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Study of body condition score and milk yield during different stages of lactation

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Abstract
The present study was conducted at dairy unit number 20 situated at Aarey milk colony, Goregaon, Mumbai and Department of Livestock Production and Management, Bombay Veterinary College, Mumbai. For the present study 45 Murrah buffaloes were and they were divided into three equal groups of 15 each for early (0-90 days), mid (90-180 days) and late (180-270 days) lactation stage. The Body Condition Score was highest at late lactation than mid and early lactation whereas the milk yield was found to be highest during the early lactation as compared to mid and late lactation. From the statistical analysis it is concluded that milk yield and BCS were negatively correlated with each other.

Keywords: BCS, buffaloes, lactation stage, milk yield

Introduction
Body condition score (BCS) is a subjective measure of body energy reserve and is used as an indirect indicator of energy balance status. It is a quick, non-invasive, inexpensive, visual and tactile way of assessing the degree of fattiness of dairy animals and it is recognized by the animal scientists and producers as an important factor in dairy bovine management. Optimal body condition of buffalo is important for obtaining elite herd and quantity milk production because low or excessive body energy reserve may have a greater risk of lower milk yield. Therefore, the ideal body condition score of dairy animals throughout lactation not only optimizes milk yield, but also maximizes economic return

Body condition scores can also influence the feed intake and metabolism leading to variations in economic parameters (Mushtaq *et al*., 2012) [21], indicating the energy intake and utilization in the form of growth and milk production. Therefore, it is routinely practiced in the farm management for evaluation of nutritional status of animals.

To asses changes in body reserves as a consequence of negative energy balance BCS has been recommended as a practical monitoring tool (Berry *et al*., 2002) [3]. In spite of its subjectivity, BCS gives an accurate evaluation of a live animal's energy reserves. It has been confirmed that body reserves are better reflected by body condition score than by live weight change (Grainger *et al*., 1982; Johnson *et al*. 1984; Ducker *et al*., 1985) [13, 14, 11].

Energy shortfall in early lactation enhances, but energy intake does not maintain pace with continuously increasing milk yield, creating a competitive situation among milk yield, fertility and health status of the dairy animal as all these traits are interlinked with energy. High-yielding herds usually get very limited dry period, suggesting that the drop in fertility can be compensated by proper management (Laben *et al*., 1982; Nebel and McGilliard, 1993) [15, 25].

Therefore Correlation between body condition score and milk yield during different stages of lactation is very important to increase profit of dairy farm, the present study was planned.

Materials and Methods
Place of experiment
The present study was carried out at dairy unit number 20 of Shri. Sandip Dubey situated at Aarey milk colony farms, at Goregaon, Mumbai, Goregaon is located at 19.155″N 74°72.85″E in the Mumbai district of Maharashtra has an average elevation of 14 meters (46 ft) above mean sea level.

The Murrah buffaloes having almost uniform size and body condition score were selected for the experiment purpose, They were divided into three groups of fifteen each having third parity which were depicted as follows

1. 15 Murrah buffaloes in early lactation stage (0-90 days)

2. 15 Murrah buffaloes in mid lactation stage (90-180 days)
3. 15 Murrah buffaloes in late lactation stage (180-270 days)

Housing facility
All the three groups of animals were allotted same floor space of 24 sq. ft. per animal. The animals were maintained under conventional barn system. The orientation of housing system was east to west and sheds were well ventilated with asbestos roof. Tail to tail housing arrangement was followed. The manger space was 1.05 metre with front height 0.5 metre and 0.25 metre of depth. The height of roof was 5 metres and side walls of shed were 2 metres high. Floor was made up of concrete and non-slippery with slope of 3 cm per metre for proper drainage.

Feeding and watering management
All the experimental animals were fed adlib dry roughages throughout the day. The concentrate ration mixed soaked in water was offered to the experimental animals twice a day in the morning and evening uniformly to all the animals and animals were also supplemented with the mineral mixtures. The animals were allowed to drink twice daily in the morning and evening hours after milking.

Milking management
Milking was done twice daily at 4 a.m. at morning and at 4 p.m. at evening hours. All animals were milked by full hand milking method followed by stripping to remove all milk from the udder of buffalo. The milking was finished in 5 to 7 minutes in clean and sanitary conditions. Hygienic practices were strictly followed on farm to avoid contamination of milk. All utensils were washed before milking and udder of buffalo was properly disinfected after milking.

Body Condition Score
The BCS was recorded by visual observations of the animals at fortnightly interval by using score card sheet. This BCS score was judged according to Lowman *et al* (1976) [16] for present investigation.

BCS	Condition of animal
1	Emaciated
2	Thin
3	Average
4	Fatty
5	Obese

Eight skeletal checkpoints were examined and merits within each area were used to indicate the body condition.
The eight locations observed were:
1. Tail head to pin bones.
2. Spinous processes of the lumbar vertebrae.
3. Depression between the spinous and transverse processes.
4. Transverse processes of lumbar vertebrae.
5. Point between 12th and 13th ribs.
6. Sacral crest.
7. Depression between sacral crest and hooks.
8. Depression between hooks and pins.

Milk yield (kg)
Milk yield was recorded fortnightly during morning and evening hours by being present at the time of milking of respective animal and the same was recorded in milk register. Milk yield recorded in kg. and least count of weighing balance was 10 gm.

Statistical Analysis
The data regarding the present study was analyzed by Completely Randomized Design and for correlation student T-test and correlation matrix (WASP 2.0).

Results and Discussion
Body Condition Score
The Body condition score is an important indicator for the sound health of animal and indicate fattiness and nutritional status of buffalo. The BCS of an animal reflects the feeding and management and reproduction and genetic capability of animal. The BCS influences the dry matter intake of animal specially before calving. (Broster and Broster 1998) [7].
The BCS of Murrah buffalo at different stages of lactation early, mid and late are presented in table 1, 2 and depicted in fig1-.3 The BCS was highest at late lactation since in this stage the nutritional goals were to replenish completely body fat reserve as the fetus was growing and also the plan of nutrition was increased and more over the animal were dried prior to calving resulting in higher BCS then mid and early lactation period. The animal had BCS in range from 2.93 ± 0.120 to3.48 ± 0.083.
However some researcher concluded animals with the superior genetic potential having moderate BCS, performed very good in early lactation, whereas the animals having higher BCS during late lactation did not perform well. These findings were in close agreement with these reported by Butler *et al*.,(1981) [8], Wildman *et al*.,(1982) [33], Gearhart *et al*., (1990), Pedron *et al*.,(1993) [23], Palmquist *et al*., (1993) [22], Koenan *et al*.,(2001) [24], Berry *et al*.,(2002) [3], Roche *et al*.,(2009), Mouffok *et al*.,(2012), Mushtaq A. *et al*.,(2012) [21], Mishra *et al*.,(2016), Whereas contrast findings to present findings were reported by Rossi *et al*., (1997) [28], Mao *et al*.,(2003) and Banos *et al*.,(2004) [5]. As the lactation advanced in early lactation, BCS declined from 3.23 to 2.70 upto 90 days of lactation. Thereafter BCS continuously improved from 2.70 to 3.70 (table 1) in mid and late lactation. It might be due to reduction of body fat reserve in early lactation reduce BCS while in mid and late lactation BCS improved due to reduction in milk yield and fat yield, lead to accumulation of fat by utilizing surplus energy in better nutrition status. Statistically significant difference for BCS were observed among the early and late and mid and late lactation stage of Murrah buffalo respectively and non significant difference were observed among early and mid stage of lactation in Murrah buffalo.

Milk Yield (kg.)
Average milk yield per day of Murrah buffalo at different stages of lactation was 8.78 ± 0.307 kg, 7.97 ± 0.163 kg, 6.13 ± 0.275 kg at early, mid and late lactation respectively are presented in table 3, 4 and depicted in fig. 4,5,and 6.. The milk yield per day of Murrah buffalo was highest at early lactation with 8.78 ± 0.307 kg and lowest at late lactation with 6.13 ± 0.275 kg per day. The milk yield was found to be highest during the early lactation since the increased lipolysis provides an energy substrate for non-mammary tissues in early lactation thereby sparing glucose for mammary lactose synthesis and increasing milk yield. (Bauman and Currie, 1980). Generally in early lactation as cows partitions energy from body reserve to support milk production and also upto one third of the total solids produced in early lactation is produced from body tissue reserve (Bauman and Currie, 1980). The adipose tissue mechanism changes during early

lactation as nutrients are partitioned to the mammary gland (Smith and MC Namera 1990) [30]. These findings are in close associations with the findings of Cero´n-Mun˜ oz, *et al*.(2002) [10], Qureshi *et al* (2010) [27], Aspilcueta-Borquis *et al* (2010) [2], Mushtaq *et al* (2012) [21], Yadav *et al* (2013), Singh *et al* (2015). There was significant difference amongst treatment groups for the milk yield. The milk peak yield was found at 45 to 60 days of lactation and then starts declining upto end of lactation. Statistically significant difference for milk yield was observed among different stages of lactation of Murrah buffalo. The peak yield was obtained at 45 to 60 days of lactation and then it declined upto end of lactation. These findings are in close agreement with those reported by Butler *et al*., (1981) [8], Catillo *et al*. (2002) [9], Berry *et al*.,(2007) [4], Shelke *et al*.(2012) [29].

Correlation

The correlation of milk yield and BCS of Murrah buffaloes during different stages of lactation are presented in table 5. and depicted in fig.7.

From the result it was evident that there exist a negative correlation between milk yield and BCS. Milk yield and BCS were negatively correlated with each other. Significant difference was found between BCS and milk yield throughout lactation.

Significant difference was found between BCS and milk yield throughout lactation (-0.869). Similar findings were reported by Butler *et al.,* (1981) [8], Rossi *et al*.,(1997) [28], Berry *et al*.,(2002) [3], Pryce *et al*., (2002) [26], Berry *et al*.,(2007) [4], Mushtaq *et al*.,(2010) [20], Qureshi *et al*.,(2010) [27], Anitha *et al*.,(2011) [1] and Mushtaq., *et al*.,(2012) [21]

Table 1: Body condition score of Murrah buffalo during different stages of lactation.

		BCS	
Days of experiment	**Early Lactation (0-90 days)**	**Mid Lactation (90-180 days)**	**Late Lactation (180-270 days)**
15	3.23	2.77	3.27
30	3.20	2.80	3.30
45	3.17	2.83	3.33
60	2.63	2.87	3.63
75	2.67	3.20	3.67
90	2.70	3.23	3.70
AVG ± SE	2.93^{b} ± 0.120	2.95^{b} ± 0.086	3.48^{a} ± 0.083

Table 2: ANOVA for BCS of Murrah buffalo during different stages of lactation

ANOVA Table					
Source of variation	**DF**	**SS**	**MS**	**F cal**	**F prob**
Groups	2	1.174	0.587	10.321	0.002
Groups	15	0.853	0.057	-	-
Total	17	-	-	-	-

Treatments found Significant at 1% and 5% level of significance
CD(0.01) = 0.406 CD(0.05) = 0.293

Table 3: Milk yield of Murrah buffalo during different stages of lactation

		Milk yield (kg.)	
Days of experiment	**Early Lactation (0-90 days)**	**Mid Lactation (90-180 days)**	**Late Lactation (180-270 days)**
15	7.73	8.51	7.00
30	8.02	8.31	6.70
45	9.54	8.01	6.30
60	9.52	7.91	6.00
75	9.24	7.71	5.60
90	8.74	7.41	5.20
AVG ± SE	8.78^{a} ± 0.307	7.97^{b} ± 0.163	6.13^{c} ± 0.275

Table 4: ANOVA for milk yield of Murrah buffalo during different stages of lactation

Anova Table					
Source of variation	**DF**	**SS**	**MS**	**F cal**	**F prob**
Groups	2	22.35	11.175	27.556	0
Groups	15	6.083	0.406	-	-
Total	17	-	-	-	-

Treatments found Significant at 1% and 5% level of significance
CD(0.01) = 1.084 CD(0.05) = 0.784

Table 5: correlation of milk yield and body condition score of Murrah buffalo during different stages of lactation

Days of lactation	milk yield (kg)	BCS
15	7.73	3.23
30	8.02	3.20
45	9.54	3.17
60	9.52	2.63
75	9.24	2.67
90	8.74	2.70

105	8.51	2.77
120	8.31	2.80
135	8.01	2.83
150	7.91	2.87
165	7.71	3.20
180	7.41	3.23
195	7.00	3.27
210	6.70	3.30
225	6.30	3.33
140	6.00	3.63
255	5.60	3.67
270	5.20	3.70

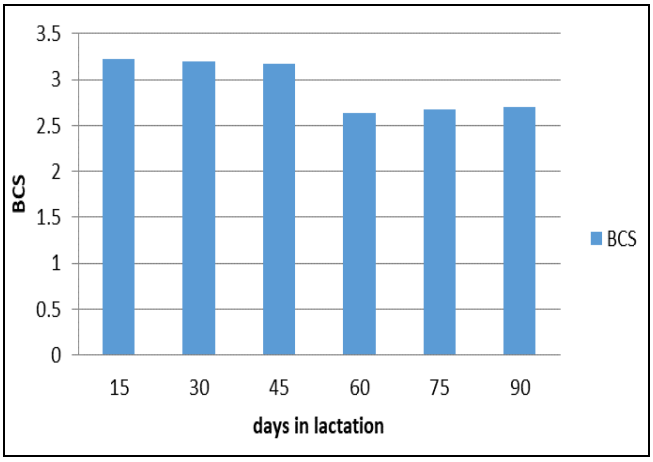

Fig 1: BCS of Murrah buffalo during early stage of lactation

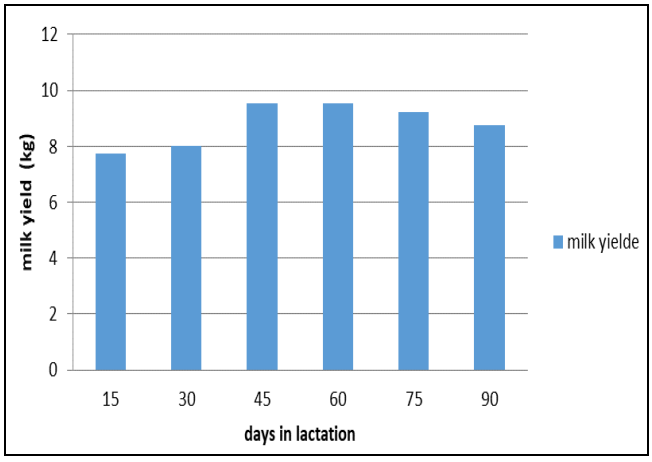

Fig 4: Milk yield of Murrah buffalo during early stage of lactation

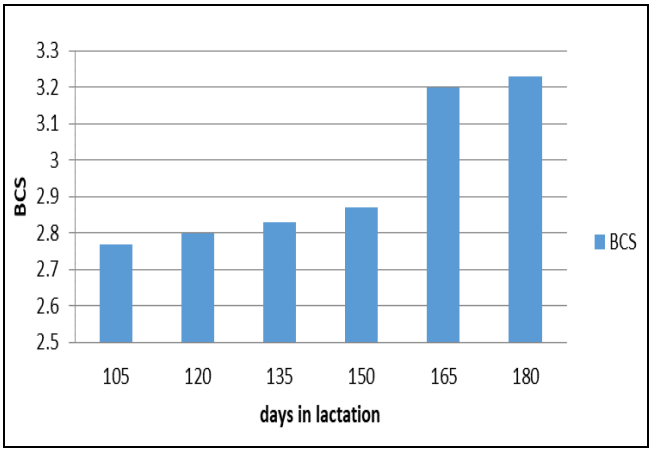

Fig 2: BCS of Murrah buffalo during mid stage of lactation

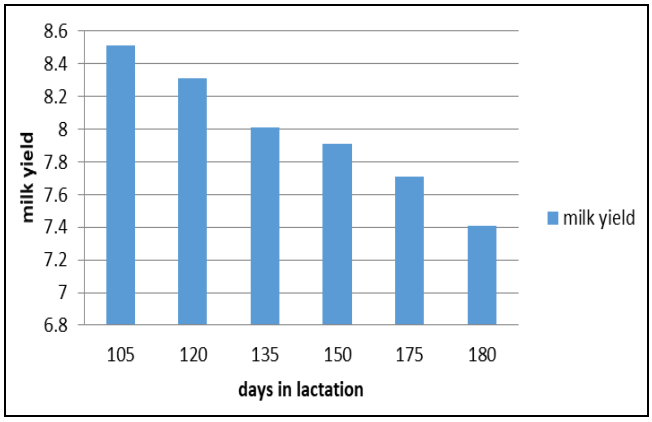

Fig 5: Milk yield of Murrah buffalo during mid stage of lactation

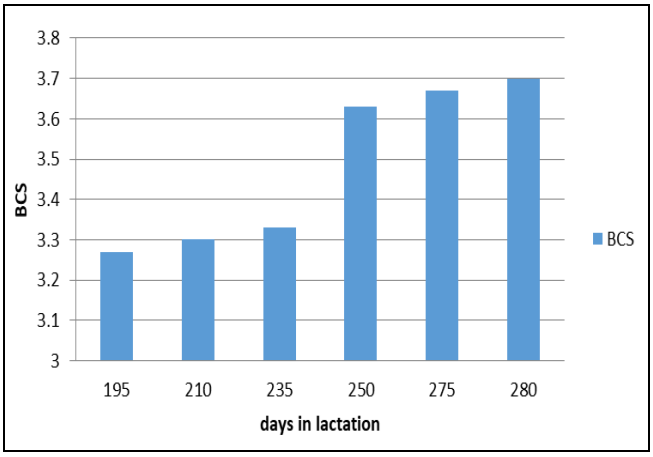

Fig 3: BCS of Murrah buffalo during late stage of lactation

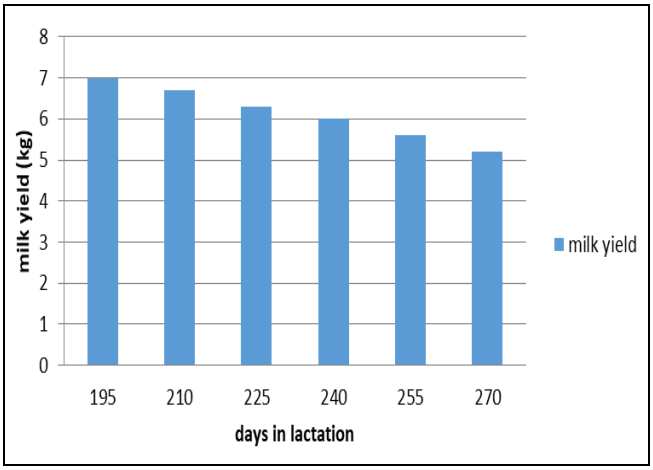

Fig 6: Milk yield of Murrah buffalo during late stage of lactation

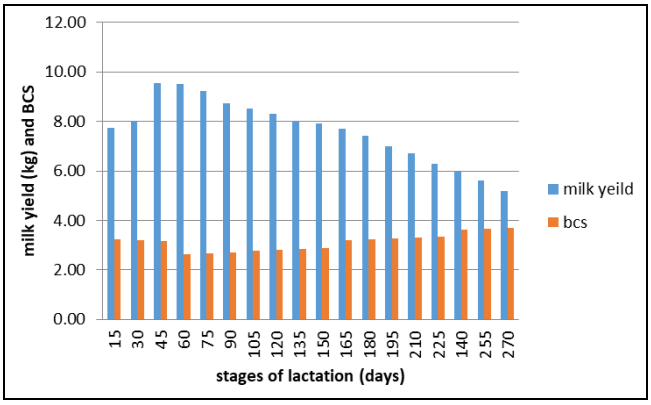

Fig 7: Correlation of milk yield and body condition score of Murrah buffalo during different stages of lactation.

Conclusion

The BCS showed significant difference among the early and late and mid and late lactation stage of Murrah buffalo respectively and non significant difference among early and mid stage of lactation. The milk yield showed significant difference among different stages of lactation of Murrah buffalo. The peak yield was obtained between 45 to 60 days of lactation and then it gradually declined up to end of lactation. The Milk yield and BCS were negatively correlated with each other.

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