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Effect of Body Condition Score (BCSc) at Calving on Subsequent Reproductive Performance in Murrah and Graded Murrah Buffaloes Under Field Conditions

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A B S T R A C T

Body Condition Score (BCS) system is a subjective scoring method of evaluating the energy reserves of dairy animals which provide the better understanding of biological relationship between body fat, milk production and reproduction that helps in adopting the optimum manage mental practices to derive maximum production and maintain better health status. The effect of BCS at calving on the reproductive performance studied in 24 buffaloes in a 4 x 6 CRD showed increase in body weight of 38.50 kg was observed for every one unit increase of BCSc between BCSc groups of 2.5 – 2.99 and 3.5 – 3.99 and 22.33 kg between BCSc groups of 3.0 – 3.49 and 4.0 – 4.49. Buffaloes of BCSc above 3.5 with significantly ($P < 0.01$) higher body weights showed better reproductive performance compared to buffaloes of BCSc groups below 3.5 with less body weights. The prepartum and weekly postpartum changes in BCS studied showed that the buffaloes gained a BCS of 0.38 from 3 months prepartum to one week prepartum, lost 0.72 ± 0.05 BCS due to calving, further showed a decline in BCS upto 8-9 weeks of postpartum and then started regaining BCS gradually until 18 weeks postpartum. The mean LBCS over the period of 18 weeks postpartum was comparatively higher (0.72 ± 0.05) than BCS restored in the early lactation which was shown as GBCS (0.12). The difference of 0.34 units between LBCS and GBCS was observed over a period of 18 weeks postpartum. The monthly postpartum changes in BCS showed that BCS decreased from calving to two months of lactation and then gradually increased.

Introduction

India ranks first in the buffalo population of the world and is showing an increasing trend in the population growth (FAO, 2010). It is the native tract for the best buffalo breeds of the world. In order to derive the maximum potential from native buffaloes and for their better management, there is a need to validate the developed body condition scoring systems

to evaluate their fitness. Earlier studies were conducted only in small herds and mostly organized controlled livestock feeding centres and farms. Hence, the present study is taken up to validate the score system developed by [1] in field conditions using large herds of buffaloes both by taking into consideration the anatomical features and amount of fat reserves at various skeletal checkpoints in relation to the production, reproduction and health status of buffaloes. Keeping this in view, the present research work was carried out with the following objectives.

Materials and Methods

Postpartum estrus was observed by the acceptance of male by female which was the most prominent and reliable symptom of estrus in buffalo[4]. The date of oestrus onset was recorded based on heat signs observed by the researcher and owners of the buffaloes as well as with help of Gopala mitras available in the village households.

The service period was calculated from the date of calving to date of successful service [16].The data was obtained from the AI records available in AI centres as well as from the records of the progressive farmers. The data regarding number of services per conception were obtained from the data records of the AI centres.

The first service conception rate was calculated by the percentage of experimental buffaloes conceived out of the total buffaloes at first insemination[11]. The total number of services for successful conception also were recorded.

BCSC and Loss in BCS (LBCS), Gain in BCS (GBCS)

The buffaloes were scored at weekly intervals from calving (BCSc) to 18 weeks postpartum as LBCS / GBCS to study the postpartum changes in BCSc. BCS was the first BCS assigned within three days after the buffaloes had calved. LBCS was calculated as the difference between BCSc and minimum BCS, whereas the minimum BCS refers to the lowest BCS obtained during the study lactation period of 18 weeks. GBCS was calculated as the difference between minimum BCS and BCS obtained at the end of the study lactation period of 18 weeks[15].

BCSc = First BCS assigned within three days after calving

LBCS = Minimum BCS – BCSc

GBCS = BCS at the end of study lactation period of 18 weeks – minimum BCS

Postpartum resumption of ovarian activity

To study the postpartum resumption of ovarian activity, the serum progesterone (P_4) concentration was estimated as per the procedures of [7]. (1982) from 24 buffaloes used for study (n=24).Blood samples were collected from day 5 postpartum once in every 5 days until 60 days postpartum. Approximately, 6 ml of blood was collected into the sterile test tubes by jugular vein puncture and allowed to clot by placing the test tubes in slanting position. After one hour, the serum was separated and centrifuged at 3000 rpm for 5 minutes to get clear serum. The serum was stored at -20°C until utilized for the estimation of P_4 concentration. The serum P_4 concentration was estimated by using Enzyme Linked Immuno Sorbent Assay (ELISA) technique with the help of P_4 kits (Biotron Diagnostics Inc. Hemet California, USA) and was expressed as ng/ml. The increase in serum progesterone concentration beyond one ng/ml for atleast 5 days was considered as an indication of ovulation and corpus luteum formation. The day of first ovulation was

presumed to be four days before the first rise in progesterone concentration of above one ng/ml. The day of first ovulation was presumed to be the day of postpartum resumption of ovarian activity [5].

The ovaries were palpated through per rectal examination daily from fifth day of calving to 60 days postpartum. On ovulation the follicle was collapsed and the corpus luteum was palpated as a depression which was considered as the day of 1st palpable corpus luteum. The day on which first palpable corpus luteum was noticed, was considered to be the day of ovulation and the resumption of ovarian activity [2].

Physiological data and endocrine parameters

The relationship between the BCS (body fat reserves) and animal comfort, reproductive performance as indicated by the circulating concentrations of Insulin Growth Factor-I as described by [13].

The Circulating Insulin Growth factor-I was assessed from the serum samples collected from 4 BCS ranges of buffaloes at 2nd week and 10 week post partum using Radio Immune Assay technique in the laboratory.

Prepartum BCS

The buffaloes were scored three months before calving and again at one week before calving.

Breeding efficiency

The Breeding Efficiency (BE) of experimental buffalo herd in relation to BCSc was calculated by using the formula[8]:

$$\text{BE of buffalo} = \frac{[n(365) + 1040]100}{AC + C_i}$$

Where, n is the number of calving intervals

AC is the age at first calving

C_i is the calving interval in days

The data regarding the calving intervals and age at first calving were obtained from the data records of the farm.

Results and Discussion

The body weights of the buffaloes of BCSc group 2.5 – 2.99 ranged from 414 kg to 504 kg with mean ± SE value of 454.00 ± 11.14. The body weights of the buffaloes of BCSc group 3.0 – 3.49 ranged from 455 kg to 552 kg with mean ± SE value of 502.16 ± 16.16. The body weights of the buffaloes of BCSc group 3.5 – 3.99 ranged from 460 kg to 584 kg with mean ± SE value of 524.67 ± 12.30 and the body weights of buffaloes of BCSc group 4.0 – 4.99 ranged from 501 to 612 kg with a mean ± SE value of 547.00 ± 17.40. The relationship between BCSc to the body weight of the test herd (Table 1) showed that there was a significant ($P < 0.01$) difference in body weight of buffaloes of various BCSc group. Buffaloes of BCSc group 4.0 - 4.49 had higher body weight followed by BCSc groups of 3.5 – 3.99, 3.0 – 3.49 and 2.5 – 2.99.

The BCS values assigned to the buffaloes three months before calving, one week before calving, BCSc, weekly postpartum changes up to 18 weeks. The mean ± SE changes in BCS of the test herd were also shown. BCS assigned 3 months before calving in the test herd ranged from 2.23 to 3.9 with a mean ± SE BCS of 3.25 ± 0.10. BCS assigned 1 week before calving ranged from 2.72 to 4.62 with a mean ± SE BCS of 3.79 ± 0.12. The BCSc values assigned at the time of calving ranged from 2.56 to 4.44 with a mean ± SE value of 3.37 ± 0.12. The mean ± SE value of BCS at first week postpartum was 3.62 ± 0.12 which

showed that mean BCS increased during first week after calving, thereafter decreased to 2.91 ± 0.13 by 8 weeks postpartum and later on increased gradually to 3.30 ± 0.13 by 18 weeks postpartum.

The relationship between BCSc to the LBCS and GBCS of all the buffaloes of the test herd were presented in Table 2. LBCS and GBCS of the test herd ranged from 0.26 to 1.34 and 0.13 to 0.58 with a mean ± SE values of 0.72± 0.05 and 0.38 ± 0.02respectively. Though, the LBCS values were not matching with the concomitant GBCS values observed at 18 weeks postpartum, the buffaloes might have regained their body condition in the subsequent postpartum period of time as per the trends observed in the study. The LBCS and GBCS depicted for individual buffaloes in the test herd showed that there was much variation among the values assigned for buffaloes.

The mean ± SE values of BCS for the BCSc groups of 2.5 – 2.99, 3.0 – 3.49, 3.5 – 3.99 and 4.0 to 4.49 were 2.41 ± 0.02, 3.01 ± 0.03, 3.34 ± 0.03 and 3.84 ± 0.03 respectively. The mean values of BCS 3 months before calving for the buffaloes of BCSc groups of 2.5 – 2.99, 3.0 – 3.49, 3.5 to 3.99 and 4.0 to 4.49 were 2.82, 2.98, 3.24 and 3.87, respectively.

The weekly postpartum changes in BCS for buffaloes of various BCSc groups in the test herd showed that the mean BCS of buffaloes of BCSc group 2.5 to 2.99 decreased upto 9 weeks postpartum and thereafter showed an increased trend. The mean BCS of buffaloes of BCSc group 3.0 – 3.49 and 4.0 to 4.49 decreased upto 10 weeks postpartum and thereafter increased gradually until 18 weeks postpartum. The mean BCS of buffaloes of BCSc group 3.5 – 3.99 decreased until 7 weeks postpartum and thereafter showed an increased trend. Buffaloes of BCSc 3.5 – 3.99 started regaining their body condition. 2 weeks in advance to the buffaloes of BCSc 2.5 – 2.99 and 3 weeks in advance to the buffaloes of BCSc 3.0 – 3.49 and 4.0 – 4.49. The relationship between BCSc and weekly postpartum changes in BCS in the test herd was presented in Table 2. There was a significant ($P < 0.01$) difference in the mean BCS of buffaloes of various BCSc groups. There was a significant ($P < 0.01$) change in the weekly postpartum BCS of the test herd but there was no significant difference in the weekly postpartum changes in BCS within each BCSc group.

There was a significant ($P < 0.01$) difference between buffaloes of various groups of BCSc in minimum BCS but there was no significant difference between BCSc groups in LBCS and GBCS. The relationship between LBCS / GBCS of buffaloes and their BCSc showed that LBCS was more for buffaloes with BCSc of 3.5 to 3.99 (though not statistically significant).

The frequency distribution of BCSc of buffaloes of 1, 2 and 3 lactations in the test herd of 24 buffaloes was presented in Table 3. The mean BCSc of the test herd was 3.50. The mean BCSc for buffaloes of BCSc groups 2.5 – 2.99, 3.0 – 3.49, 3.5 – 3.99 and 4.0 – 4.49 were 2.77 ± 0.06, 3.27 ± 0.06, 3.72 ± 0.06 and 4.25 ± 0.05 respectively. The mean BCSc for parity number 1, 2 and 3 of the test herd were 3.47 ± 0.23, 3.50 ± 0.24 and 3.53 ± 0.20 respectively. The relationship between mean BCS at calving in buffaloes of various BCSc groups and parity was presented in Table 3a. There was a significant ($P < 0.01$) difference in the BCS at calving of buffaloes of various BCSc groups but there was no significant difference in BCS at calving in the buffaloes of various lactations. There was no significant effect of the interaction of BCSc groups and parity on the BCS at calving. The postpartum estrus period for buffaloes of various BCSc groups and parity in the test herd was

presented in Table 4. The mean post-partum estrus period of the test herd was 61.16 days. The mean postpartum estrus period in days for buffaloes of BCSc groups 2.5 – 2.99, 3.0 – 3.49, 3.5 – 3.99 and 4.0 – 4.49 were 77.16 ± 5.33, 65.66 ± 5.46, 46.66 ± 4.26 and 55.16 ± 4.19 respectively. The mean postpartum estrus period values for buffaloes of parity number 1, 2 and 3 were 67.75 ± 6.51, 61.12 ± 3.28 and 54.62 ± 6.68 respectively.

The relationship between BCSc, parity and postpartum estrus in the test herd was presented in Table 4a.There was a significant difference in the postpartum estrus period in buffaloes of different BCSc groups. But there was no significant effect of parity on postpartum estrus and there was no significant difference in the postpartum estrus of buffaloes within BSCc and parity. Table 4b showed that buffaloes of BCSc 3.5 – 3.99 had less postpartum estrus period followed by BCSc groups 4.0 – 4.99, 3.0 – 3.49 and 2.5 – 2.99. BCSc group 3.5 – 3.99 had less postpartum estrus period than BCSc group 4.0 – 4.49 and significantly ($P < 0.01$) less postpartum estrus period than BCSc groups 3.0 – 3.49 and 2.5 – 2.99 BCSc group 4.0 – 4.49 had less period than BCSc group 3.0 – 3.49 and significantly ($P < 0.01$) less postpartum estrus period than BCSc group 2.5 – 2.99.

The serum progesterone (P_4) concentration (ng/ml) and postpartum resumption of ovarian activity in buffaloes of BCSc group 2.5 – 2.99 of the test herd was presented in Table 5. The serum P_4 concentration from 5 to 60 days postpartum estimated once in every 5 days showed that the mean progesterone concentration (ng/ml) increased gradually from day 5 (0.11 ± 0 02) to day 55 (0.92 ± 0.21) postpartum and then decreased from day 60 (0.82 ± 0.19) postpartum. The first rise in P_4 level above 1 ng/ml occurred at 55 days postpartum in 2 buffaloes, at 50 days postpartum in one buffalo, at 45 days postpartum in a buffalo and two buffaloes have not shown rise in P_4 level of above 1 ng/ml during the study period. The first palpable corpus luteum was observed through per rectal examination at mean days of 49.45± 2.12 after calving in four buffaloes. In two buffaloes there was no palpable corpus luteum during the study period of 60 days postpartum. Overall, the resumption of ovarian activity occurred at a mean of 49.45± 2.12 days postpartum in four buffaloes. Two buffaloes have not shown resumption of ovarian activity during the study period.

The serum progesterone concentration and postpartum resumption of ovarian activity in buffaloes of BCSc group 3.0 – 3.49 was presented in Table 6. The mean serum progesterone concentration (ng/ml) increased gradually from day 5 (0.18 ± 0.02) to day 50 (0.90 ± 0.17) postpartum and thereafter decreased from 55 (0.88 ± 0.23) postpartum. The first rise in serum P_4 level of above 1 ng/ml occurred at day 40 postpartum in two buffaloes, day 45 postpartum in one buffalo day 50 postpartum in one buffalo, day 55 postpartum in one buffalo. One buffalo had not shown rise in P_4 level above 1 ng/ml during the study period. The corpus luteum was palpated through per rectal examination in five buffaloes at mean days of 42.00 ± 2.91postpartum. In one buffalo there was no palpable corpus between during the study period. Overall, the resumption of ovarian activity occurred at a mean of 42.00 ± 2.91 days postpartum in five buffaloes. One buffalo has not shown resumption of ovarian activity during the study period.

The mean serum progesterone concentration (ng/ml) increased gradually from day 5 (0.21 ± 0.02) to day 30 (1.1 ± 0.19) postpartum, thereafter decreased upto day 40 (1.0 ± 0.20) postpartum and again increased on day 45 (1.14 ± 0.18) postpartum which later on

decreased gradually upto 60th day (0.91 ± 0.20) postpartum. The first rise in P_4 level of above 1 ng/ml was occurred at 25th day in two buffaloes, 30th day in one buffalo, 35th day in one buffalo, 40th day in one buffalo and 45th day postpartum in one buffalo. Four of the buffaloes have shown second rise in P_4level of above 1 ng/ml during the study period. The first palpable corpus luteum was noticed through per rectal examination at a mean of 32.33± 3.11 days postpartum. Overall, the resumption of ovarian activity occurred at a mean of 32.33± 3.11 days postpartum.

The mean serum progesterone concentration (ng/ml) increased gradually from day 5 (0.12 ± 0.04) to day 55 (1.19 ± 0.24) postpartum, and decreased to 1.16 ng/ml on day 60 postpartum.

The first rise in P_4level above 1 ng/ml occurred at day 30 postpartum in one buffalo, day 35 in one buffalo, day 40 in one buffalo, day 45 in one buffalo and day 55 postpartum in two buffaloes. Two of the buffaloes have shown second rise in P_4 level of above 1 ng/ml during the study period.

The first palpable corpus luteum was noticed at a mean days of 39.50 ± 4.14 postpartum. Overall, the resumption of ovarian activity occurred at a mean days of 39.50 ± 4.14 postpartum.

The first rise in mean serum progesterone concentration of above 1 ng/ml occurred earlier in buffaloes of BCSc 3.5 – 3.99 at 25 days postpartum, followed by BCSc group 3.0 – 3.49 at 50 days postpartum, BCSc group 4.0 – 4.49 at 55 days postpartum whereas the buffaloes of BCSc group 2.5 – 2.99 have not shown the mean serum progesterone concentration of above 1 ng/ml during the study period. The relationship between BCSc and postpartum resumption of ovarian activity in the test herd showed that there was significant ($P < 0.05$) difference among buffaloes of various BCSc groups in the resumption of ovarian activity. Buffaloes of BCSc group 3.5 – 3.99 had earlier resumption of ovarian activity of 32.32 days followed by BCSc group. 4.0 – 4.49 of 39.50 days, 40.20 of 42 days and BCSc group 2.5 – 2.99 of 49.45 days.

The mean of the number of services per conception in test herd was 2.0. The number of services per conception for buffaloes of BCSc groups 2.5 – 2.99, 3.0 – 3.49, 3.5 – 3.99 and 4.0 – 4.49 was 2.66 ± 0.61, 2.0 ± 0.40, 1.5 ± 0.37 and 1.83 ± 0.52 respectively.

The number of services per conception for buffaloes of parities 1, 2 and 3 were 2.12 ± 0.58, 1.75 ± 0.33 and 2.12 ± 0.31 respectively. There was no significant difference in the number of services per conception between buffaloes of various BCSc groups, different parities and within BCSc and parity

The breeding efficiency of buffaloes of various BCSc groups in the test herd was presented in Table 8. The mean breeding efficiency of buffaloes of BCSc groups 2.5 – 2.99, 3.0 – 3.49, 3.5 – 3.99 and 4.0 – 4.99 were 67.70 ± 2.35, 77.29 ± 2.01, 88.32 ± 1.98 and 83.66 ± 1.10 respectively.

The relationship between breeding efficiency and BCSc in the test herd (Table 8a) showed that buffaloes of BCSc group 3.5 – 3.99 had higher breeding efficiency than BCSc group of 4.0 – 4.49 and significantly ($P < 0.01$) higher breeding efficiency than BCSc group 3.0 – 3.49 and 2.5 – 2.99. The BCSc group 4.0 – 4.99 had significantly higher breeding efficiency than BCSc group 3.0 – 3.49 ($P < 0.05$) and BCSc group 2.5 – 2.99 ($P < 0.01$).

The BCSc group 3.0 – 3.49 had significantly ($P < 0.01$) higher breeding efficiency than BCSc group of 2.5 – 2.99.

Table.1 The Relationship between BCSc and Body weight (kg) of buffaloes in the test herd

S. No.	BCSc			
	2.5 – 2.99	**3.0 – 3.49**	**3.5 – 3.99**	**4.0 – 4.99**
1.	421	414	495	**501**
2.	409	422	460	**511**
3.	421	504	536	**533**
4.	432	489	526	**522**
5.	410	442	587	**612**
6.	400	455	544	**603**
Mean	**415.50 ± 12.44^{c}**	**454.00 ± 11.14^{bc}**	**524.67 ± 12.30^{ab}**	**547.00 ± 17.40^{a}**

Table.2 Relationship between BCSc to the LBCS, GBCS and minimum BCS of the test herd

Groups of BCSc	LBCS			GBCS			Minimum BCS		
	Mean	**SE**	**'F' Value**	**Mean**	**SE**	**'F' Value**	**Mean**	**SE**	**'F' Value**
2.5-2.99	0.75	0.09	0.35	0.40	0.04	0.75	1.98	0.11	**21.08****
3.0-3.49	0.65	0.12		0.38	0.05		2.69	0.13	
3.5-3.99	0.78	0.13		0.36	0.03		2.97	0.15	
4.0-4.49	**0.72**	**0.09**		**0.38**	**0.05**		**3.47**	**0.12**	

** Significant (P < 0.01)

Table.3 The frequency distribution of BCS at calving during different lactations of the test herd

BCSc / Parity	2.50 – 2.99	3.00 – 3.49	3.50 – 3.99	4.00 – 4.49	Overall Mean
1	2.87	3.44	3.75	4.19	
	2.56	3.06	3.69	4.25	
Mean	2.71 ± 0.22	3.25 ± 0.26	3.72 ± 0.04	4.22 ± 0.04	**3.47 ± 0.23**
2	2.75	3.25	3.94	4.44	
	2.69	3.19	3.62	4.12	
Mean	2.72 ± 0.04	3.22 ± 0.04	3.78 ± 0.24	4.28 ± 0.22	**3.50 ± 0.24**
3	2.94	3.37	3.56	4.19	
	2.81	3.31	3.75	4.31	
Mean	2.87 ± 0.09	3.34 ± 0.04	3.65 ± 0.13	4.25 ± 0.08	**3.53 ± 0.20**
Overall Mean	**2.77 ± 0.06**	**3.27 ± 0.06**	**3.72 ± 0.06**	**4.25 ± 0.05**	**3.50**

Table.3a Relationship between BCSc and parity in the test herd

Source	Df	SS	'F' Value
Between BCSc groups	3	2.39	**105.66****
Between parity	2	0.01	**0.25**
Within BCSc and lactation	**6**	**0.01**	**0.43**

** Significant (P < 0.01)

Table.4 Postpartum estrus period for buffaloes of various BCSc groups and parity in the test herd

BCSc / Parity	2.50 – 2.99	3.00 – 3.49	3.50 – 3.99	4.00 – 4.49	Overall Mean ± SE
1	90	85	42	52	
	83	68	56	66	
Mean ± SE	86.50 ± 4.95	76.50 ± 12.02	59.00 ± 9.89	50.00 ± 9.89	**67.75 ± 6.51**
2	76	60	60	65	
	68	56	47	57	
Mean ± SE	72.00 ± 5.65	58.00 ± 2.82	53.50 ± 9.19	61.00 ± 5.65	**61.12 ± 3.28**
3	87	52	38	49	
	59	73	37	42	
Mean ± SE	73.00 ± 19.79	62.50 ± 14.84	37.50 ± 0.70	45.50 ± 4.95	**54.62 ± 6.68**
Overall Mean	**77.16 ± 5.33**	**65.66 ± 5.46**	**46.66 ± 4.26**	**55.16 ± 4.19**	**61.16**

Table.4a Relationship between BCSc, parity and postpartum estrus in the test herd

Source	Df	MSS	'F' Value
Between BCSc groups	3	1045.00	**10.81****
Between parity	2	344.542	**3.56**
Within BCSc and parity	**6**	**83.70**	**0.86**

Table.4b Relationship between postpartum estrus and BCSc in the test herd

BCSc	Mean postpartum estrus (days)
2.5 – 2.99	**77.16^{c}**
3.0 – 3.49	**65.66^{bc}**
3.5 – 3.99	**46.66^{a}**
4.0 – 4.49	**55.16^{ab}**

a, b, c : values with different superscripts vary significantly (P < 0.01)** Significant (P<0.01)

Table.5 Relationship between BCSc and postpartum resumption of ovarian activity on recto-vaginal examination

BCSc	Postpartum resumption of ovarian activity (days)	'F' Value
2.5 – 2.99	49.45^{b}	**4.48***
3.0 – 3.49	40.20^{b}	
3.5 – 3.99	32.32^{a}	
4.0 – 4.49	**39.50^{b}**	

a, b : values with different superscripts very significantly (P < 0.05)

Table.6 Comparison of serum progesterone (P_4) concentration (ng/ml) and palpable postpartum resumption of ovarian activity

2.5-2.99 BCScMean ± SE	**0.11 ± 0 02**	**0.13 ± 0.02**	**0.17 ± 0.05**	**0.26 ± 0.05**	**0.32 ± 0.06**	**0.40 ± 0.06**	**0.44 ± 0.08**	**0.51 ± 0.10**	**0.72 ± 0.19**	**0.80 ± 0.22**	**0.92 ± 0.21**	**0.82 ± 0.19**	**49.45± 2.12**	**49.45± 2.12**
3.0-3.49BCScMean ± SE	0.18 ± 0.02	0.19 ± 0.02	0.28 ± 0.05	0.35 ± 0.02	0.48 ± 0.06	0.56 ± 0.10	0.63 ± 0.08	0.82 ± 0.14	0.90 ± 0.17	0.97 ± 0.21	0.88 ± 0.23	0.83 ± 0.12	42.00 ± 2.91	**42.00 ± 2.91**
3.50-3.99 BCScMean ± SE	0.21 ± 0.02	0.27 ± 0.03	0.49 ± 0.06	0.60 ± 0.06	1.01 ± 0.20	1.1 ± 0.18	1.04 ± 0.12	1.0 ± 0.20	1.14 ± 0.18	1.02 ± 0.20	0.96 ± 0.12	0.91 ± 0.20	32.33± 3.11	**32.33± 3.11**
4.0-4.49 BCScMean ± SE	**0.12 ± 0.04**	**0.25 ± 0.03**	**0.43 ± 0.04**	**0.45 ± 0.05**	**0.58 ± 0.05**	**0.72 ± 0.14**	**0.88 ± 0.11**	**0.94 ± 0.09**	**0.98 ± 0.12**	**1.10 ± 0.19**	**1.19 ± 0.24**	**1.17 ± 0.15**	**39.50 ± 4.14**	**39.50 ± 4.14**

Table.7 Relationship between BCSc and postpartum resumption of ovarian activity on recto-vaginal examination

BCSc	Postpartum resumption of ovarian activity (days)	'F' Value
2.5 – 2.99	49.45^{b}	**4.48***
3.0 – 3.49	40.20^{b}	
3.5 – 3.99	32.32^{a}	
4.0 – 4.49	**39.50^{b}**	

a, b : values with different superscripts very significantly (P < 0.05)

Table.8 Breeding efficiency (%) of buffaloes of various BCSc groups in the test herd

S. No.	BCSc			
	2.5 – 2.99	**3.0 – 3.49**	**3.5 – 3.99**	**4.0 – 4.49**
1.	66.22	76.13	89.12	**86.14**
2.	64.20	75.29	92.11	**84.39**
3.	68.46	77.00	92.33	**88.00**
4.	68.00	79.32	83.22	**84.33**
5.	69.89	76.12	87.34	**82.62**
6.	69.42	79..90	85.77	**84.32**
Mean ± SE	**67.70 ± 2.35**	**77.29 ± 2.01**	**88.32 ± 1.98**	**83.66 ± 1.10**

Table.8a Relationship between breeding efficiency and BCSc in the test herd

BCSc	Breeding Efficiency	'F' Value
2.5 – 2.99	67.70 [c]	**18.12****
3.0 – 3.49	77.29 [b]	
3.5 – 3.99	**88.32** [a]	
4.0 – 4.49	**83.66** [a]	

a, b, c : values with different superscripts vary significantly (P < 0.01)

Studies on the effect of BCSc and parity on the postpartum estrus, service period, number of services per conception and 1st service conception rate showed that there was significant difference in the reproductive performance among buffaloes of various BCSc groups whereas no significant difference was observed in the reproductive performance of buffaloes within BCSc and parity. However,[14] reported that the interaction of calving BCS with parity was consistent and suggested that cows in first and second parity may have good reproduction performance from greater BCS at calving. It was observed that parity had no significant effect on reproduction whereas[3] reported that parity was associated with likelihood of pregnancy at first service. [10] identified first parity as a risk factor for conception failure at first AI.

Significant difference was observed in the postpartum estrus period relative to BCSc. Buffaloes of BCSc group 3.5 – 3.99 have shown early postpartum estrus (42.66 ± 3.26 days) which was comparable with BCSc group of 4.0 – 4.49 (56.49 ± 3.19) when compared to BCSc groups of 3.0 – 3.49 (63.66 ± 4.46) and 2.5 – 2.99 (72.16 ± 3.33). For every one unit increase in BCSc, a decrease in postpartum estrus period of 29.5 and 08.5 days was observed for the BCSc ranges of 2.5 – 2.99 to 3.5 – 3.99 and 3.0 – 3.49 to 4.0 – 4.49 respectively with a mean decrease of 19 days for every one unit increase in BCSc. These findings were in tune with the reports of [9]who observed that cows with higher BCS at calving had lower intervals to first detected oestrus. Similarly, [12]observed that beef cows calved with BCS ≥ 5 (10 point scale) returned to oestrus earlier (49 ± 2 days) than those calved with BCS ≤ 4 (61 ± 2 days). The oestrus was 12 days longer for cows calved with BCS ≤ 4 compared with those calved with BCS ≥ 5. [6]also reported that as BCS at calving increased from 1 to 3.5 the number of days to first signs of oestrus has decreased. In

contrast, [15]reported that BCS at calving was not a source of variation in days to first recorded oestrus. The lower values reported in the present study in comparison to [1]might be attributed to the moderate reproductive management practices being adopted by the farmers in field conditions and other infrastructural problems related to the detection of oestrus.

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