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Effect of Body Condition Score on Milk Production, Milk Composition and Reproductive Performance of Lactating Murrah Buffaloes

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A B S T R A C T

A total of 18 Murrah buffaloes of 1st to 3rd parity were selected to study the effect of Body Condition Score (BCS) in milk production, milk composition and reproductive performance of lactating Murrah buffaloes. The Murrah buffaloes were distributed into three different groups with six animals in each group based on their pre-calving BCS (15 days before expected date of calving) namely G1 (2.50 - 3.00), G2 (3.25 - 3.75) and G3 (4.00 and above). BCS, daily milk yield up to 12 weeks of lactation, milk components (fat, protein, lactose, total solids and Solid Not Fat), Post-Partum estrus, service period, first service conception rate and numbers of service per conception were studied. The result of the present study indicated that there was decrease in BCS after calving in all the groups. G3 group animals produced highest total milk than G1 and G2 group animals, however the difference was not significant The G3 group animals attained their peak yield earlier compared to G2 and G1 group of animals and highest predicted lactation milk yeild. The increase in body condition score was accompanied by a significant increase in the content of fat, protein, lactose and total solid in the milk. The animals of G2 group had shorter postpartum estrus period, fewer services per conception, higher first service conception rate and shorter service period than G1 and G3 group. Thus in the present study, it was observed that BCS subsequently related to the production and fertility status of an animal.

Introduction

The body condition score (BCS) system is a subjective scoring method of evaluating the energy reserves of dairy animals which provides a better understanding of biological relationship between body fat, milk production and reproduction that helps in adopting the optimum managemental practices to derive maximum production and maintain better health status. It is based on evaluation of the outer appearance of the animal that interacts

with its body fat reserves and therefore is directly influenced by energy balance. It gives an immediate appraisal of the body state of the animal and is readily incorporated in operational decision making (Gransworthy, 1988). It has been considered an effective tool in monitoring the energy intake of cows and herds (Jeffrey and James, 1989). In order, to asses changes in body reserves as a consequence of negative energy balance BCS recording has been recommended (Berry *et al.*, 2003). The body condition is usually judged through a 5-point scale, with 1 equivalent to an extremely lean cow, while 5 to a cow having excessive fat reserves (Peters and Ball, 1987).

The mobilization of body energy reserves is the major capability of the dairy cow and buffalo. The mobilization of reserves is indispensable for maintaining high milk yield following parturition. The dairy animals are normally in negative energy status at the start of lactation (Nielsen, 1999). The change in BCS in the first few weeks of lactation point towards the level of metabolic load as the shortfall of energy to milk production is considered to be met through mobilizing body reserves (Pryce and Løvendahl, 1999). Since energy intake does not maintain speed with continuously increasing milk yield, energy shortfall in early lactation enhances, creating a competitive conditions among milk yield, fertility and health status of the animal as all these traits are interlinked with energy.

India 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 study the effect of BCS on milk production and its composition, reproduction in the subtropical environment of India with local dairy buffaloes under the existing management practices. Therefore, the present work has been carried out to assess the effect of BCS in milk production, milk composition and reproductive performance of lactating Murrah buffaloes under subtropical conditions of India.

Materials and Methods

Animals and feeding

A total of 18 Murrah buffaloes of 1st to 3rd parity were selected for the study at Livestock Farm, Adhartal, College of Veterinary Science and A.H., Nanaji Deshmukh Veterinary Science University, Jabalpur (Madhya Pradesh, India). The experimental animals were fed according to their body weight and production. Buffaloes were maintained in intensive system. Half of the total required quantity of feed offered daily at morning 5.30 am and rest of amount offered in the afternoon 3.00 pm. The water was kept available to animals round the clock.

Grouping of animals

Eighteen Murrah buffaloes were distributed into three different groups based on their pre-calving BCS (15 days before expected date of calving) namely G1, G2 and G3 with six animals in each group.

Data recorded

Milk yield

Daily milk yield up to 12 weeks of lactation was measured every day both morning and evening. Peak milk yield was obtained from the computed data of the farm. Predicted Lactation yield (305 days) was calculated by using ratio estimates of partial lactation of Murrah buffaloes (Thomas and Sastry, 1991). The lactation yield up to 12 weeks was multiplied by the corresponding ratio estimates of 2.8096 to obtain estimates of lactation yield.

Milk components

The milk components, including fat, protein, lactose, total solids and Solid Not Fat (SNF) was measured from calving to 12 weeks postpartum at weekly intervals. The representative milk samples were collected from the milking bucket after complete milking of the individual animal. The milk samples were analyzed by auto analyzer (Ultrasonic auto milk analyzer, Netco Pvt. Ltd.)

Reproductive parameters

Post-Partum estrus was observed by the acceptance of a male by the female, which is the most prominent and reliable symptoms of estrus in buffalo. The service period was calculated from the date of calving to date of successful service leading to conception. The first service conception rate was calculated by the percentage of experimental buffaloes conceiving out of the total buffaloes at first insemination. Numbers of service per conception were obtained from the record of the farm.

Statistical analysis

The data obtained in the study was statistically analyzed using ANOVA described by Snedcor and Cochran (1994) to study the impact of BCS on performance of Murrah buffaloes.

Mathematical model:

$Y_{ij} = \mu + B_j + e_{ij}$
Yij = Observation under the i^{th} group
μ = Overall mean
B_j = Fixed effect of i^{th} group (i = 1, 2, 3, 4 &5)

e_{ij} = Random error, which is assumed to be normally and independently distributed with zero mean and constant variance $\sigma^2 e$

Means showing significant differences in the ANOVA table were compared using the Duncan Multiple Range Test (Steel and Torrie, 1980).

Results and Discussion

Body Condition Score (BCS)

The fortnightly changes in BCS pattern after calving to 90 days post-partum in Murrah buffaloes are presented in table 1 and figure 1. The result of the present study indicated that there was decrease in BCS after calving in all the groups. In G1 group BCS loss started from 15^{th} day post-partum and continued up to 30^{th} day which was found to be significant ($P<0.05$). After that BCS increased gradually and reached to its pre-partum level at 90^{th} day post-partum. Loss of BCS in G2 and G3 groups, continued upto 90^{th} day post-partum which was found to be significant ($P<0.05$).

The highest loss of BCS was observed in animals of G3 group during study period.

Milk yield

The changes in average fortnightly milk yield (with different BCS groups in Murrah buffaloes are presented in table 2 and figure 2. In G1 group animals, the average fortnight milk yield increased up to 60^{th} day and thereafter declined up to 90^{th} day, which was non-significant. In G2 group animals, the average fortnight milk yield increased up to 60^{th} day, remained same up to 75^{th} day and thereafter declined up to 90^{th} day, which was non-significant. In G3 group animals, the average fortnight milk yield increased up to 45^{th} day, remained same up to 60^{th} day and thereafter declined up to 90^{th} day, which was also found to be non-significant. G3 group animals produced highest total milk than G1 and G2 group animals, however the difference was not significant (Table 3).

Fig.1 Changes in BCS from calving (pre-partum) to 90 days postpartum in different groups of Murrah buffaloes

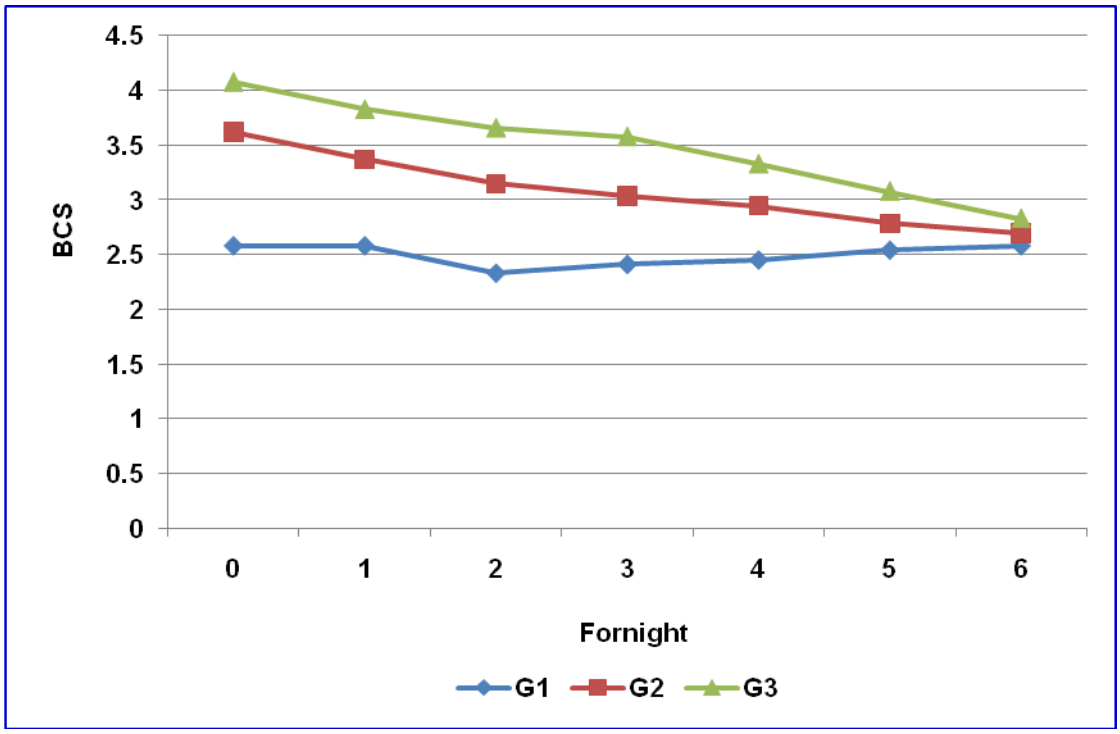
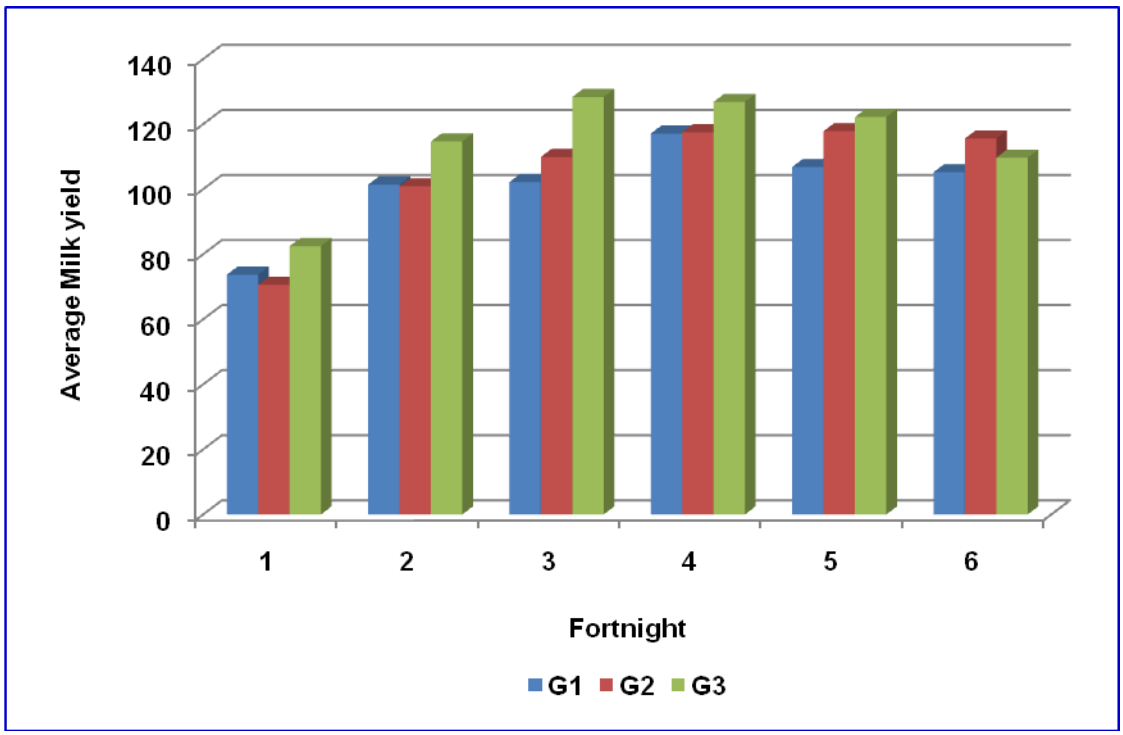


Fig.2 Average fortnightly milk yield (litre) with different BCS groups in Murrah buffaloes



Grouping of animals

Groups	No. of animals	BCS
G1	06	2.50 - 3.00
G2	06	3.25 - 3.75
G3	06	4.00 and above

Table.1 Changes in BCS from calving (pre-partum) to 90 days postpartum in Murrah buffaloes

Fortnight Intervals days	BCS groups		
	G1	G2	G3
At calving	2.58^{ap}±0.08	3.62^{bp} ±0.06	4.08^{bp} ±0.06
15	2.58^{apq} ±0.08	3.37^{bpq} ±0.06	3.83^{bq} ±0.06
30	2.33^{aqr} ±0.08	3.15^{bqr} ±0.10	3.66^{bqr} ±0.12
45	2.41^{aqr} ±0.05	3.04^{brs} ±0.08	3.58^{br} ±0.06
60	2.45^{ast} ±0.08	2.95^{brst} ±0.10	3.33^{bs} ±0.06
75	2.54^{a} ±0.12	2.79^{bst} ±0.11	3.08^{bt} ±0.06
90	2.58^{ap} ±0.11	2.70^{bt} ±0.13	2.83^{cu} ±0.06

^{a,b} Means within a row with different superscripts differ significantly (P<0.01) and
^{p,q,r,s,t,u} Means within a column with different superscripts differ significantly (P<0.05)

Table.2 Average fortnightly milk yield (litres) in different BCS groups in Murrah buffaloes

Fortnight Intervals (days)	Average Milk yield of animals in BCS groups (lit.)		
	G1	G2	G3
15	71.67^{p} ±5.00	76.70^{p} ±3.85	83.80^{p} ±8.15
30	101.42^{q} ±4.64	103.40^{q} ±7.14	110.10^{pq} ±15.67
45	102.25^{q} ±7.84	108.70^{q} ±6.68	124.60^{q} ±6065
60	117.08^{q} ±4.90	114.10^{q} ±10.92	124.14^{q} ±4.35
75	106.75^{q} ±7.09	114.30^{q} ±9.02	118.40^{q} ±5.96
90	105.17^{q} ±5.50	111.00^{q} ±9.05	105.80^{q} ±9.39

^{p,q} Means within a column with different superscripts differ significantly (P<0.05)

Table.3 Effect of BCS on production performance in Murrah buffaloes

	G1	G2	G3
Total milk yeild in litres (90 days)	604.33±16.94	628.20±40.53	667.10±48.71
Predicted lactation milk yeild (305 days) (litres)	1694.36	1793.48	1941.55
Days to attain peak milk yeild (litres)	54.50	42.40	38.36
Milk Fat percentage	$6.56±0.09^{a}$	$6.79±0.95^{b}$	$7.19±0.06^{c}$
Milk Solid Not Fat percentage	8.73±0.06	9.25±0.64	9.95±0.08
Milk protein percentage	3.37^{a}±0.03	3.58^{a}±0.04	3.94^{b}±0.03
Milk lactose percentage	$4.44±0.05^{a}$	$4.73±0.05^{b}$	$5.12±0.04^{c}$
Milk total solids percentage	$15.30±0.11^{a}$	$16.03±0.13^{b}$	$17.12±0.08^{c}$

^{a,b,c} Means within a row with different superscripts differ significantly (P<0.05)

Table.4 Effect of BCS on reproductive traits in Murrah buffaloes

	G1	G2	G3
Post-partum estrus (days)	63.64^{a}±5.63	39.46^{b}±5.46	52.8^{c}±4.25
No. of service per conception	2.8^{a} ±0.59	1.68^{b} ±0.36	1.90^{c} ±0.50
1st service conception rate (%)	28.50	62.65	48.56
Service period (days)	113.5^{a} ±15.42	69.88^{b} ±12.46	82.48^{c} ±5.83

[a,b] Means within a row with different superscripts differ significantly (P<0.01)

The G3 group animals attained their peak yield earlier compared to G2 and G1 group of animals (Table 3).

The result of the study indicated that highest predicted lactation milk yield was obtained in G3 group animals and the lowest predicted lactation milk yield was obtained in G1 group animals. There was no significant difference between the G1, G2 and G3 groups.

Milk composition

The average fat percentage significantly (P<0.05) differed between the three groups throughout the study period. The G3 group animals had the highest fat percentage in the milk followed by G2 and G1 group animals (Table 3).

There was no significant difference in fortnight average Solid Not Fat (SNF) percentage between the three groups throughout the study period. G3 group animals had highest SNF percentage among all the groups (Table 3).

The G3 group of animal had significant (P<0.05) difference in milk protein percentage with G1 and G2 groups animal, but there was no significant difference between G1 and G2 group. G3 group had highest milk protein percentage followed by G2 and G1 groups (Table 3).

The milk lactose percentage significantly (P<0.05) differed between the three groups throughout the study period. The G3 group animals had the highest milk lactose percentage in the milk followed by G2 and G1 group animals (Table 3).

There was significant (P<0.01) difference in Total Solid (TS) percentage in the milk of G1, G2 and G3 groups throughout the study period. The average TS percentage in G3 group animals were highest followed by in G2 and G1 group (Table 3).

Reproductive performance

The animals of G2 group had shorter postpartum estrus period, fewer services per conception, higher first service conception rate and shorter service period than G1 and G3 group (Table 4).

The changes in BCS pattern in the present study were in agreement with that of Banuvalli *et al.*, (2014) who in crossbred dairy cows reported that highest loss of BCS was seen in cows with calving BCS >3.50. The dairy cow with high genetic merit, have a higher predisposition for mobilization of body fat reserves to cover milk production demands (Pryce *et al.*, 2000). Similarly, Horan *et al.*, (2005) reported that BCS changes in high producing animals after calving were higher than in animals with lower genetic merit.

The results of present study were in agreement with Dechow *et al.*, (2002) who reported higher milk yields in cows with high BCS losses. The results were also in

agreement with Berry *et al.,* (2003) who reported that animals selected for higher milk yield mobilized her lipid reserves more than low producers. Thus, compromise on her body condition is more in high producers than lower ones. The results were also in agreement with Samarütel *et al.,* (2006) who reported that, thin cows at the calving could not achieve their genetic milk yield potentials due to lack of body reserves that would support increasing the milk yield at the beginning of lactation. The present findings were also similar to that of Roche *et al.,* (2007a) who reported that lower calving BCS is associated with reduced production. Two presumptions were suggested regarding this positive relation: first is the increase in the mammary cells of the cows with high condition scores during the calving period and the second suggestion is the reduction in the decomposition of foods. Contrary to this study, Anitha *et al.,* (2011) reported that buffaloes of BCS group 3.5-3.99 had higher (P <0.01) milk yields up to 18 weeks of lactation (kg), 305 day predicted lactation yield (kg), and peak milk yield (kg) followed by buffaloes of BCS group 4.0-4.49. The study was also in disagreement with Bayram *et al.,* (2012) who reported that actual milk yield and 305 day milk yield of thin cows were significantly higher than those of the moderate cows (P<0.01).

The study revealed that BCS had significant (P<0.01) effect on the reproductive traits under the study. These findings were in agreement with the reports of Buckley *et al.,* (2003), Sarjan and Anitha (2013). Extended service period and increased number of services per conception were also reported in cows with low BCS at calving due to late postpartum ovulation or excessive inactive ovum (Lopez-Gatius *et al.,* 2003; Roche *et al.,* 2007b). Tapkı *et al.,* (2005) reported significant differences between the service period (78 and 94 days) and number of services per conception (1.27 and 1.53) in the fat (≤ 4) and over fat (> 4) groups during the dry period. Bayram *et al.,* (2012) reported that the service period of the cows with low condition score at calving was significantly longer and their number of services per conception was significantly lower than moderate group. As the nutrients obtained through the ration is insufficient for lactation during the first 60-90-day period of lactation, body reserves are used to attempt to meet the necessary energy requirement. In case of condition loss as a result of negative energy balance, LH hormone level in the animal decreases and the response to LH reduces to a low level. As a result, there is a decrease in the available follicle number and thus in the number of ovule and follicle (Butler, 2000). Since the low BCS derived from the negative energy balance during the early lactation period resulted in low LH release and weak follicle formation, it causes extended postpartum estrus cycle and extended service period (Jilek *et al.,* 2008). Dechow *et al.,* (2002) found a genetic correlation between the condition loss and service period ranging from 0.29 to 0.68. According to this relationship, service period extends with the increase in BCS loss.

Thus in the present study, it was observed that BCS subsequently related to the production and fertility status of an animal. Thus, BCS may be used as a tool to aid in the management of nutritional and production programs in dairy herds. However, additional long term studies are required with more number of animals observing the impact of BCS to test the marginal condition effect.

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