MedCrave Step into the World of Research

Journal of Dairy, Veterinary & Animal Research

Research Article

Open Access CrossMark

The effect of body condition score at calving on milk yield, milk composition and udder health status of dairy animals

Abstract

To assess the effect of body condition score on milk yield, milk composition and udder health status of dairy bovines, 50 cows (HF cross) and 50 buffaloes (Murrah type) at 2nd parity were selected randomly from teaching livestock farm and nearby villages of N.D.U.A.T., Kumarganj. The animals were divided into three groups on the basis of BCS at calving and kept in observation for 120days; their milk yield, milk composition (fat and SNF) and somatic cell score were assessed. The BCS values of Group III animals were significantly (P<0.05) higher than those of Group-I animals. The daily fat-corrected milk (FCM) yield and milk fat were higher in groups with high BCS than in groups with lower BCS; however, SCS was lower in the milk of Group III than of other groups. Therefore, the FCM and milk fat were positively correlated with BCS at calving, but the udder health status–in terms of SCS–was correlated negatively.

Keywords: BCS, buffalo, cattle, fat, SCC, SNF

Volume 2 Issue 2 - 2015

Vikas Singh, VK Singh,[1] SP Singh,[2] B Sahoo[3]

[1]Department of Animal Nutrition, Narendra Deva University of Agriculture & Technology, India
[2]Narendra Deva University of Agriculture & Technology, India
[3]Indian Veterinary Research Institute, India

Correspondence: VK Singh, Head Department of Animal Nutrition, College of Veterinary Science and Animal Husbandry, Narendra Deva University of Agriculture & Technology, Kumarganj-224 229, Faizabad, Uttar Pradesh, India, Tel +91 941 565 5520, Email vksinghnduat@gmail.com

Received: January 10, 2015 | **Published:** April 29, 2015

Abbreviations: BCS, body condition score; SE, standard error; SNF, solids not fat

Introduction

Body condition score (BCS) is a subjective measure of body energy reserve and is used as an indirect indicator of energy balance status.[1] It is a quick, non-invasive, inexpensive, visual and tactile way of assessing the degree of fatness of dairy animals[2] and it is recognized by the animal scientists and producers as an important factor in dairy bovine management.[3] Optimal body condition of dairy cow 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 and higher milk somatic cell count, SCC.[4] Therefore, the ideal BCS of dairy animals throughout lactation not only optimizes milk yield, but also maximizes economic return.[5]

Studies relating the effect of BCS on milk production and milk composition have provided inconsistent results. Ruegg & Milton,[6] and Domecq et al.[7] reported no significant effect of BCS at calving on subsequent milk production, while Markusfeld et al.[8] and Roche et al.[9] reported the contrary to the previous findings. Singh et al.[10] and Lents et al.[11] stated that BCS did not influence fat, SNF and specific gravity of milk, while Doreau et al.[12] reported high milk fat in fatty animals. However, negative correlation between BCS and milk yield, fat and SNF was observed by Mustaq & Quereshi.[13]

Dairy cows with high milk yields have been displaying higher incidence of mastitis [14] that can be assessed by SCC or somatic cell score (SCS, log-transformed SCC) in milk.[15] Therefore, SCC is widely used as a marker to determine the udder health and quality of milk.[16] Very few studies have attempted to quantify the relationship between BCS and SCC.[6] Body condition score had a favorable correlation with SCS, but it was not strong,[4,17] while others[2,6] reported insignificant relationship between BCS and SCC. Hence, it is argued that there are no consistent results regarding the relationship between body condition score and milk yield, milk composition and milk somatic cell counts, viz. udder health status of dairy animals. Therefore, the present study was carried out to investigate the effect of body condition score on milk yield, milk composition and udder health status in terms of milk SCC of dairy bovines.

Materials and methods

The experiment was conducted in and around the Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad (Uttar Pradesh) to assess the effect of body condition score on milk yield, milk composition and udder health status of dairy bovines. In total, 100 lactating dairy bovines of second parity were selected from the Teaching Livestock Farm, the Narendra Deva University of Agriculture and Technology, Kumarganj, and from small dairy farms of nearby villages. The animals were selected randomly and observed for 4months. The data were collected at fortnightly intervals. Milking was done twice daily by hand-milking method. Body condition score of animals after calving was assessed fortnightly, after milking in the morning, by restraining the animals and using body condition scoring chart formulated by Prasad.[18] This score chart is a 6 point scale (1 – 6) with "1" indicating under-condition and "6" representing over-condition of the dairy cows.

For a better interpretation of BCS effect on milk yield, milk composition and udder health status, further 1 to 6 scales were broken down into half- or quarter-point increment (e.g., 2.5 or 3.25) and the animals were divided into three groups, viz. Group I (Thin, BCS<3), Group II (Moderate, BCS 3.0-3.5), and Group III (Fat, BCS>3.5), on the basis of BCS at calving. The values of BCS at calving were measured within the first week after calving, but not more than ten days after parturition.[19]

Milk yield of selected animals was recorded on the observation days by adding both morning and evening milk. Milk sample was collected fortnightly, directly from the animal during milking to assess milk composition, such as fat and solids-not-fat (SNF). The fat and SNF values were estimated by EKOMILK-Ultra, a milk analyzer (Milkana KAM 98-2A). The milk yield was further corrected on four percent fat basis (fat-corrected milk, FCM) to standardize milk yield due to its different fat content. The FCM was calculated according to the formula proposed by Gaines:[20] FCM=0.4×milk yield (l)+15×milk fat(kg).

The udder health status was determined by SCC of milk. SCC was assessed in the laboratory for each animal immediately after collection of milk in fortnightly intervals as per Mrode & Swonson[21] method. After that, fortnightly test day observation of SCC was log-transformed into the SCS.

Statistical analysis

The data obtained on milk yield, composition and SCS were analyzed using an SPSS statistical package (version 11.5) to obtain the mean and standard error (S.E.) values of various parameters. The significance of differences in various measurements was tested using Duncan's Multiple Range Test. The Pearson's correlation coefficient was estimated between BCS and various measurements to find any relationship among them.

Results and discussion

To assess the effect of BCS on milk yield, milk composition and udder health status, animals were distributed on the basis of BCS at calving into thin (Group I), moderate (Group II), and fat (Group III), which is presented in Table 1. In case of crossbred cattle, the number (40%) was the highest in the moderate group; however, for buffaloes the number was the highest in the fat group (38%), which means that buffaloes had better nutritional status than cattle. It might be due to better roughage utilization ability of buffaloes than that of cattle, because most of the dairy bovines in our country are reared on cereal crop residues and a very low amount of concentrates.[22]

Table 1 Distribution of bovines according to BCS at calving

Parameters	Crossbreed cows			Buffaloes		
	Number	Percent	BCS at calving	Number	Percent	BCS at calving
Group I(Thin)	13	26	2.83±0.06	14	28	2.88±0.04
Group II(Moderate)	20	40	3.38±0.03	17	34	3.40±0.04
Group III(Fat)	17	34	4.22±0.11	19	38	4.33±0.12

Table 2 data reveals that daily milk yield followed the trend of BCS at calving, viz. was the lowest in Group I and the highest in Group III. Dairy milk yield was significantly (P<0.01) correlated with the BCS at calving in both cattle and buffaloes. The mean fat (%) in cow milk showed significant (P<0.05) differences and it was higher in Group III followed by Group II and Group I. However, fat percentage was significantly (P<0.05) higher in buffalo milk in Group III than in Group I. A significant (P<0.01) relationship was also observed between buffalo milk fat and BCS at calving. The mean SNF level in cow milk ranged from 8.24 to 8.45 percent, and in buffalo milk from 10.30 to 10.38 percent. The Group III cow milk had significantly (P<0.05) higher SNF value than cow milk in Group I; however, SNF content in buffalo milk did not show any variation among the groups. Statistically non-significant (P>0.05), but negative, association was obtained between SCS in milk and BCS at calving both in cattle and buffaloes.

The variation in milk yield, fat, SNF and SCS in the milk of cattle and buffaloes at different monitoring periods after lactation is present in Table 3. Scanning of the data revealed that milk yield was increasing till 45days of lactation, after which showed decreasing trends, in both groups. The level of fat was significantly (P<0.05) higher at the 15th day after calving than in the remaining period of the study, also for both groups. The fortnightly variation in milk SNF during the monitoring of animals in lactation was linear and the lowest value of SNF was 8.27 and 10.17 percent 60days after calving in cow and buffalo milk, respectively. The SCS during monitoring showed that the lowest SCS in cow milk (4.60) and in buffalo milk (4.53) was found on the 45th day of lactation. The SCS decreased during the first 45days and then increased in the course of lactation.

A higher milk yield in higher BCS groups is in line with the findings of Samarutel et al.,[19] who observed that fat groups (BCS>3.75) had significantly (P<0.05) higher FCM during the first two month of lactation, as compared to moderate (BCS 3.25-3.5) and thin (BCS<3.0) groups.[19] Similar to this, Waltner et al.[2] suggested that BCS at calving and a change in BCS during lactation were related to the total yield of 3.5 percent FCM from cows which were 90days in lactation.[2] Markusfeld et al.[8] and Roche et al.[9] also reported a significant rise in milk production with an increase of BCS at calving. Contrary to the present findings, Jilek et al.[23] reported that milk production was the highest in cows with BCS before calving less than 4, than in cows with BCS more than or equal to 4.[23] Balkrishnan et al.[24] also observed that BCS higher than 3.5 was detrimental to milk yield in crossbreed cows. Furthermore, Pedron et al.[25] and Aeberhard et al.[27] did not find any significant effect of BCS at calving on milk production.

A higher milk fat concentration in early lactation by fatter cows and buffaloes is in line with the previous studies of Samarutel et al.,[19] Similarly, Grainger et al.[27] reported that an improved body condition at calving had a positive effect on milk fat percentage, particularly in early lactation. This is attributable to a greater predisposition of fatter cows to lose condition in early lactation.[28] Furthermore, the above-mentioned observation was also in agreement with the findings of Berry et al.,[4] who reported that greater BCS at calving was linearly associated with greater milk fat concentration in early lactation.[4] Broster & Broster[29] also found a positive response of milk fat percentage to increased BCS at calving.[29] However, Lents et al.[11] and Singh et al.[10] observed no influence of BCS at calving on milk fat. The milk SNF level was more or less similar to the findings of Lents et al.,[11] who reported 8.62, 8.34, 8.49, and 8.40 percent SNF in the cows having <3, 4, 4.5, and >5 BCS at calving. The nonsignificant variation of SNF in buffalo milk was in agreement with the findings of Singh et al.[10] that the effect of BCS on SNF was non-significant in buffaloes.

The udder health status was assessed by measuring SCC in milk.

The non-significant (P>0.05) decrease of SCS with an increase of BCS at calving might have been due to the positive relation of daily milk yield to BCS of cows and buffaloes in different groups. Besides, the higher SCS in the later stage of lactation also might have been due to reduction in the milk yield at this stage. Similarly, Juozaitiene et al.[30] reported that cows with a lower milk production were in a higher class for SCC. Similarly to this observation, Atasever & Erdem[5] also found a negative correlation between BCS at calving and SCS. In contrast to our findings, Berry et al.,[4] estimated a positive association between BCS at calving and SCS. However, Heuer et al.[31] and Dang et al.[32] reported no significant association between body condition score at calving and somatic cell score.[32]

Therefore, our results revealed that an increase of BCS at calving had a positive effect on daily milk yield and milk composition, with a negative effect being observed on udder health status of dairy animals. Thus, BCS at calving can be used as a reliable criterion in selection of dairy bovines for higher milk production with better udder health status.

Table 2 Effect of BCS at calving on average daily fat-corrected milk (FCM), fat, SNF and SCS in the milk of dairy bovines

Parameters	Cattle					Buffaloes				
	Group I	Group II	Group III	SEM	Correlation	Group I	Group II	Group III	SEM	Correlation
FCM(l/d)	11.84^{c}	14.50^{b}	16.58^{a}	0.21	0.752**	9.16^{c}	10.13^{b}	11.24^{a}	0.11	0.518**
Fat(%)	3.17^{c}	3.32^{b}	3.46^{a}	0.02	0.154	6.18^{b}	6.34^{ab}	6.49^{a}	0.04	0.619**
SNF(%)	8.24^{b}	8.35^{ab}	8.45^{a}	0.03	0.249	10.33	10.3	10.38	0.25	0.049
SCS	5.01	4.99	4.84	0.12	-0.238	5.19	5.01	4.97	0.12	-0.181

Values with different small letter superscripts in a row within a species significantly differ between groups (P<0.05)

**Correlation is significant at the 0.01 level (2-tailed)

Table 3 Milk yield, fat, SNF and SCS in the milk of dairy bovines at particular monitored periods of lactation

Monitored periods during lactation (days)	Cattle				Buffaloes			
	FCM(l/d)	Fat(%)	SNF(%)	SCS	FCM(l/d)	Fat(%)	SNF(%)	SCS
15	10.44^{F}	3.60^{A}	8.46	5.65	5.02^{E}	6.70^{A}	10.60^{A}	5.67^{A}
30	14.39^{CD}	3.41^{B}	8.38	4.98	9.03^{D}	6.45^{AB}	10.43^{ABC}	5.40^{AB}
45	17.57^{A}	3.20^{B}	8.32	4.6	12.44^{A}	6.21^{B}	10.24^{C}	4.53^{B}
60	16.47^{AB}	3.23^{B}	8.27	4.62	11.94^{AB}	6.19^{B}	10.17^{D}	4.69^{AB}
75	16.02^{B}	3.24^{B}	8.3	4.79	11.69^{AB}	6.25^{B}	10.24^{C}	4.80^{AB}
90	15.27^{BC}	3.27^{B}	8.34	4.78	11.05^{BC}	6.29^{B}	10.24^{C}	5.01^{AB}
105	13.81^{DE}	3.30^{B}	8.38	4.92	10.62C	6.32^{B}	10.38^{BC}	5.10^{AB}
120	12.75^{E}	3.36^{B}	8.43	5.27	10.45C	6.38^{AB}	10.55^{AB}	5.17^{AB}
SEM	0.21	0.02	0.03	0.12	0.11	0.04	0.25	0.12

Values with different capital letter superscripts in a column within a species differ significantly between periods (P<0.05)

Acknowledgements

None.

Conflict of interest

Author declares that there is no conflict of interests.

References

1. Roche JR, Dillon PG, Stockdale CR, et al. Relationships among international body condition scoring systems. *J Dairy Sci*. 2004;87(9):3076–3079.
2. Waltner SS, McNamara JP, Hillers JK. Relationships of body condition score to production variables in high production Holstein dairy cattle. *J Dairy Sci*. 1993;76(11):3410–3419.
3. Roche JR, Friggens NC, Kay JK, et al. Body condition score and its association with dairy cow productivity, health, and welfare. *J Dairy Sci*. 2009;92(12):5769–5801.
4. Berry DP, Lee JM, Macdonald KA, et al. ssociation among body condition score, body weight, somatic cell count, and clinical mastitis in seasonally calving dairy cattle. *J Dairy Sci*. 2007;90(2):637–648.
5. Atasever S, Erdem H. Association between subclinical mastitis markers and body condition scores of Holstein cows in the ablack Sea region. *Turkish Journal of Animal and Veterinary Advances*. 2009;8(3):476–480.

6. Ruegg PL, Milton RL. Body condition scores of Holstein cows on Prince Edward Island, Canada: relationships with yield, reproductive performance, and disease. *J Dairy Sci*. 1995;8(3):552–564.
7. Domecu JJ, Skidmore AL, Lloyd JW, et al. Relationship between body condition scores and milk yield in a large dairy herd of high yielding Holstein cows. *J Dairy Sci*. 1997;80(1):101–112.
8. Markusfeld O, Galon N, Ezra E. Body condition score, health, yield and fertility in dairy cows. *Veterinary Record*. 1997;141:67–72.
9. Roche JR, Lee JM, Macdonald KA, et al. Relationships between body condition score, body weight and milk production variables in pasture-based dairy cows. *J Dairy Sci*. 2007;90(8):3802–3815.
10. Singh RR, Dutt T, Joshi HC, et al. Effect of body condition Score on performance traits in crossbred dairy cows. *Journal of Applied Animal Research*. 2009;36(2):372–376.
11. Lents CA, Looper ML, Wettemann RP. *Effects of postpartum body condition score of beef cows on milk components and weaning weights of calves*. OSU Research report; 1997. p. 1–4.
12. Doreau M, Sylviane B, Chilliard Y. Yield and composition of milk from lactating mares: effect of body condition at foaling. *J Dairy Res*. 1993;60(4):457–466.
13. Mustaq A, Quereshi MS. Variation in milk composition and its relationship with physiological states and management in crossbred cattle under tropical conditions; 2009.
14. Gonyon DS, Everson DO, Christian RE. Heritability of mastitis score in Pacific Northwest dairy herds. *J Dairy Sci*. 1982;65(7):1269–1276.
15. Kadarmideen HN, Pryce JE. Genetic and economic relationships between somatic cell count and clinical mastitis and their use in selection for mastitis resistance in dairy cattle. *Animal Science*. 2001;73:19–28.
16. Dohoo IR, Meek AH. Somatic cell counts in bovine milk. *Can Vet J*. 1982;23(4):119–125.
17. Kadarmideen HN. Genetic correlations among body condition score, somatic cell score, milk production, fertility and conformation traits in dairy cows. *Animal Science*. 2004;79:191–201.
18. Prasad S. *Studies on body condition scoring and feeding management in relation to production performance of crossbreed dairy cattle*. Karnal, India: Thesis submitted to NDRI; 1994.
19. Samarutel J, Ling K, Jaakson H, et al. Effect of body condition score at parturition on the production performance, fertility and culling in primiparous estonian holstein cows. *Veterinaija IR Zootechnikaal T*. 2006;36(58):69–74.
20. Gaines WL. The energy basis of measuring milk yield in dairy cows. *Illinois Agriculture Experimental Small Bulletin*. 1928;308:1-52.
21. Mrode RA, Swanson GJT. Genetic and statistical properties of somatic cell count and its suitability as an indirect means of reducing the incidence of mastitis in dairy cattle. *Anim Breed Abstr*. 1996;64:847–857.
22. Singh AK, Vidyarthi VK, Verma DN, et al. Nutritional status of buffaloes in rural areas of Azamgarh district of Uttar Pradesh. *Indian Journal of Animal Nutrition*. 1998;15(2):126–128.
23. Jilek F, Pytloun P, Kubesova M, et al. Relationships among body condition score, milk yield and reproduction in Czech Fleckvieh cows. *Czech J Anim Sci*. 2008;53(9):357–367.
24. Balakrishnan M, Ramsha KP, Chinnaiya GP. Effect of postpartum body condition loss on performance in cross bred cows, an assessment through body condition scoring. *Indian Journal of Dairy Science*. 1997;50(5):393–397.
25. Pedron O, Cheli F, Senatore E, et al. Effect of body condition score at calving on performance, some blood parameters, and milk fatty acid composition in dairy cows. *J Dairy Sci*. 1993;76(9):2528–2535.
26. Aeberhard K, Bruckmaier RM, Kuepfer U, et al. Milk yield and composition, nutrition, body conformation traits, body condition scores, fertility and diseases in high-yielding dairy cows--part 1. *J Vet Med A Physiol Pathol Clin Med*. 2001;48(2):97–110.
27. Grainger C, Wilhelms GD, McGowan AA. Effect of body condition at calving and level of feeding in early lactation on milk production of dairy cows. *Australian Journal of Experimental Agriculture and Animal Husbandry*. 1982;22(115):9–17.
28. Roche JR, Macdonald KA, Burke CR, et al. Associations among body condition score, body weight, and reproductive performance in Seasonal-Calving dairy cattle. *J Dairy Sci*. 2007;90(1):376–391.
29. Broster WH, Broster VJ. Body score of dairy cows. *J Dairy Res*. 1998;65(1):155–173.
30. Juozaitiene V, Juozaitis A, et al. Relationship between somatic cell count and milk production or morphological traits of udder in black-and-white cows. *Turk J Vet Anim Sci*. 2006;30:47–57.
31. Heuer C, Schukken YH, Dobbelaar P. Postpartum body condition score and results from the first test day milk as predictors of disease, fertility, yield, and culling in commercial dairy herds. *J Dairy Sci*. 1999;82(2):295–304.
32. Dang AK, Prasad S, Mukherjee J, et al. *Effect of different physiological stages and managemental practices on milk somatic cell counts of Murrah buffaloes*. 9th world Buffalo Congress (Milk Production); 2010. p. 549–551.