (> 3.5)	22	3.36±0.05	3.84±0.07	3.75±0.05	3.86±0.06	3.89±0.07	3.48±0.08	3.23±0.06	3.07±0.07	2.98±0.06	2.84±0.05	2.84±0.08	2.82±0.06	2.75±0.06	2.73±0.08	2.73±0.08	2.73±0.08	2.75±0.09	2.77±0.09	2.80±0.09

** : $P \leq 0.01$; * : $P \leq 0.05$ and NS: Non-significant

N: Number of Observations

Table 2: Production parameters in Murrah buffaloes according to Prepartum BCS Class

Particulars	Peak yield(kg)	Days to attain peak yield	90 Days milk yield(kg)	PLMY(kg)	P305MY(kg)	PLL(days)
Overall mean	9.66±0.29 (68)	38.17±2.71 (68)	669.26±31.98 (68)	2133.04±83.95 (47)	2028±79.99 (16)	292.87±11.56 (47)
Pre-partum BCS classes	NS	NS	NS	NS	NS	NS
1 (BCS ≤ 3.5)	9.75±0.41 (46)	39.91±3.47 (46)	673.06±31.98 (46)	2215.91±94.28 (31)	2120±103.58 (10)	294.81±12.81 (31)
2 (BCS > 3.5)	9.47±0.34 (22)	34.54±4.18 (22)	661.32±23.14 (22)	1972.481±162.62 (16)	1875±107.4 (6)	289.12±23.83 (16)

PLMY: Previous lactation milk yield; P305MY: Previous 305 milk yield; PLL: Previous lactation length

NS: Non-significant; Figures given in the parenthesis indicates number of animals

Table 3: BCS wise reproductive performance in Murrah buffaloes

Particulars	AFS (d)	AFSS (d)	AFC (d)	DP (d)	DTO/PPIE (d)	SP (d)	S/C (number)	CI (d)	BE (%)	CR%
Overall mean (μ)	841.38±24.65 (64)	925.97±29.04 (64)	1243.34±28.13 (68)	159.66±12.81 (47)	125.64±9.65 (53)	145.73±13.64 (33)	1.48±0.12 (33)	452.53±13.66 (47)	84.45±1.81 (47)	62.26
Prepartum BCS class	NS	NS	NS	NS	NS	NS	NS	NS	NS	
1 (≤ 3.5)	817.05±25.85 (43)	905.53±27.63 (43)	1226.72±27.80 (46)	160.13±14.49 (31)	121.09±11.16 (34)	145.1±17.98 (21)	1.43±0.13 (21)	454.94±15.7 (31)	83.46±2.15 (31)	61.76
2 (> 3.5)	891.19±52.67 (21)	967.81±68.43 (21)	1278.09±65.23 (22)	158.75±25.76 (16)	133.79±18.32 (19)	146.83±21.43 (12)	1.58±0.26 (12)	447.88±26.87 (16)	86.37±3.34 (16)	63.16

AFS: Age at first service; AFSS: Age at first successful service; AFC: Age at first calving; DP: Dry Period; DTO/PPIE: Postpartum interval to estrus; SP: Service Period; S/C: Number of services per conception;

CI: Calving Interval; BE: Breeding efficiency; CR%-Conception rate%

NS: Non-significant; Figures within parenthesis are number of animals

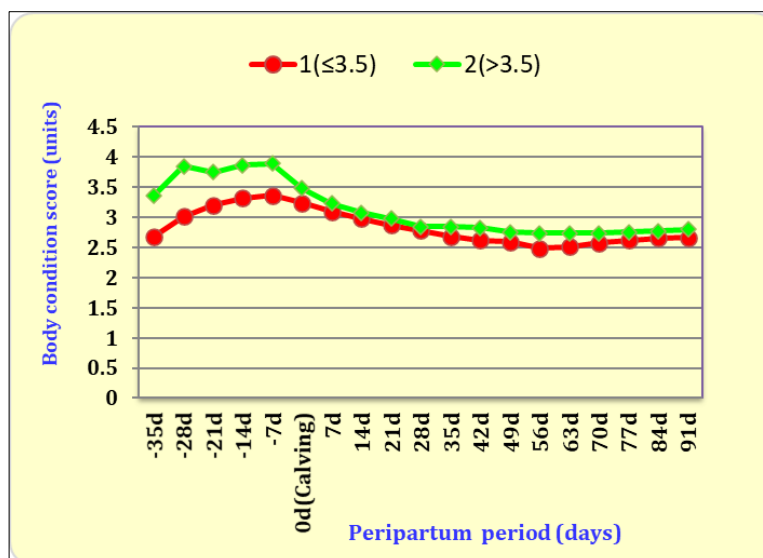


Fig 1: Weekly body condition score at different stages (days) of peripartum period in Murrah buffaloes

Conclusion

However, the findings did not show any significant effect of pre-partum BCS on production and reproductive performance, it would be highly recommended that ideal pre-partum BCS in buffaloes during advanced stages be maintained below 3.5 and avoid NEB and higher body condition loss. Body condition scoring is widely recommended practice in dairy animal management and it could be beneficial to separately manage the buffaloes during the advancement of pregnancy based on pre-calving body condition score. However, further studies should examine whether the difference in BCS loss could be attributed to pre-partum BCS or the insufficient nutrition due to group feeding.

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