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Original Article

BIOCHEMICAL PROFILE OF MALNAD GIDDA BREED OF CATTLE

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Abstract: The present study was conducted to establish the base line biochemical values in Malnad Gidda cattle in different seasons (winter and summer) under the agro-climatic condition of Western Ghats of Karnataka. Thirty healthy Malnad Gidda cattle divided into five groups based on age, sex and lactation. Group I and II consisted of male Malnad Gidda cattle aged between one to three years and four to five years, respectively. Group III, IV and V consisted of female Malnad Gidda cattle aged between one to three years, four to five years lactating and four to five years nonlactating animals, respectively. The biochemical parameters such as total serum cholesterol, triglycerides, HDL-Cholesterol, LDL-Cholesterol, VLDL-Cholesterol, activities of aspartate aminotransferase and alanine aminotransferase, serum total protein, serum albumin, blood urea nitrogen, serum creatinine, blood β-hydroxy butyrate and blood glucose levels were estimated. The results revealed non-significant variation between the genders within the age group and also between the age within the gender. Further, none of the biochemical parameters differed significantly between summer and winter season in Malnad Gidda cattle. The established biochemical values in present study could be used as reference values in Malnad Gidda breed reared under similar climatic and environmental conditions and also useful for academic purposes.

Key words: Malnad Gidda cattle Biochemical profile

INTRODUCTION

India has vast animal genetic resources with a wide variety of indigenous cattle. The preservation and conservation of the indigenous cattle breeds has gained priority in the recent past. Indigenous breeds of cattle from Southern India are well known for draft purposes and resistance to diseases. Malnad Gidda is one such dwarf breeds of Indian cattle with their home tract in Shivamogga, parts of Chickmagalur and Hassan, North and South Canara and Belgaum districts of Karnataka. The animals are harsh, sturdy, small to medium in size with light body, short horns with sturdy legs. They are well known for their tenacity to cope-up with adverse climatic conditions of the hilly terrain of Western Ghats [1].

Blood biochemical characterization of any animal species is a must for further biological research on the respective species. The blood biochemical profiles are very much important in evaluating the health, nutrition and physiological status of animals. Serum

biochemical data of physiologically normal animals are inevitable for the diagnosis and therapeutic purposes. Therefore, it is of utmost important to determine the range of serum biochemical constituents of the animals inhabiting a particular region with specific climatic conditions. The level of blood contents are greatly affected by factors like altitude, climate and season etc [2,3]. Owing to the need for establishment of breed specific reference ranges in indigenous cattle and paucity of information on such parameters, the present study was undertaken in Malnad Gidda cattle to establish reference values of biochemical parameters during winter and summer seasons.

MATERIALS AND METHODS

The study was conducted at Rayarakoppalu village, Magge Hobli, Alur taluk, Hassan district, Karnataka during winter season (November and December, 2011) and summer season (April and May months of 2012). Thirty randomly selected Malnad Gidda cattle with good body condition score were utilized in the present study. The selected animals were into five groups according to the age, sex and lactation, with six animals in each group. Group I and Group II consisted of male Malnad Gidda cattle aged between one to two years and four to five years, respectively. Group III, Group IV and Group V consisted of female Malnad Gidda cattle aged between one to two years and four to five years lactating and nonlactating, respectively. Male animals were uncastrated and the female animals were not in the state of pregnancy.

In all the animals, approximately 10 ml of blood was collected aseptically by jugular venipuncture in to the vaccutainers without EDTA (ethylene diamine tetraacetic acid), twice at an interval of one week during the winter and summer months. The blood samples collected were allowed to clot for 45 min at room temperature. Serum was separated by centrifugation at 3000 rpm at 30 ^{0}C for 20 min and stored at -20 ^{0}C for until analyses of biochemical parameters.

The biochemical analysis of the total serum cholesterol [4], triglycerides [5], HDL-Cholesterol [5], LDL-Cholesterol [6], VLDL-Cholesterol [6], activities of aspartate aminotransferase [7], alanine aminotransferase [7], serum total protein [7], serum albumin [7], blood urea nitrogen [7] and serum creatinine [8] was carried out in ARTOS® Semi automatic biochemical analyser using diagnostic kits obtained from M/s Span Diagnostics Ltd., Surat. The β-hydroxy butyrate [9] and blood glucose [10] were estimated immediately after the blood collection using Optium Xceed glucometer® manufactured by Abbott Diabetes Care Inc, USA.

Statistical analyses: Data obtained were analyzed by GraphPad Prism version 5.01 (2007) by application of two way ANOVA with Tukey's post test and the significance was determined at P value of 0.05.

RESULTS

The biochemical parameters such as total serum cholesterol, triglycerides, HDL-Cholesterol, LDL-Cholesterol, VLDL-Cholesterol, activities of aspartate aminotransferase and alanine aminotransferase, serum total protein, serum albumin, blood urea nitrogen, serum creatinine, blood β-hydroxy butyrate and blood glucose levels were estimated during winter and summer seasons. Mean and standard error (SE) values of all the biochemical parameters during winter and summer seasons are depicted in Table 1, which are self explanatory. The results revealed non-significant (P>0.05) variation between the genders within the age group and also between the age within the gender. Further, none of the biochemical parameters differed significantly (P>0.05) between summer and winter season in Malnad Gidda cattle.

DISCUSSION

The mean values recorded for serum total cholesterol in the present study were within the normal physiological range of 65 to 220 mg/dL reported for cattle [4]. The differences in the levels between different studies by earlier workers could be due to differences between breeds and their ecologies as well as differences in the manage-mental conditions and age of the animals. The similarity in the serum cholesterol levels of male and female animals in the present study may be due to availability of good nutrition and better health status. The significantly higher cholesterol level during summer and rainy seasons than winter season could be attributed to enhanced cortisol synthesis that occurs during summer stress wherein cholesterol acts as a precursor for the synthesis of steroid hormones in the body [5].

Table 1: Biochemical values (Mean ± SE) of different age groups in Malnad Gidda cattle during winter and summer seasons

Groups	Pre-pubertal males (aged 1 to 3 years)		Pubertal males (aged > 4 to 5 years)		Pre-pubertal females (aged 1 to 3 years)		Lactating females (aged > 4 to 5 years)		Non-lactating females (aged > 4 to 5 years)	
Seasons /Biochemical Entities	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer
Serum total cholesterol (mg/Dl)	145.22 ± 2.18	150.38 ± 6.47	152.66 ± 3.83	153.26 ± 4.02	141.87 ± 3.29	147.62 ± 2.78	137.22 ± 8.23	139.52 ± 6.14	142.49 ± 9.92	149.72 ± 7.23
Serum triglycerides (mg/dL)	71.35 ± 2.32	69.72 ± 1.52	74.14 ± 3.60	69.66 ± 2.94	67.46 ± 1.58	65.00 ± 1.37	64.17 ± 2.96	62.27 ± 2.50	72.02 ± 2.88	68.66 ± 2.81
Serum HDL-Cholesterol (mg/dL)	40.50 ± 0.76	41.67 ± 1.23	42.66 ± 0.84	43.03 ± 1.69	38.83 ± 1.56	40.53 ± 0.96	41.67 ± 1.52	42.33 ± 1.14	41.81 ± 1.29	43.37 ± 1.29
Serum LDL-Cholesterol (mg/dL)	16.41 ± 1.83	15.28 ± 1.21	17.49 ± 1.75	13.07 ± 1.76	13.44 ± 0.46	13.17 ± 0.31	14.01 ± 2.12	12.12 ± 2.56	17.05 ± 2.22	13.12 ± 1.49
Serum VLDL-Cholesterol (mg/dL)	13.95 ± 1.67	14.27 ± 1.76	13.93 ± 1.23	15.62 ± 1.67	13.00 ± 1.11	13.50 ± 1.82	12.45 ± 2.14	12.83 ± 1.43	13.73 ± 2.01	15.06 ± 1.09
AST (U/L)	75.23 ± 2.91	75.25 ± 4.40	75.18 ± 2.63	74.95 ± 4.09	72.62 ± 2.78	73.87 ± 3.29	74.74 ± 1.48	75.72 ± 1.76	74.64 ± 1.95	74.10 ± 3.10
ALT (U/L)	17.58 ± 1.08	18.39 ± 1.21	19.75 ± 1.14	19.62 ± 1.16	17.62 ± 2.78	17.87 ± 3.29	18.47 ± 1.22	17.77 ± 1.70	20.02 ± 1.20	19.95 ± 1.48
Serum total protein (g/dL)	7.79 ± 0.12	7.63 ± 0.28	8.65 ± 0.26	8.54 ± 0.21	7.60 ± 0.37	7.47 ± 0.25	8.14 ± 0.21	8.00 ± 0.27	8.47 ± 0.11	8.21 ± 0.14
Serum albumin (g/dL)	3.11 ± 0.14	3.06 ± 0.20	3.88 ± 0.17	3.67 ± 0.18	3.22 ± 0.16	2.94 ± 0.14	3.30 ± 0.19	3.25 ± 0.17	3.63 ± 0.15	3.31 ± 0.21
Blood Urea Nitrogen (mg/dL)	33.44 ± 2.48	32.29 ± 1.91	34.58 ± 0.88	34.71 ± 2.24	33.40 ± 1.79	32.99 ± 1.95	34.43 ± 2.59	34.37 ± 1.35	34.54 ± 2.30	34.69 ± 1.97
Serum Creatinine (mg/dL)	1.38 ± 0.15	1.30 ± 0.10	1.24 ± 0.10	1.27 ± 0.13	1.24 ± 0.19	1.36 ± 0.11	1.25 ± 0.05	1.22 ± 0.03	1.37 ± 0.15	1.26 ± 0.09
Blood β-hydroxy butyrate (µmol/L)	128.51 ± 2.21	125.52 ± 2.10	124.00 ± 2 .01	120.92 ± 2.13	124.71 ± 2.15	121.22 ± 2.11	128.12 ± 2.05	122.42 ± 2.13	127.41 ± 2.15	126.21 ± 2.09
Blood glucose (mg/dl)	45.80 ± 0.94	44.30 ± 1.70	45.20 ± 1.49	45.00 ± 1.08	45.30 ± 1.25	46.10 ± 0.40	47.80 ± 0.35	46.00 ± 1.58	44.90 ± 0.58	46.00 ± 0.48

The mean values of serum triglyceride level recorded in the present study were above the normal physiological range of zero to 14 mg/dL reported for cattle [4]. The values obtained in the present study were higher than the results in Hallikar cattle [5], in healthy dairy cows [6], in Holstein dairy cows [7], and in Kasargod dwarf and Vechur cattle [8]. But, these reported values were also above the established range of serum cholesterol for cattle. The serum triglycerides level was not significantly ($P>0.05$) different among the seasons but was appear to be lower during summer than winter season among all the groups. This could be due to relative reduction in serum triglycerides because of the increased activity of hormone sensitive TG-lipase in response to enhanced secretion of the cortisol during summer stress [5]. The similarity in the serum cholesterol levels of male and female animals within age group was suggestive of better nutrition and good health status.

The mean values of HDL cholesterol level were in the range of 38.83 ± 1.56 to 43.37 ± 1.29 mg/dL in different age groups during winter and summer seasons. The values obtained in the present study were lower than the results in healthy dairy cows [6], in Kasargod dwarf and Vechur cattle [8] and in dairy cattle [9]. Also, in Hallikar cattle the non-significant difference in HDL cholesterol was observed between seasons [5]. HDL cholesterol is involved in reverse transportation of cholesterol for its degradation and elimination from the body [10].

The relative increase in LDL cholesterol during summer in the present study could be attributed to the correspondingly higher levels of circulating total cholesterol. The relative increase in VLDL cholesterol during summer could be serving as antioxidant against relatively increased LDL cholesterol during this period [5].

The mean values of AST activity recorded were below the normal physiological range of 78 to 132 U/L, reported for cattle (4). But, these lower values could be assigned to the normal deviations from the normal range and to the animal differences. Similar to the present study, in the native cattle of the hilly area of Bangladesh [11] and in cattle of South Iraq [12] was observed non-significant difference between male and females animals. But, increased AST activity with advancement of age was observed among shorthorn beef cows [11] and in Angoni cattle [13]. The activity of AST varies between the species and it could be used as a marker for the detection of hepatocyte/monocyte injury [14]. The present finding signifies normal functioning of organs and good health status.

The mean values of ALT activity recorded in the present study were within the normal physiological range of 11 to 40 U/L reported for cattle [4]. But, the values obtained in the present study were lower than the results in the native cattle of the hilly area of Bangladesh [11], in Sahiwal cows [15], in Hariana cattle [16] and in Swiss brown cattle [17]. The ALT activity is found in several body organs like liver, heart and skeletal muscles. The serum ALT is recognized as a marker of hepatocelluar injury especially in dogs and cats and to a lesser extent in horses, cattle, swine, sheep and goats [18]. The present observation reveals normal health status of the animals.

The mean values of serum total protein level recorded in the present study were in the normal physiological range of 5.7 to 8.1 g/dL reported for cattle [14]. The functions of proteins in the body of animals are innumerable and forms the basis of structure of cells, organs and tissues, maintenance of osmotic pressure, catalyzing biochemical reactions, buffering acid-base balance, blood coagulation by fibrinogen, host defenses against the pathogens by immunoglobulin's, regulation of cellular metabolism and in maintenance of osmotic pressure [14]. The total protein level is an appraisal of nutritive status of an animal reflecting food intake and metabolism [18]. The variations in the total proteins levels could be due to the differences in breed, nutrition, manage-mental and environmental factors [19,20].

The mean values of serum albumin level recorded in the present study were within the normal physiological range of 2.1 to 3.6 g/dL reported for cattle [4]. The present finding signifies good health condition with adequate nutrition.

The mean values of BUN level recorded in the present study were higher than the normal physiological range of 6 to 27 mg/dL reported for cattle [4]. But, the values obtained in the present study were similar to the observations in Hariana cattle heifers [16]. The present findings reveal the normal protein metabolism without any apparent change in kidney functions.

The mean values of serum keratinize recorded in the present study were within the normal physiological range of 1 to 2 mg/dL [4]. The present findings together with observations on BUN level reveal the normal protein metabolism with adequate functioning of kidney and liver organs.

The mean values of β-hydroxy butyrate recorded in the present study were within the normal physiological range of 30 to 410 µmol/L reported for cattle [21]. The whole-blood β-hydroxy butyrate concentrations accumulate in blood when the rate of acetate oxidation is inhibited by inadequate supply of cellular oxaloacetate derived from serum glucose [14]. The increased concentration of serum non-esterified fatty acids and β-hydroxy butyrate causes detrimental effect on reproductive performance and milk production [22].

The mean values of blood glucose level recorded in the present study were lower than the normal physiological range of 45 to 75mg/dL reported for cattle [4] and it could be due to the biochemical variations which are common for all the metabolites. Glucose, being the principal carbohydrate, is involved in maintaining homeostasis and metabolism. Deficiency of glucose causes ketosis, decreased milk yield, delayed estrus, lower conception rates and increased inter-calving intervals. The present study revealed the normal glucose metabolism in the animals with better reproductive capacity.

CONCLUSIONS

It was concluded that the various biochemical values established in Malnad Gidda cattle in their native tract could serve as reference values and contribute to a better understanding of the metabolic profile for estimating the physiological status of these endangered cattle, for further investigation and for diagnostic purposes and also they are useful for academic purposes.

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