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Seasonal variation in blood biochemical characteristics of Badri cattle

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Abstract

Badri cattle is found in hilly districts of Uttarakhand. The present study was carried out at University Dairy Farm, Baeni, GBPUAT, Pantnagar. Blood samples were taken randomly from 30 animals above 1 year of age each during summer and winter season to study the effect of season on blood biochemical profile. It was found that the serum glucose during winter season was significantly higher as compared to summer season. The total serum proteins during winter and summer months of Badri cattle were found to be 7.43 ± 0.09 and 7.06 ± 0.11 mg/dl, respectively with an overall average of 7.25 ± 0.08 mg/dl revealing that the total serum protein during winter months are higher than summer season. The average serum globulin, triglyceride and cholesterol levels during winter season were significantly higher than summer season. Serum creatinine and urea levels were significantly higher during summer season where as albumen and bilirubin concentrations were unaffected by seasonal effects. Thus it can be concluded that serum biochemical levels are affected by seasonal effects.

Keywords: Albumen, Badri, cholesterol, total protein, triglycerides

1. Introduction

The photoperiodic variation helps animals to forecast the changes which in turn modify their physiological responses in relation to shifts in their physical environment [1]. Blood biochemical profile undergoes a seasonal variation in response to various environmental factors. Blood profile is an important indicator for diagnosis, treatment, and prognosis of diseases [2, 3]. The alteration of hemato-biochemical parameters are major markers for physiological and pathological states of the animal [4, 5]. In order to show optimum productivity, the animal should be in thermo comfortable zone with least stressful conditions. The variation in environmental variables such as ambient temperature, relative humidity, wind and rainfall are recognized as the potential hazards in livestock growth and production [6]. Outside the thermo comfortable range, animal has to adjust the temperature by activating thermoregulatory mechanisms which occurs through physiological and behavioural changes by synchronizing the cell with its environment, innate and genetically operated timekeeping systems modifies metabolic processes in a temporally appropriate manner [7]. The severe temperature during winter and summer puts a lot of stress to animal which results in production losses. Temperature-humidity index (THI) is an important indicator of thermal conditions and the degree of stress on cows [8]. In response to high environmental temperature, there is a reduction in metabolic rates, feed intake and productivity of animal [9]. Summer and winter stress causes rigorous changes in the blood biochemical and hormonal concentration and thereby reducing the production performance of the animals [10]. Badri cattle is a short statured cattle found in hilly districts of Uttarakhand state of India. It is a source of milk and draught power for people living in hilly areas of Uttarakhand. Apart from this it is source of A2 milk which is regarded as more safe [11]. There is no information up to date regarding the biochemical characteristics of Badri cattle. So an effort was done to know the normal biochemical parameters of Badri cattle. Keeping in view the fact that environmental factors affect the animals normal physiology, present study was also designed to know the effect of season on biochemical characteristics of Badri cattle.

2. Materials and Methods

The present study was carried out at University Dairy Farm, Baeni, GBPUAT, Pantnagar. It is located in Himalayan foot hills in Tarai region at 29° N latitude, 79.3° E longitude and 243.84 m altitude. Climate is humid subtropical with cold winter and hot and humid summer.

The temperature during winters goes down upto 2°C and maximum temperature during summers may reach up to 43 °C with relative humidity ranging between 15 to 95%. Blood was collected in summer and winter during May, 2018 and January, 2019 as these two months are most severe. The average temperature during May was 31.2 °C with a range of 23.1-38.8 °C whereas in January, it was 14.8 °C ranging from 8.6 to 21.1 °C.

2.1. Experimental animals and blood collection

The blood collection site was prepared aseptically by clipping the hairs and using sterile gauze piece and spirit. About 4 ml blood sample was collected from jugular vein aseptically using disposable syringe (Dispovan HSMD) containing 18 gauge hypodermic needle early in morning at 8 am. The blood was transferred immediately to 4 ml clot activator tube and immediately transported to laboratory in a box containing ice packs. 30 blood samples from Badri cattle above 1 year of age were collected at each time in May 2018 and January 2019 for biochemical study.

2.2. Separation of serum and analysis

The blood collected in 4 ml clot activator tube was kept undisturbed in standing position at room temperature for serum separation. The clot activator tubes were centrifuged at 3000 rpm for 10 minutes after refrigeration for clot retraction. The clot was separated by using spinal needle. The serum was collected in a 2ml ependroff tube using capillary pipette and stored at -20 °C for biochemical studies. Serum analytes - total proteins (Biuret method), albumin (BCG Dye method), triglycerides (GPO-Trinder method), glucose (God-Pod method) creatinine (Jaffe's method), bilirubin (Diazo method), cholesterol (Chod-Pap method) and urea (GLDH-Urease method) were analysed by UV-VIS spectrophotometer (Bio Rad, USA) using diagnostic kits (Erbha Mannheim).

2.3. Statistical analysis

For statistical analysis, independent two sample test were performed using SPSS software. A statistical significance of was checked for p value, 0.05.

3. Results

3.1. Blood glucose

The serum glucose levels of Badri cattle during winter and summer season is given in table 1. The estimated serum glucose levels in Badri cattle were found to be 67.22±1.19 and 60.83±2.02 mg/dl, respectively with the average value of 64.17±1.23 mg/dl. The serum glucose levels in both the seasons were in normal range [12]. It was found that the serum glucose during winter season was significantly higher as compared to summer season.

3.2. Total protein

The mean serum total proteins of the Badri cattle estimated during winter and summer months have been presented in table 1. The total serum proteins during winter and summer months of Badri cattle were found to be 7.43±0.09 and 7.06±0.11 mg/dl, respectively with an overall average of 7.25±0.08 mg/dl revealing that the total serum protein during

winter months are higher than summer season. The serum total protein concentration in both the seasons was in normal range [12].

3.3. Albumen

The mean serum albumen of the Badri cattle estimated during winter and summer months have been presented in table 1. The estimated values of serum albumen were found to be non-significantly higher during summer season (3.53±0.14) than the winter season (3.43±0.16). The overall mean of serum albumen were found to be 3.48±0.11 mg/dl. The serum total protein concentration in both the seasons was found to be in normal range [12].

3.4. Globulin

The average serum globulin levels in Badri cattle were found to be 4.00±0.19 and 3.54±0.15 mg/dl during winter and summer season with an overall average of 3.77±0.12 mg/dl (Table 1).

3.5. Albumen to globulin ratio (A/G)

The average serum globulin levels in Badri cattle were found to be 1.00±0.11 and 1.10±.90 during winter and summer season with an overall average of 1.05±0.07 (Table 1). The results revealed that the serum globulin levels differed significantly during winter and summer months.

3.6. Triglycerides

The average serum triglycerides levels in Badri cattle during winter and summer seasons were found to be 35.47±0.75 and 31.96±0.95 33.72±0.64 mg/dl, respectively with an overall average of 33.72±0.64 mg/dl. the serum triglycerides were found be significantly higher during winter season owing to the reason of better feed availability and voluntary feed intake is more during winter season as compared to summer season

3.7. Cholesterol

The serum cholesterol levels in Badri cattle found during summer and winter months were found to be 110.46±1.90 and 104.57±1.66 mg/dl, respectively. The overall average of serum cholesterol levels was found to be 107.51±1.31 mg/dl. There was a significantly higher serum cholesterol levels during winter season in Badri cattle than summer season.

3.8. Creatinine

The average serum creatinine in case of Badri cattle during winter and summer seasons were found to be 1.35±0.01 and 1.73±0.07 with an overall average of 1.54±0.04 (Table 1). Statistically the present study revealed that the serum concentration were higher during summer season owing to excess muscular catabolism for energy supply as voulantry feed intake is less due to summer stress.

3.9. Urea

The average values of blood urea nitrogen in Badri cattle were found to be 27.84±0.78 and 31.67±0.99 during winter and summer months with an overall average of 29.75±0.67. Further it was found that serum urea levels were elevated significantly during summer season.

Table 1: Blood biochemical parameters of Badri cattle

	Winter season (N=30)	Summer season (N=30)	Overall mean (N=60)
Glucose (mg/dl)	67.22±1.19 ^a	60.83±2.02 ^b	64.17±1.23
Total protein (mg/dl)	7.43±0.09 ^a	7.06±0.11 ^b	7.25±0.08
Albumen (mg/dl)	3.43±0.16	3.53±0.145	3.48±0.11
Triglycerides (mg/dl)	35.47±0.75 ^a	31.96±0.95 ^b	33.72±0.64
Cholesterol (mg/dl)	110.46±1.90 ^a	104.57±1.66 ^b	107.51±1.31
Creatinine (mg/dl)	1.35±0.01 ^b	1.73±0.07 ^a	1.54±0.04
Blood urea (mg/dl)	27.84±0.78 ^b	31.67±0.99 ^a	29.75±0.67
Billirubin (mg/dl)	0.20±0.01	0.21±0.01	0.20±0.01
Globulin (mg/dl)	4.00±0.19	3.54±0.15	3.77±0.12
A/G ratio	1.00±0.11	1.10±0.90	1.05±0.07

Means bearing different superscripts in a row differ significantly ($p < 0.05$)

3.10. Billirubin

The average serum bilirubin levels in Badri cattle were found to be 0.20 ± 0.01 and 0.21 ± 0.01 during winter and summer months with an overall average of 0.20 ± 0.01 . The bilirubin concentration obtained in present study was in the normal range of bilirubin reference values in cattle [12]. The serum levels of bilirubin are unaffected by the seasonal effects.

4. Discussion

Blood profile is an important indicator for diagnosis, treatment, and prognosis of diseases [2, 3]. The blood glucose level is a representative of energy status of animals. The forage availability during the winter season is more which is responsible for elevated serum glucose levels during winter than summer season. The summer stress results in reduction of feed intake which in turn leads to lower glucose levels. The present study was in conformity with the results of [13, 14, 15, 16] who also reported that the serum glucose levels during winter were higher than that of winter. Cerutti *et al.* [17] also reported that there is seasonal effect on blood glucose concentration of cattle. Contrary to the present study Giri *et al.* [18] reported a higher level of glucose in dairy cattle during summer season. Serum protein levels are dependent upon the nutritive status and metabolism of animals which indirectly is affected by feed and fodder availability. Fodder availability is higher in winter months and environmental stress is also low. The stressful condition of summer leads to reduction of feed intake as a thermoregulatory mechanisms to decrease metabolic heat production which leads to lower serum protein concentration during summer. The serum total protein concentration was in normal range as that of other Zebu cattle [19]. The present findings corroborates with the findings of Muna *et al.* [16] and Chandershekar *et al.* [13] who also reported a significantly higher total serum proteins during winter season. However Shrikhande *et al.* [15], Das *et al.* [20] and Cozzi *et al.* [21] reported a higher serum total protein during summer as compared to winter season. The serum albumen concentrations obtained in present study were higher than Zebu cattle breeds of India [19]. These reports were in conformity with the results of Cozzi *et al.* [21] and Chandershekar *et al.* [13] who reported that serum albumen level remains unaffected by seasonal effects. However contrary to the present study, [14, 16, 20] reported a higher levels of serum albumen during summer season. Giri *et al.* [18] reported higher serum albumen content during summer season in dairy cattle at higher altitudes. Serum globulin levels in the present study were not affected by seasonal effects. The serum globulin concentration was in normal range as reported in other Zebu cattle breeds of India [19]. These results were in line with the results of Giri *et al.* [18] who also reported that there is no seasonal effect on serum globulin levels of dairy

cattle. Contrary to present study Muna *et al.* [16] reported a higher globulin concentration during winter season. Similar to the present findings, Chandershekar *et al.* [13] and Ahmed and Abdalla [9] also reported higher triglyceride levels during winter season. Contrarily Giuseppe *et al.* [22] reported higher concentration of serum triglycerides in dairy cows during summer season. Cerutti *et al.* [17] also reported that there is seasonal effect on serum triglycerides level in bulls.

The present findings were in agreement with that of [9, 13, 14] who also reported significantly higher cholesterol levels during winter season. The lower cholesterol values during summer may be attributed to lower liver activity during this period [14]. Conversely Sinha *et al.* [23] reported that the serum cholesterol levels were high in cattle during summer season. Cerutti *et al.* [17] also reported that there is a significant seasonal effect on serum cholesterol level in bulls. There are also some reports that season has no effect on cholesterol levels of cattle [24, 25].

The serum creatinine concentration obtained in present study was in normal range as that of other Indian cattle breeds [19]. The present findings were in conformity with that of Ronchi *et al.* [26] who also reported higher creatinine levels during summer season. Contrarily Muna *et al.* [16] and Chandershekar *et al.* [13] reported significantly lower levels of creatinine during summer season. Cerutti *et al.* [17] also reported a significant seasonal effect on blood creatinine levels of cattle.

The urea concentration was in normal range as reported in other Zebu cattle breeds [19]. The results were in agreement with that of Rasooli *et al.* [14] and Chandershekar *et al.* [13] who also reported higher blood urea nitrogen during summer season. This increase may be due to utilization of amino acids for energy. The other reasons may be due to protein mobilization from muscle tissue and stress related cortisol elevation which in turn increases catabolism of body proteins. In contrast to present study Eldon *et al.* [27] reported a higher urea level in dairy cattle during winter season. Cerutti *et al.* [17] also reported that there is seasonal effect on blood urea nitrogen of cattle. Giri *et al.* [18] reported that there is no seasonal variation in blood urea content of dairy cattle.

5. Conclusion

Thus the present study revealed that the blood biochemical parameters are affected by seasons.

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7. Disclosure statement

The authors certify that they have no conflict of interest.

8. Ethical statement

The permission for conducting the experiment was granted by Indian Animal Ethics Committee, College of Veterinary and Animal Sciences, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar.

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