The Pharma Innovation Journal 2022; SP-11(7): 794-797

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(7): 794-797

www.thepharmajournal.com
Received: 17-04-2022
Accepted: 21-05-2022

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Production traits evaluation based on pre-partum body condition score in Murrah buffaloes

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Abstract
The objective was to study body condition score (BCS) and its changes during peripartum period in Murrah buffaloes and the effect of pre-partum BCS on production parameters. For the study 68 advance pregnant Murrah buffaloes as per the availability from February to December, 2019 and body condition scores were recorded from 35 days before calving up to 90 days post-partum at weekly intervals. The obtained data of BCS prior to calving was used to classify buffaloes into groups (1.≤ 3.5 BCS and 2.>3.5 BCS). The highest BCS was found during a week prior to calving and then followed a steep reduction in BCS during calving in both the BCS groups. BCS change was significantly different between the two groups during pre-partum than the post-partum stage. The BCS loss was found to be pronounced in buffaloes with >3.5BCS and the total BCS loss at the end of 91 days post partum differed significantly between >3.5 BCS and ≤3.5 BCS buffaloes with mean values 0.56±0.10 and 0.02±0.09, respectively. 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 hence pre-calving BCS did not show any effect on these parameters. Negative non-significant phenotypic correlation has been observed between BCS and 90DMY, PY and days to attain peak yield.

Keywords: Body condition score, peripartum, pre-partum, post-partum

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.* 2017) [7]. 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) [15]. Therefore, BCS is an indirect tool to analyse the economic status of the dairy business. Cavestany and co-workers (2005) [4] observed that milk production was negatively correlated with BCS. Also Patel *et al.* (2018) [13] 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) [8] 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) [14] concluded that BCS at calving was positively correlated to milk yield during early lactation whereas Delfino *et al.* (2018) [5] 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 traits of buffaloes. Hence, a study was carried out with the objective to study the body condition score and BCS changes during peripartum period in Murrah buffaloes and the effect of pre-partum BCS on production 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 2019 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.≤ 3.5 BCS and 2.>3.5 BCS). All the buffaloes under study were housed under uniform feeding and management conditions. BCS change was also estimated by calculating the difference between the two successive BCS recorded. The data pertaining to milk production was procured from the milking unit and farm records. The data generated was analysed using IBM SPSS 22.0 (Statistical Package for Social Sciences, 2013) software. Data was analyzed, using ANOVA described by Snedecor and Cochran (1994) [17] to study the impact of pre-partum BCS on Production performance.

Results and Discussion

Body condition score and BCS change during the peripartum period in Murrah Buffaloes

The BCS means for the buffaloes during peripartum period under the study have been depicted in the Table 1 and change in BCS is represented in Fig 1. BCS showed an increasing trend during the pre-partum period in both the groups except for a minor decrease during 21 days prior to calving in >3.5 BCS buffaloes. The highest BCS was found during a week prior to calving and then followed a steep reduction in BCS during calving in both the BCS groups (Fig 1). The BCS differed significantly ($P \leq 0.01$) prior to calving and on the day of calving. These results were similar to that of Delfino *et al.* (2018) [5] and might be probably due to certain metabolic alterations that take place during this critical period of homeorhesis. Later on it was noticed that BCS was gaining a steady state during the initial stages of lactation upto 7 weeks of lactation and recorded least BCS around 8th week of lactation in both the groups with significant difference ($P \leq 0.01$). The reduced BCS during the initial days of lactation may be attributed towards the loss of body energy and fat catering the peak production demand. However, a slight increase in BCS was observed from 9th week and 11th week of lactation in buffaloes belonging to ≤3.5 BCS and >3.5 BCS, respectively wherein the demand of energy for production might have reduced. The BCS on 91st day post partum almost recovered to its pre partum value (-35day) in 1 group as the BCS loss was less compared to group 2. These findings were in accordance with Patel *et al.* (2018) [13]. The BCS loss was found to be pronounced in buffaloes with >3.5BCS and the total BCS loss at the end of 91 days post partum differed significantly between >3.5 BCS and ≤3.5 BCS buffaloes with mean values 0.56±0.10 and 0.02±0.09, respectively. This could be because of the negative energy balance (NEB) that caused body condition loss and was considered physiologically normal which might have negatively affected production and health (Bayaram *et al*. 2012). The buffaloes with higher pre calving BCS mobilized higher body fat reserves and loss was significant that was in agreement with Patel *et al*. (2018) [13], Gheise *et al*. (2017) [6] and Roche *et al*. (2009) [16].

Table 1: Weekly Body Condition Score at different stages (days) of peripartum period in Murrah buffaloes

Particulars	Body Condition Score																		
	-35d	**-28d**	**-21d**	**-14d**	**-7d**	**0d (at calving)**	**+7d**	**+14d**	**+21d**	**+28d**	**+35d**	**+42d**	**+49d**	**+56d**	**+63d**	**+70d**	**+77d**	**+84d**	**+91d**
Overall mean (N=68)	2.90 ±0.06	3.28 ±0.06	3.38 ±0.05	3.49 ±0.05	3.5 3±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
Pre-partum BCS classes	**	**	**	**	**	**	NS	NS	NS	NS	NS	*	*	**	*	NS	NS	NS	NS
1(≤3.5) (N=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) (N=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

Figures given in the parenthesis indicates number of animals

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) [9]. 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) [12]. The results were also similar to the reports of Bayram *et al.* (2012) [2] 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) [10] 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) [13] 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 ≤3.5BCS buffaloes without any significant difference and the findings were similar to that of Bayram *et al*. (2012) [2] 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) [3] 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.

Negative non-significant phenotypic correlation has been observed between BCS and 90DMY, PY and days to attain peak yield. It could be inferred that the peak daily milk yield, 90 days milk yield decreased and peak yield was achieved in a shorter duration as BCS increased at different stages of peripartum period in buffaloes. Similar studies were published by Bouska *et al*. (2008) [3] and Bayaram *et al*. (2012).

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: Phenotypic correlation coefficients between body condition score at different stages of peripartum period and 90 Days milk yield, Peak yield and Days to attain peak yield.

Parameters	90 Days milk yield	Peak yield	Days to attain peak yield	BCS at different stages(days) of peripartum period						
				-35d	-7d	0d	+7d	+35d	+60d	+90d
90 Days milk yield	-									
Peak yield	0.946**	-								
Days to attain peak yield	0.139	0.134	-							
-35days	0.06	0.048	-0.078	-						
-7days	-0.011	-0.026	-0.197	0.454**	-					
0day(at calving)	-0.023	-0.022	-0.122	0.245*	0.627**	-				
+7days	-0.103	-0.076	-0.156	0.148	0.345**	0.593**	-			
+35days	-0.1	-0.095	0.004	0.179	0.197	0.168	0.461**	-		
+60days	-0.007	-0.018	-0.012	0.134	0.123	-0.122	-0.032	0.384**	-	
+90days	0.128	0.104	0.06	-0.045	0.041	-0.129	-0.071	0.239	0.736**	-

Where**: $P \leq 0.01$;*:$P \leq 0.05$

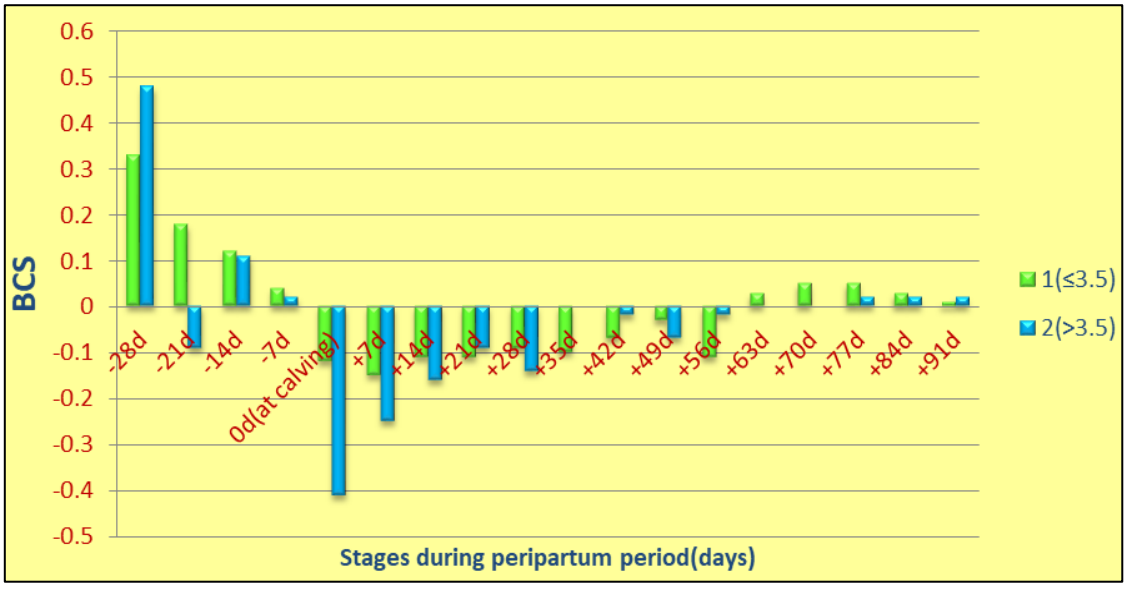

Fig 1: Changes in Body Condition Score (units)

Conclusion

The buffaloes with the BCS >3.5 during their pre-partum period retained higher BCS throughout the study period. Though the findings did not show any significant effect on production performance but could be clearly observed that there has been certain difference with regard to loss in condition which could be indicator of negative energy balance in higher BCS buffaloes. Hence, it would be highly recommended that ideal pre-partum BCS in buffaloes during advanced stages to maintain below 3.5 and avoid NEB and higher body condition loss. Milk production correlates with the body condition score hence; 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.

Acknowledgements

The authors are thankful to ICAR-Indian Veterinary Research Institute, Izatnagar for providing the necessary facilities for conducting the experiment.

Conflict of interest

The authors declare no competing interests

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