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SHORT COMMUNICATION

EFFECT OF BODY CONDITION-SCORE ON SERUM BIOCHEMICAL PROFILE AND BODY MORPHOMETRY IN CROSSBRED DAIRY CATTLE

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ABSTRACT

A study was conducted to investigate association of body condition-score (BCS) with serum biochemical profile and body morphometry of cross-bred cows. Crossbred cows of same parity were selected randomly and grouped into three categories of 6 animals each, based on body condition score (BCS) [2-3 (A), 3-4 (B) and >4 (C)] at MLRI, Mansbal (Kashmir). Blood samples were collected from these animals at 5 stages *viz*., 15 days prepartum (stage I); and 5th day (stage II), 15th day (stage III), 30th day (stage IV) and 45th day (stage V) postpartum. Highest BCS was observed at stage I in all the groups and lowest at stage IV in group A and stage V in groups B and C. Serum glucose was highest at stage I in all the groups but significantly decreased at stage II. Serum urea showed highest value at stage IV. Total protein and albumin contents in all groups increased with progress of lactation. Total cholesterol was lowest at stage I in group B and C and at stage II in group A. Body length didn't differ among the various BCS groups. Chest girth and pelvic girth varied significantly within BCS groups with highest values of BCS in group C.

Key words: Body condition score, crossbred cattle, morphometry, serum biochemistry

INTRODUCTION

Dairy animal management is challenged by a number of factors related to the production, metabolic diseases, nutrition, reproduction, etc., which contribute to the low productivity in a dairy herd. Timely identification and monitoring of these problems through specific managemental tools helps in their control by timely interventions. Body condition score (BCS) is one such managemental tool which can be suitably used to overcome these problems and improve profitability in a dairy farm. BCS is an accepted non-invasive, inexpensive and subjective measure to assess body reserves regardless of body measurement (Mushtaq *et al*., 2012).

For dairy cows the crucial periods are calving and early lactation stages. High BCS cows loose more body condition and are metabolically challenged during early lactation due to intense mobilization of body fat (Pires *et al.,* 2013). Achieving correct body condition at calving is important to avoid calving difficulties and losses. Serum metabolic profiles (cholesterol, glucose, urea nitrogen) and BCS are known to change during days close to calving and early lactation period (Ruegg *et al.,* 1992). Relationship between BCS and the resultant changes in metabolic profile near calving to early lactation period may provide useful information related to energy balance and productive performance of dairy cattle.

With the advancement of age till maturity, skeletal developmental takes place and body dimensions increase which affect the morphometric traits (Aamir *et al*., 2010). Wither height increased by 3 cm from 1st to 2nd parity and peaked with the additional increase of 2-3 cm during 5th and 6th parities (Kertz *et al.*, 1997). A linear relationship exists between body weight and age while inverse relationship exists between BCS and body weight related to their age, as fat cows have low weight than that of muscular cows of same frame size and age (Anitha *et al.*, 2005). Body weight, heart girth and BCS are highly correlated (Gallo *et al.*, 2001; Yan *et al.*, 2009). Keeping in view the importance of BCS as dairy animal management tool, the present study was aimed to assess the association of BCS with serum biochemical profile and body morphometry in crossbred cattle near calving and during early lactation stages at an organized farm in Kashmir valley.

MATERIALS AND METHODS

The present study was conducted at Mountain Livestock Research Institute, SKUAST-K, Mansbal (Kashmir) from September 2014 to February 2015. Eighteen healthy crossbred cows (Jersey x Local cattle) of same parity were grouped into 3 groups on the basis of their body condition-score (BCS). Animals having BCS of 2-3, 3-4 and >4 on 6-point scale (Prasad, 1994) were allotted to A, B and C groups, respectively. Blood samples were collected at prefeeding (0 h) from each animal of group at 5 different stages near calving and during early lactation *viz*., 15 days before calving (stage I); and 5th day (stage II), 15th day (stage III), 30th day (stage IV) and 45th day (stage V) postpartum. A total of 90 samples were subjected to centrifugation at 3500 rpm for 5 min to obtain the concentrated serum with help of a micropipette in Eppendorf tube and were estimated for total protein, albumin, glucose, cholesterol and urea by Biuret method (Thomas, 1998), BCG method (Thomas, 1998), enzymatic GOD-POD method (Kirschner and Woods, 2001), CHOD-POD method (Rifai *et al*., 1999) and enzymatic UV-urease-GLDH method (Thomas, 1998), respectively, in an auto-analyser (Dia Sys, model: 5010 V5+) as per the instructions of the respective kits. BCS of animals were estimated on the day of blood collection.

For the estimation of body morphometry, 54 crossbred cows were randomly selected and placed in 3 groups (A, B and C) based on their BCS as above. Body length, height at wither, chest girth and pelvic girth were estimated as per standard method (Soares and Dryden, 2011) with help of a measuring tape. Data was analysed by using standard methods (Snedecor and Cochran, 1994).

RESULTS AND DISCUSSION

Body condition score (BCS) of all the 3 groups was significantly high at stage I which gradually decreased till stage V in groups B and C, while group A showed increase in BCS value after stage IV (Table 1). During stage l, the maximum loss of BCS was observed in group B (0.2) and minimum in group A (0.1). Overall BCS loss from stage l to stage V was 0.60 and 0.85 points in B and C groups, respectively; while in group A loss was only up to stage IV (0.48 points), thereafter it showed a marginal increase (0.06 points) in BCS between stage IV and V. Similar findings have been reported by Gergovska *et al.* (2011) who noticed higher BCS losses for longer periods in Holstein cows. Singh *et al.* (2009) observed a significant decrease in BCS during early lactation in moderate and high BCS groups, while there was gain in condition even during early lactation in low BCS group. In moderate and high BCS cows the body reserves got depleted to maximum during early lactation in response to more production demand while low BCS cows have high maintenance requirement and they channelled energy intake to meet this demand and build their body reserves.

Table 1: BCS and serum biochemical profile of crossbred cows at different stages

Stages	BCS	Glucose (mg dL^{-1})	Urea (mg dL^{-1})	Total protein (g dL^{-1})	Albumin (g dL^{-1})	Globulin (g dL^{-1})	Cholesterol (mg dL^{-1})
			Group A (BCS 2-3)				
I	2.80±0.16	$55.42±2.67^{a}$	$29.68±3.20^{b}$	5.98±0.29	$2.44±0.25^{b}$	$3.54±0.18^{a}$	$143.4±3.84^{b}$
II	2.70±0.16	$44.95±2.51^{bc}$	$33.34±1.72^{ab}$	5.39±0.39	$2.63±0.20^{ab}$	$2.76±0.17^{b}$	$122.0±2.15^{c}$
III	2.53±0.18	$46.74±3.62^{bc}$	$35.46±1.71^{ab}$	6.29±0.28	$3.03±0.26^{ab}$	$3.25±0.22^{ab}$	$140.9±4.58^{b}$
IV	2.32±0.16	$52.23±1.70^{ab}$	$39.32±1.41^{a}$	6.18±0.20	$3.23±0.23^{a}$	$2.95±0.29^{b}$	$128.3±5.35^{bc}$
V	2.38±0.18	$40.55±1.79^{c}$	$36.21±1.38^{a}$	6.08±0.26	$3.27±0.16^{a}$	$2.81±0.21^{b}$	$164.0±3.78^{a}$
			Group B (BCS 3-4)				
I	$3.70±0.26^{a}$	$52.34±1.49^{ab}$	$27.38±2.11^{b}$	5.49±0.35	3.61±0.16	2.06±0.29	$153.3±5.31^{d}$
II	$3.50±0.25^{ab}$	$41.23±1.74^{c}$	$30.46±3.33^{b}$	5.26±0.46	3.51±0.19	1.81±0.08	$172.5±4.16^{c}$
III	$3.43±0.23^{ab}$	$47.86±3.52^{bc}$	$34.53±1.50^{ab}$	5.84±0.27	3.71±0.20	2.12±0.27	$182.8±5.22^{bc}$
IV	$3.26±0.17^{ab}$	$55.72±2.69^{a}$	$39.97±1.57^{a}$	5.63±0.12	3.76±0.27	1.87±0.06	$206.6±2.96^{a}$
V	$3.10±0.06^{b}$	$49.12±1.60^{ab}$	$31.70±3.21^{b}$	5.94±0.07	3.78±0.27	2.16±0.28	$188.5±3.63^{b}$
			Group C (BCS>4)				
I	$4.50±0.09^{a}$	$64.16±3.41^{a}$	$26.53±2.20^{b}$	5.29±0.41	3.43±0.29	1.86±0.06	$169.6±8.30^{c}$
II	$4.35±0.28^{ab}$	$54.63±2.64^{b}$	$29.42±3.29^{ab}$	5.21±0.46	3.45±0.32	1.69±0.08	$180.7±5.41^{bc}$
III	$4.05±0.18^{abc}$	$55.78±2.68^{b}$	$32.84±1.88^{ab}$	5.65±0.13	3.56±0.27	2.08±0.28	$193.8±4.31^{ab}$
IV	$3.80±0.22^{bc}$	$54.26±2.50^{b}$	$36.23±1.39^{a}$	5.64±0.13	3.69±0.17	1.95±0.13	$184.3±5.28^{abc}$
V	$3.65±0.26^{c}$	$52.39±1.73^{b}$	$28.79±2.83^{ab}$	5.69±0.16	3.67±0.16	2.02±0.21	$198.8±3.72^{a}$

Group A (BCS 2-3), group B (BCS 3-4) and group C (BCS>4) and stages I, II, III, IV and V represent 15 days prepartum; and 5 days, 15 days, 30 days and 45 days postpartum, respectively. The number of animals in each group are six (6). Mean showing different superscripts in a column differ significantly at $p<0.05$.

Serum glucose was highest at stage I in group A, B and C with mean values of 52.23±1.49, 55.42±2.76 and 64.16±3.41 mgdL^{-1}, respectively. It decreased significantly in stage II and the magnitude of decrease varied among the groups. The results are consistent with Singh *et al.* (2009) who reported that cows in moderate to thin condition have greater requirements of glucose than cows in fat condition due to their increased maintenance requirements thereby enhancing the utilization of glucose in low condition group and reducing the serum glucose. Lactation is maintained at the cost of body reserves. Andersen *et al.* (2001) reported that heavy mobilization of body reserves towards the end of dry period resulted in more glucose level in blood. The study revealed that the mobilized energy reserves might be used by the cows to facilitate the uterine relaxation and preparing the uterus for parturition.

Urea value was lowest at stage I in all the 3 groups with mean values of 29.68±3.20, 27.38±2.11 and 26.53±2.20 mg dL^{-1} in A, B and C groups, respectively. From stage II the urea showed increase and reached highest at stage IV with values of 39.32±1.41, 39.97±1.57 and 36.23±1.39 mg dL^{-1} in groups A, B and C, respectively. In all the 3 groups mean serum urea value increased up to stage IV which might be due to the mobilization of primarily body in fat dairy cows during early lactation with a limited amount of body protein to suffice high demand of lactation. Similar trend has been observed by Singh *et al.* (2009) in dairy crossbred cattle of different BCS. Wathes *et al*. (2007) reported that dairy cows during early postpartum period mobilize fat and muscle to support lactation resulting in high plasma urea concentration.

No significant difference in total protein (TP) was observed in five stages in all the 3 groups and the values were within normal physiological range. During stage II all the groups had minimum TP value, which increased with progress in lactation period. Less feed intake in cows before a few days of calving may have led to restricted propionic acid supply resulting in reduced availability of glucose for lactogenesis. Hence, for gluconeogenesis a significant amount of protein gets directed to meet the requirements of lactose synthesis. This is in line with Singh *et al.* (2009) who reported that proteins get mobilized to support lactation. Bell *et al.* (2000) reported that body protein to an equivalent of 1 kg tissue protein gets mobilized in high yielding cows per day during 1st 7-10 days of

Table 2: Correlation coefficient among BCS and serum biochemical profile in crossbred cows

Parameters	BCS	Glucose	Urea	Total protein	Albumin	Globulin	Total cholesterol
BCS	1.00						
Glucose	0.232	1.00					
Urea	-0.584*	-0.289	1.00				
Total protein	-0.709**	-0.053	0.327	1.00			
Albumin	0.396	-0.450	-0.022	-0.327	1.00		
Globulin	-0.634*	0.289	0.293	0.706**	-0.815**	1.00	
Total cholesterol	0.490	-0.095	-0.303	-0.414	-0.362	-0.328	1.00

*Significant at P<0.05; **Significant at P <0.01

lactation. Albumin and globulin values did not significantly differ in the 5 stages between groups. The values showed increasing trend with progress in lactation. This is in conformity with Singh *et al.* (2009) who found increase in albumin increase in albumin and globulin and attributed it to their involvement in transport of fat soluble vitamins, free fatty acids, Ca, P, etc.

Minimum total cholesterol (TC) was observed at stage I in group B and C with values of 153.32±5.31 and 169.64±8.30 mg dL^{-1}, respectively; while in group A minimum TC value was found at stage II (163.96±3.78 mg dL^{-1}). Maximum TC was observed at stage V in group A and C (163.96±3.78 and 198.81±3.72 mg dL^{-1}, respectively); while in group B it was observed at stage IV as 206.64±2.96 mg dL^{-1}. The findings are in agreement with Singh *et al.* (2009) in case of crossbred cattle. Ruegg *et al.* (1992) found that from day 4-60 postpartum, serum cholesterol increased directly in association with milk production.

A weak positive correlation was observed between BCS and serum glucose (r = 0.232), albumin (r = 0.396) and total cholesterol concentration (r = 0.490) [Table 2]. Also, a negative correlation was found between BCS and serum urea concentration (r = -0.584), globulin (r = -0.634) and total protein concentration (r = -0.709). This was in consistent with Singh *et al.* (2009) who found similar correlation between BCS and serum biochemical profile in crossbred cattle.

Mean body length in all the BCS groups were statistically at par with each other (Table 3). Height at wither was significantly lower in group C (113.76±0.98 cm) as compared to group A and B; but non-significant between A and B groups. Chest (149.70±1.75 cm) and pelvic girth (155.58 ±1.75 cm) was significantly highest in group C but non-significant between A and B groups. Results suggested that with increase in BCS there was increase in chest and pelvic girth which is in accordance with of Gallo *et al.* (2001) who found increase in girth with increase in BCS.

Table 3: Body morphometric of crossbred cattle in different BCS groups

BCS group	Body length (cm)	Height at wither(cm)	Chest girth(cm)	Pelvic girth (cm)
Group A (7)	124.14±2.76	117.71±1.22^{a}	144.71±2.22^{a}	150.85±2.73^{a}
Group B (30)	123.10±0.83	117.47±1.17^{a}	146.50±0.69^{ab}	153.26±1.14^{ab}
Group C(17)	124.12±4.38	113.76±0.98^{b}	149.70±1.32^{b}	155.58±1.75^{b}

Mean showing different superscripts (a, b, c) in a column differ significantly at P<0.05; The number in parenthesis (n) depicts the number of animals

Conclusion: High BCS group cows during early lactation loose greater portion of BCS than medium and low BCS cows. High BCS cows have high serum glucose and total cholesterol while low BCS cows have high serum total protein, globulin and urea. BCS and serum glucose, albumin and total cholesterol are positively correlated.

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