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RELATIVE CHANGES IN BLOOD BIOCHEMISTRY OF SPITZ DOG UNDER VARIABLE ILL HEALTH STATES

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ABSTRACT

A study was conducted in Spitz breed of dogs to evaluate relative changes in some blood biochemical and enzymatic parameters of clinical significance under some important health stress condition namely, dermatitis, gastroenteritis and ascites. Both ascites and dermatitis provoked marked hypoglycemia whilst hypercholesterolemia was indicated in dermatitis and gastroenteritis. Blood urea nitrogen was only increased in dogs with skin infections. Hyperglobulinemia with a concomitant marked reduction in A: G ration as well as remarkable rise in AST and ALT activity in gastroenteritic suffered dogs may be of diagnostic value. Ascitic condition was indicated by a marked hypoalbuminemia and a steep rise in enzymatic activity. Such changes in profiles may be explored as marker to characterize disease or infection in dogs.

KEYWORDS: Blood Biochemistry, Ascites, Gastroenteritis, Dermatitis, Spitz Dog

INTRODUCTION

Most people in the society maintain pets especially dogs, for companionship that also provide physiological and psychological benefits (Pachauri 1999). Their proper health care is of utmost importance to pet owners with understanding on infectious and non-infectious diseases. However, for proper diagnosis and subsequent treatment, biochemical diagnostic approach may be useful besides physical examination. The present study was therefore, undertaken to monitor relative changes in some blood biochemical parameters of clinical significance in the domestic breed of dog, suffering either from ascites, dermatitis or gastroenteritis, with an aim to explore these profiles as marker to characterize the disease and/or infection.

MATERIALS AND METHODS

Spitz dogs of 3-5 years of age were selected, when brought to Teaching Veterinary Service Complex in the Veterinary College, Jabalpur, and Madhya Pradesh as well as at local pet clinics by pet owners for treatment purpose. These were divided into three groups of six each, constituting those suffering either from ascites, gastroenteritis or dermatitis. Normal and healthy dogs were also used that formed the control group. A case history was recorded for each dog and was also physically examined.

Blood was withdrawn from the cephalic vein of the dogs belonging to each group and put into a test tube containing dry powdered EDTA (2 mg/ml) as an anti-coagulant. It was mixed rapidly and thoroughly by holding the test tube horizontally and tapping it with one hand. For estimation of blood urea nitrogen, creatinine and sugar, sodium fluoride (10mg/ml) was also added to the test tube and estimation was conducted as early as possible.

The activity of aspartate amino transferase (AST, EC: 2.6.1.1) and alanine amino transferase (ALT, EC: 1.4.1.2) was assayed in the serum, upon separation from blood by routine procedure and was conducted without delay using diagnostic kits on blood analyzer. The concentration of glucose, cholesterol, total proteins, albumin, globulin, blood urea nitrogen and creatinine was also estimated using diagnostic kits from Span diagnostics. The data were subjected to statistical analysis after calculating mean and standard deviation using conventional formulae (Snecdecor and Cochran 1964).

RESULTS AND DISCUSSIONS

The results of the present investigation revealed that the level of glucose in the blood of spitz dogs was reduced under variable ill-health states; the reduction being minimal under gastroenteritis and the maximal in ascitic suffered dogs (Table 1). The level was also significantly low in dogs with skin infection. A hypoglycemic effect observed in the present study clearly indicated a typical stress response. This may be ascribed to the disturbances in the hormonal regulation of blood glucose level by affecting the increased uptake of glucose by hepatocytes or by the extra-hepatic tissues to counteract the stress. Glucose utilization in the peripheral tissues may be increased whilst the hepatic glucose production may be decreased by decreasing the activities of gluconeogenic enzymes and increasing the activity of glucose catabolic enzymes (Murray et al. 2000). This would result into a low glucose level in the blood, as indicated in the present study. However, the extent of reduction was the maximal in the ascitic suffered dogs and the minimal under gastroenteritis state of health (Table 1). During gastroenteritis, decrease absorption of carbohydrates with other nutrients during diarrhea would affect the metabolism of the absorbed nutrients that may result into hypoglycemia, as has also been observed in the present study. To counteract stress and energy requirements, stored carbohydrates in liver and muscles may be broken down that may prevent a marked reduction in the hypoglycemic condition that may otherwise prove fatal. However, severe hypoglycemia observed in dogs suffering from ascites may be due to impairment of liver functions (Kaneko et al.1997).

The content of blood cholesterol was remarkably high in dogs suffering from either acute gastroenteritis or dermatitis. Under such health states, onset of hypoglycemia may affect cellular glucose utilization due to non-availability of fatty acids for energy purposes in order to compensate. The supply of fatty acids for hepatic utilization is obtained by mobilization from the body fat depots. This may lead to hyperchylomicronemia with an increased presence of very low density lipo-proteins resulting in the increased level of triglycerides and cholesterol (Rogers et al. 1975). During gastro-enteric condition also, vomiting and/or diarrhea causes the malabsorption of nutrients including fats that may contribute unquestionably to energy deficiency. It may increase the rate of lipolysis in the tissues and cholesterol transport in the blood may be affected that may contribute to hypercholesterolemia during such condition. However, hypercholesterolemia observed under ascites in dogs may be ascribed to the liver malfunctioning that may affect complete utilization of dietary cholesterol ester and the losses are in the form of bile acids and free cholesterol and its derivatives in bile.

The level of serum protein was slightly but significantly increased in dogs with skin infection that may be ascribed to the inflammation of the skin with concomitant significant increase in the level of globulins (Table 1). The rate of release of globulins and their clearance half times are important factors in response to inflammation and is of diagnostic usefulness (Kaeneko et al.1997). Hyperproteinemia also indicates to the simple dehydration, as is commonly observed during dermatitis in the tissues. However, decrease in albumin is a common form of dysproteinemia that may be attributed to either albumin loss or failure of albumin synthesis. During acute stage of infection, it can conveniently be associated

with slight hyperproteinemia, as has also been observed in the present study (Table 1). Therefore, hyperproteinemia associated with hypoalbuminemia may be regarded as an index to diagnose inflammation due to dermatitis. However, an investigation on the protein profile in the blood of animals suffering from different types of dermatitis will be more fruitful for clinical diagnosis.

In gastroenteritic condition too, an insignificant increase in protein level was observed. This was accompanied by hypoalbuminemia and a marked elevation in the level of globulins; A: G ratio was drastically reduced (Table1). The result of the present study correlates well with the findings of the earlier workers (Allen et al. 1996, Potoenjak et al. 2001). The hypoalbuminemia and unlike hyperproteinemia may be ascribed to the dehydration state due to vomiting or diarrhea in the dogs as well as to the inflammation of intestinal tissues during such health state.

In contrast, the level of serum protein was drastically reduced in dogs suffering from ascites. The level of albumin was also low with that may be a clinical sign of hepatocellular disease contributing to the development of ascites. This may be used as a marker for the onset of this disease, if estimated at regular intervals. In severe chronic hepatopathy, both decreased albumin and increased globulin cause a decrease in A: G ratio (Temnant 1997), as has also been observed in the present study.

In the investigation, the level of blood urea nitrogen (BUN) and creatinine were also studied to analyze the retention of nitrogenous wastes by kidney of dogs under stress (Table 1). In dogs with skin infection, level of BUN was slightly increased that may reflect an accelerated rate of protein catabolism in response to hypoglycemia, as indicated above. Its level was drastically reduced in animals suffering from gastroenteritis that indicates an increased rate of gluconeogenesis for supply of energy to counteract stress in these animals. The level of blood creatinine was markedly increased in dogs suffering from dermatitis that may indicate increased creatinine production.

Small quantities of creatinine are ingested by animals consuming diets containing animal tissues, since creatinine is distributed through body water. The quantity of creatinine formed in each day depends on dietary intake, rate of synthesis of creatinine and muscles mass (Murray et al. 2000). Thus, the infection in the muscle of the skin and tissue wasting may affect the size of creatinine pool and thereafter, the daily production of creatinine. Even in dogs with normal renal function, a direct relationship seems to exist between muscle mass and serum creatinine level (Kaeneko et al. 1997). In dogs suffering from ascites, a drastic rise in the level of blood creatinine and a moderate reduction in the concentration of blood urea nitrogen were noticed. Severe hepatic insufficiency is well reported to a reduction in the level of blood urea nitrogen (BUN) and therefore, may account for its decreased level under ascitic condition in dogs.

In present study, the changes in the activity of two protein metabolic enzymes namely ALT and AST were also monitored under ill health states of animal since these enzymic activities are being used routinely in clinical diagnosis during hepatocellular and cholestatic forms of liver injury. In skin infected dogs, the activity of both the enzymes was more or less the same (Table 1) indicating undamaged liver cells during this infection that were correlated well with the reports of earlier workers (Dzaja et al. 2004, Kiral et al. 2004). In contrast, animals suffering from acute gastroenteritis had increased serum ALT and AST activities (Table 1), indicating hepatocellular damage, as was also reported earlier (Webb et al. 2000). However, if severe condition persists, estimation of bilirubin level may also be of diagnostic significance. Likewise, both the enzymic activities were markedly elevated in ascites suffered dogs; ALT activity was increased three times as compared to AST activity that was doubled when compared to those of normal healthy dogs. This is a suggestive of hepatocyte damage as caused by ascites. A significant rise in AST activity also indicates soft tissues damage in the liver

under ascitic condition in dogs. The results are in good agreement with the work reported by earlier worker (Harder et al. 2002; Koreze et al. 2006).

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APPENDICES

Table 1: Changes in the Concentration of Some Biochemical Constituents in The Blood of Spitz Dogs under Variable Health States

Sl. No	Biochemical Parameters	Health States			
		Normal	Dermatitis	Gastroenteritis	Ascites
1	Glucose (mg/dl)	80.92± 3.607[a]	59.66 ± 3. 159[b]	75.72 ± 1.944[a]	45.53±1.217[c]
2	Cholesterol (mg/dl)	131.88± 0.469[a]	170.64 ± 6.879[b]	221.67± 6.892[c]	79.31± 1.483[d]
3	Protein	7.24 ± 0.222[a]	7.69 ± 0.163[a]	7.02 ± 0.708[a]	5.56 ± 0.217[b]
4	Albumin	2.81±0.163[a]	2.35±0.515[b]	2.01±0.236[b]	1.95±0.057[c]
5	Globulin	3.99±0.135[a]	4.80±0.644[b]	5.01±0.603[b]	3.61±0.259[c]

6	Creatinine (mg/dl)	1.70± 0.340[a]	6.54 ± 0.992[b]	3.50 ± 0.918[b]	0.74 ± 0.163[c]
7	Blood Urea Nitrogen (mg/dl)	11.83± 0.981[a]	12.60 ± 1.996[a]	5.68 ± 1.012[b]	9.96 ± 0.407[c]
Enzymatic Analysis					
1	ALT (IU/L)	61.20±0.959[a]	59.20±4.224[a]	95.38±1.0456[b]	114.20±4.495[c]
2	AST (IU/L)	40.4±5.427[a]	49.05±14.360[a]	63.7±12.078[b]	80.5±2.461[c]

Values are mean ± SE of six observations.

Mean with similar superscripts do not differ significantly from each other $P< 0.05$.