Original Research

Effect of Body Condition Score on Milk Composition and Reproductive Performance of Sahiwal Cattle

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Abstract

The present study was carried out with the total of 18 Sahiwal cattle of 1st to 4th parity were selected for the study and distributed into three different groups based on their pre calving BCS (before 15 days of predicated date of calving) namely G1 (2.50 - 3.00), G2 (3.25 - 3.75) and G3 (4.00 and above) with six animals in each group. Highest average fortnightly fat percent in the milk was observed in group G3 (3.95±0.03%) followed by group G2 (3.90±0.02%) and G1 (3.63±0.02%). The highest average protein per cent 3.61±0.01 was observed in G3 group followed by 3.33±0.01% and 3.18±0.004%, respectively in G2 and G1 group. The highest average lactose per cent 4.41±0.02 was observed in G3 group followed by in G2 and G1 group 4.28±0.10 and 4.20±0.012, respectively. The highest average total solid per cent 12.67±0.03 was observed in G3 group animals followed by in G2 and G1 group with 12.57±0.02 % and 12.26±0.02 %, respectively. The Sahiwal cattle of G2 group had shorter post-partum estrus period, fewer services per conception, higher first service conception rate and shorter service period and the values for corresponding parameter were 63.67±1.17 days, 1.34±0.21, 66.67 per cent and 89.84±3.79 days, respectively. The study revealed that BCS had significant (P<0.05) effect on fat, SNF, lactose, protein, total solid percent, post-partum estrus and service period under the study.

Key words: Solid not Fat, Lactose, Service Period, Conception, Sahiwal, Fortnightly

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Introduction

The cattle contribute around 37.28% of the total livestock population as per 19th livestock census 2012. The total number of cattle in the country is 190.90 million in numbers. The female cattle (cows) population has increased by 6.52% over the previous census (2007) and the total number of female cattle in 2012 is 122.9 million numbers. Cattle produce high quality of milk in term of fat and SNF which is more profitable to

farmers, but still unscientific managemental practices are followed in cattle production. Sometimes, the animals are overfed or under fed and both the conditions are unfavourable for the optimum productive and reproductive performance of animal. Therefore, suitable strategies should be followed to monitor the nutritional status of the animals so as to make it measurable, understandable and applicable.

The dairy animals use their body reserves as an energy source in early lactation to support high milk yield that is why adequate amount of nutrients must be stored in body tissues during late lactation. In early lactation the energy intake does not keep pace with continuously rising milk yield as a result energy deficit increase. This leads to a competitive situation among milk yield, fertility and health of the dairy cow because these traits are linked with energy requirement (Coenen and Peter, 2014).

The various blood metabolites are used to measures the energy balance (EB) status in dairy animals, which has been reported to be strongly correlated with energy balance (Konigsson *et al.*, 2000 and Clark *et al.*, 2005). However, analyses of these blood metabolites are only feasible on experimental farms. Therefore, there is interest in other traits, which could serve as indicators of EB and may subsequently be related to the production and fertility status of an animal. Body condition score (BCS) is one of those measures which are widely used in many species to assess body composition and energy status of animals (De Vries and Veerkamp, 2000 and Veerkamp *et al.*, 2001).

Materials and Methods

A total of 18 Sahiwal cattle of 1st to 4th parity was selected for the study. The study was conducted for a period of 6 month at Livestock Research Station, Kodamdesar.

Experimental Design

Eighteen Sahiwal cattle were distributed into three separate groups based on their pre-calving BCS (15 days before expected date of calving) namely G_1, G_2 and G_3 with six animals in each group as shown in Table 1.

Table 1: Grouping of the cattle based on their pre-calving BCS

Grouping of the cattle based on their pre-calving BCS Groups	No. of Animals	BCS
G_1	6	2.50 - 3.00
G_2	6	3.25 - 3.75
G_3	6	4.00 and above

(As a total of 18 Sahiwal cattle of 1st to 4th parity was selected for the study. So, in different i.e. G1, G2 and G3, how these animals were distributed on the basis of parity. Means in each treatment how many animals were from 1st or 2nd or 3rd or 4th parity? Average of parity in each treatment needs to be mention.)

Parameters to be Studied

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Milk Components

The milk components, including fat, protein, lactose, total solids and Solid Not Fat (SNF), were studied in relation to BCS from calving to12 weeks post-partum 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 milk analyzer.

Reproductive Parameter

Post-Partum Estrus

Post-partum estrus was observed by the acceptance of a male by the female, which is the most prominent and reliable symptoms of estrus.

Service Period

The service period was calculated from the date of calving to date of successful service.

Number of Service per Conception

The data regarding number of service per conception was obtained from the record of the farm.

First Service Conception Rate

The first service conception rate was calculated by the percentage of experimental cattle conceived out of the total cattle at first service.

Analysis of Data

The collected and tabulated data was analyzed by using SPSS 20.0.

Facilities Existing

All the facilities exist at College of Veterinary and Animal Science, Bikaner and well-equipped laboratory for analytical work is available in the Department of Livestock Production and Management, College of Veterinary and Animal Science, Bikaner and LRS, Kodamdesar.

Results and Discussion

Milk Composition

Fat (%)

The average fortnightly fat per cent in milk of animals of each group are presented in the Table 2. The average fortnightly fat per cent in milk decreased up to 60th day and thereafter increased up to 90th day in G1 and G3 group of animals. The difference in average fortnightly fat per cent in milk was found to be significant from 15th to 30th day in G1 group, thereafter non-significant up to 90th day, whereas, in G3,

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significant difference was observed from 15th to 45th day and thereafter non-significant up to 90th day. The average fortnightly fat per cent in milk of G2 group of animals decreased up to 60th day and this decrease in fat per cent was significant (P<0.05) up to 45th day. An increase in fat per cent was observed up to 75th day and it again decreased non-significantly up to 90th day. The average fortnightly fat per cent significantly (P<0.05) differed between the G1, G2 and G3 groups throughout the study period. Highest average fortnightly fat percent in the milk was observed in group G3 (3.95±0.03%) followed by group G2 (3.90±0.02%) and G3 (3.63±0.02%).

Table 2: Average fortnightly fat (%) in milk of Sahiwal cattle with different BCS groups

Fortnight	Average Fat (%) in milk of Sahiwal cattle in BCS groups		
Intervals (days)	G1	G2	G3
15	3.80 ± 0.010^{bX}	4.06 ± 0.030^{dY}	4.15 ± 0.007^{eZ}
30	3.63 ± 0.025^{aX}	3.92 ± 0.010^{bcY}	4.08 ± 0.016^{deZ}
45	3.59 ± 0.025^{aX}	3.86 ± 0.020^{abY}	3.94 ± 0.010^{cZ}
60	3.56 ± 0.022^{aX}	3.82 ± 0.017^{aY}	3.80 ± 0.020^{aY}
75	3.57 ± 0.025^{aX}	3.84 ± 0.020^{aY}	3.81 ± 0.030^{aY}
90	3.59 ± 0.022^{aX}	3.81 ± 0.015^{aY}	3.85 ± 0.050^{abY}
Total (Average)	3.63 ± 0.020^{a}	3.90 ± 0.020^{b}	3.95 ± 0.030^{c}

Different superscript in a column (Small letter a,b,c,d,e,) differ significantly (p<0.05); Different superscript in a row (Capital letter X, Y, Z) differ significantly (p<0.05)

Similar finding were reported by Prasad and Tomar (1996), Berry *et al.* (2007), Musthaq (2010) in Nili Ravi buffalo, Janus and Borkowska (2012) in H.F. cow, Singh *et al*. (2015) in H.F. cows and Meena *et al.* (2019) in Kankrej cow.

Solid Not Fat (SNF %)

The average fortnightly Solid Not Fat per cent in milk of Sahiwal cattle with different BCS groups are presented in Table 3.

Table 3: Average fortnightly Solid Not Fat (%) in milk of Sahiwal cattle with different BCS groups

Fortnight	Average SNF (%) in milk of Sahiwal cattle in BCS groups		
Intervals (days)	G1	G2	G3
15	8.59 ± 0.011^{aX}	8.70 ± 0.010^{bY}	8.77 ± 0.006^{bZ}
30	8.60 ± 0.014^{aX}	8.71 ± 0.023^{bY}	8.75 ± 0.008^{bY}
45	8.58 ± 0.011^{aX}	8.67 ± 0.017^{abY}	8.73 ± 0.007^{abZ}
60	8.64 ± 0.008^{bX}	8.66 ± 0.015^{aX}	8.72 ± 0.004^{aY}
75	8.65 ± 0.011^{bX}	8.65 ± 0.020^{aX}	8.71 ± 0.007^{aY}
90	8.66 ± 0.013^{bX}	8.65 ± 0.017^{aX}	8.69 ± 0.007^{aX}
Total (Average)	8.63 ± 0.010^{a}	8.68 ± 0.010^{b}	8.74 ± 0.010^{c}

Different superscript in a column (Small letter a,b,) differ significantly (p<0.05); Different superscript in a row (Capital letter X, Y, Z) differ significantly (p<0.05)

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A significant increase in the average fortnightly SNF per cent in the milk of G1 group animals was observed between 45th to 60th day while in G2 and G3 group of animals were found to be non-significant throughout the study period except 45th days. The fortnightly average SNF per cent was found to be significant between the groups in 15th and 45th days of lactation. There was significant (P<0.05) difference in fortnight average SNF per cent between the three groups throughout the study period. In G3 group of animals the SNF per cent was 8.74±0.01 which was highest among all the groups and in the G2 and G1 group of animals the corresponding values were 8.68±0.01% and 8.63±0.01%, respectively.

Similar findings were reported by Prasad and Tomar (1996), Musthaq (2010) in Nili Ravi buffalo, Janus and Borkowska (2012) in H.F. cows and Meena *et al.* (2019a) in Kankrej cow.

Protein (%)

The average fortnightly protein per cent in milk of Sahiwal cattle with different BCS groups are presented in Table 4.

Table 4: Average Fortnightly Protein (%) in milk of Sahiwal cattle with different BCS groups

Fortnight	Average Protein (%) in milk of Sahiwal cattle in BCS groups		
Intervals (days)	G1	G2	G3
15	3.15 ± 0.007^{aX}	3.31 ± 0.017^{abY}	3.55 ± 0.014^{aZ}
30	3.15 ± 0.006^{aX}	3.35 ± 0.008^{cY}	3.57 ± 0.014^{aZ}
45	3.17 ± 0.004^{abX}	3.31 ± 0.01^{abY}	3.62 ± 0.018^{bZ}
60	3.16 ± 0.005^{abX}	3.29 ± 0.013^{aY}	3.63 ± 0.019^{bZ}
75	3.17 ± 0.005^{abX}	3.35 ± 0.012^{cY}	3.62 ± 0.019^{bZ}
90	3.19 ± 0.004^{bX}	3.34 ± 0.006^{bcY}	3.63 ± 0.019^{bZ}
Total (Average)	3.18 ± 0.004^{aX}	3.33 ± 0.01^{bY}	3.61 ± 0.01^{cZ}

Different superscript in a column (Small letter a,b,c) differ significantly (p<0.05); Different superscript in a row (Capital letter X, Y, Z) differ significantly (p<0.05)

The average fortnightly protein per cent in milk of G1 group of animals increased up to 45th day and thereafter decreased up to 60th day, and after that there was gradual increase in protein per cent up to 90th day, which were found to be non-significant. The average fortnightly protein per cent in milk of G2 group animals increased up to 30th day and thereafter decreased up to 60th day then again increased up to 75th day after that it again decreased up to 90th day, which were found to be non-significant. The average fortnightly protein per cent in milk of G3 group animals increased significantly (P<0.05) up to 60th day and after that it decreased up to 75th day and again increased up to 90th day. There was significant (P<0.05) difference in average fortnightly protein per cent in milk between the three groups throughout the study period. The highest average protein per cent 3.61±0.01 was observed in G3 group followed by 3.33±0.01% and 3.18±0.004%, respectively in G2 and G1 group.

Similar findings were reported by Prasad and Tomar (1996), Musthaq (2010) in Nili Ravi buffalo, Janus and Borkowska (2012) in H.F. cows and Meena *et al.* (2019) in Kankrej cow. However, Treacher *et al.*

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(1986) reported that during early lactation, the group of fat (BCS 4) cows had yielded less milk protein than the group of thin (BCS 2.5) cows which is in disagreement with present study.

Lactose (%)

The average fortnightly lactose per cent in milk of Sahiwal cattle with different BCS groups are presented in Table 5.

Table 5: Average fortnightly lactose (%) in milk of Sahiwal cattle with different BCS groups

Fortnight	Average Lactose (%) in milk of Sahiwal cattle in BCS groups		
Intervals (days)	G1	G2	G3
15	4.20 ± 0.012^{aX}	4.29 ± 0.010^{aY}	4.47 ± 0.005^{bZ}
30	4.19 ± 0.013^{aX}	4.26 ± 0.007^{aY}	4.45 ± 0.003^{bZ}
45	4.20 ± 0.012^{aX}	4.28 ± 0.010^{ay}	4.43 ± 0.006^{bY}
60	4.21 ± 0.007^{aX}	4.29 ± 0.007^{aY}	4.48 ± 0.005^{bZ}
75	4.19 ± 0.007^{aX}	4.26 ± 0.010^{aY}	4.44 ± 0.008^{bY}
90	4.18 ± 0.007^{aX}	4.26 ± 0.009^{aY}	4.16 ± 0.092^{bX}
Total (Average)	4.20 ± 0.012^{aX}	4.28 ± 0.100^{bY}	4.41 ± 0.020^{cZ}

Different superscript in a column (Small letter a,b,c,) differ significantly (p<0.05); Different superscript in a row (Capital letter X, Y, Z) differ significantly (p<0.05)

The average fortnightly lactose per cent in milk of G1 group of animals decreased up to 30th day and after that increased up to 60th day and then again decreased up to 90th day, non-significantly. The average fortnightly lactose per cent in milk of G2 group of animals decreased up to 30th day and after that it increased up to 60th day and then again decreased up to 75th day and remained same after that up to 90th day, non-significantly. In G3 group of animals, the average fortnightly lactose per cent in milk decreased up to 45th day and after that it increased up to 60th day and then again decreased up to 90th day, non-significantly. There was significant (P<0.05) difference in average fortnightly lactose per cent between the three groups throughout the study period. The highest average lactose per cent 4.41±0.02 was observed in G3 group followed by in G2 and G1 group 4.28±0.10 and 4.20±0.012, respectively**.**

Similar findings were reported by Musthaq (2010) in Nili Ravi Buffalo, Janus and Borkowska (2012) in H.F. cows and Meena *et al.* (2019a) in Kankrej cows. However, Treacher *et al*. (1986) reported that during early lactation, the group of fat (BCS 4) cows had yielded less lactose than the group of thin (BCS 2.5) cows which is in disagreement with present study.

Total Solid (%)

The average fortnightly total solids per cent in milk of Sahiwal cattle under different BCS groups are presented in Table 6. The average fortnightly total solids differ significantly (P<0.05) in milk of Sahiwal cattle among different BCS groups. The average total solid content of milk changes with advance in lactation in G1, G2 and G3 group of animals and were found to be non-significant throughout the study

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period. There was significant (P<0.05) difference in total solid per cent in the milk of G1, G2 and G3 groups throughout the study period. The highest average total solid per cent 12.67±0.03 was observed in G3 group animals followed by in G2 and G1 group with 12.57±0.02 % and 12.26±0.02 %, respectively. Similar findings were reported by Janus and Borkowska (2012) and Meena *et al.* (2019a) in Kankrej cows.

Table 6: Average fortnightly total solid (%) in milk of Sahiwal with different BCS groups

Fortnight	Average Total solids (%) of animals in BCS groups		
Intervals (days)	G1	G2	G3
15	12.40 ± 0.018^{bX}	12.77 ± 0.044^{cY}	12.91 ± 0.010^{dZ}
30	12.23 ± 0.039^{aX}	12.64 ± 0.032^{bY}	12.84 ± 0.017^{cdZ}
45	12.17 ± 0.036^{aX}	12.54 ± 0.030^{aY}	12.66 ± 0.020^{bZ}
60	12.21 ± 0.026^{aX}	12.48 ± 0.018^{aY}	12.52 ± 0.025^{aY}
75	12.22 ± 0.027^{aX}	12.49 ± 0.025^{aY}	12.52 ± 0.037^{aY}
90	12.25 ± 0.029^{aX}	12.47 ± 0.022^{aY}	12.54 ± 0.014^{aY}
Total (Average)	12.26 ± 0.020^{aX}	12.57 ± 0.020^{bY}	12.67 ± 0.030^{cY}

Different superscript in a column (Small letter a,b,c,d) differ significantly (p<0.05); Different superscript in a row (Capital letter X, Y, Z) differ significantly (p<0.05)

Reproductive Performance

The reproductive performances in Sahiwal cattle with different BCS groups are presented in Table 7.

Table 7: The reproductive performances in Sahiwal cattle with different BCS groups

S.No.	Reproductive traits	BCS groups		
		G1	G2	G3
1	Post-partum estrus (days)	98.34 ± 3.51^{c}	63.67 ± 1.17^{a}	82.17 ± 1.42^{b}
2	No. of service per conception	2.17 ± 0.31^{a}	1.34 ± 0.21^{a}	1.5 ± 0.22^{a}
3	First service conception rate (%)	16.67 ± 16.67^{a}	66.67 ± 21.08^{a}	50 ± 22.36^{a}
4	Service period (Days)	143.34 ± 6.69^{c}	89.84 ± 3.79^{a}	113.84 ± 3.26^{b}

Different superscript in a row (small letter a, b, c) differ significantly (p<0.05)

Data in Table 7 revealed that the animals of G2 group had shorter post-partum estrus period, fewer services per conception, higher first service conception rate and shorter service period and the values for corresponding parameter were 63.67±1.17 days, 1.34±0.21, 66.67 per cent and 89.84±3.79 days, respectively. The Sahiwal cattle of G3 group had 82.17±1.42 days, 1.50±0.22, 50.00 per cent and 113.84±3.26 for post-partum estrus, number of service per conception, first service conception rate and service period, respectively. Whereas, Sahiwal cattle of G1 group had 98.34±3.51 days, 2.17±0.31, 16.67 per cent and 143.34±6.69 days for post-partum estrus, number of service per conception, first service conception rate and service period, respectively. The study revealed that BCS had significant (P<0.05) effect on post-partum estrus and service period under the study.

Similar findings were reported by Gillund *et al.* (2001) in Norvegian cattle, Buckley *et al.* (2003) in H.F. cows, Roche *et al.* (2009) in dairy cow, Bayram *et al.* (2008) in Swedish Red and White cows, Rao and

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Anitha (2013) in buffalo, Stadnik *et al*. (2017) in Czech Fleckvieh cows and Meena *et al.* (2019) in Kankrej cows.

Conclusion

In present study it was concluded that the fat, protein, lactose, SNF and total solid content increases with increase in BCS and as lactation advances and varied significantly between groups. The reproductive performance was improved as the BCS increased up to 3.75, but beyond that a decline in reproductive performance was noticed. Animal with moderate (3.25-3.75) BCS at calving showed better performance in respect to productive and reproductive traits.

(In Results, discussion for above conclusion is not clearly mentioned. As BCS is good (G2) or very good (G3) it is no doubt that animal is in good condition will perform better in all aspect. So, it is needed to be discussed.

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