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Biochemical and hematological studies of sub-clinical ketosis in goat

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Abstract

In the present study twenty four sub-clinical ketotic goats and six healthy goats were used to observe biochemical, hematological alteration of sub-clinical ketosis. Goat suffered from sub-clinical ketosis had higher concentration of β -hydroxy butyrate (ketone) in blood and lower level of serum glucose, total serum protein, total cholesterol, sodium, potassium, haemoglobin (Hb), total erythrocyte count (TEC) and total leucocyte count (TLC). Biochemical and Haematological studies of the goat can help in the diagnosis of sub-clinical disease.

Keywords: Goat, sub-clinical ketosis, biochemical, haematological, alteration

Introduction

India possesses a huge population of Goats with many breeds. Goats are at risk of developing metabolic condition termed as "ketosis" which occurs in two stages one at the end of gestation (pregnancy toxemia) and the other during early lactation (lactational ketosis). Pregnancy toxemia is more common than lactational ketosis and occurs predominantly in improved breed Smith and Sherman (2009) [16]. Pregnancy toxemia in goat is observed in later part of pregnancy and is much more common in dam carrying multiple fetuses Kahn *et al.* (2010) [11]. There are changes in the different biochemical parameter in sub-clinically affected ketotic cattle and goat. Systematic studies on subclinical ketosis in goat in northeast region of India have not been carried so far. Hence an attempt was made to study the changes in haemato-biochemical parameter in goats suffering from sub-clinical ketosis under farm and individual rearing system.

Materials and Methods

Experimental design

The study was carried out in and around Guwahati city, Assam (26.1833° N, 91.7333° E) at Goat Research Station, Assam Agricultural University and few private farms for a period of one year (July 2014 to June 2015). The study procedure compiled with Institutional Animal Ethics Committee guidelines, Assam Agricultural University. Animals were selected based on the history of gestation and lactation.

A total of 210 samples were collected from 180 pregnant and 30 lactating goats. Goats having β -hydroxy level more than 0.4 mmol/l and blood glucose level less than 30 mg/dl were considered positive for sub-clinical ketosis. Twenty four sub-clinical ketotic goats were divided in a diseased group with six goats in each group and six healthy animals were kept in other group as control. Blood samples from diseased and healthy goats of the two group were collected and analyzed on 0, 3, 9, 21 days.

Analytical procedure

The β -Hydroxybutyrate analysis was carried out using commercial available β -ketone meter (Nova Biomedical). Two to three drops of blood was get in touched to the end of the meter strip of the β -ketone meter. Consequently the concentration of Beta hydroxy butyric acid was read in a moment on display screen of the device. Consecutively blood glucose, total serum protein, sodium and potassium analysis was carried out by commercially available kit as per method of Trinder. P, (1969) [17]. Automatic blood analyzer available at College of Veterinary

Science, Guwahati was utilized to analyze the different hematological parameters like hemoglobin (Hb), total leukocyte count (TLC), total erythrocyte count (TEC) was utilized to analyze as per method of Allain, C.C. (1974) [1].

Statistical analysis

Data obtained were subjected to standard statistical procedures using unpaired student's t-test. The p value less than 0.05 were considered statistically significant and p value less than 0.01 were considered highly significant.

Results

The haemato-biochemical parameter of healthy and sub-clinical ketotic goats is shown in Table 1 and Table 3.

Table 1: Least squares means± standard error value of biochemical parameters in healthy and sub-clinical ketotic goat

Parameters	Healthy	Diseased
Beta hydroxybutyrate (mmol/l)	0.30±0.01	0.93±0.08**
Glucose (mg %)	42.10±0.13	28.32±0.42**
Total serum protein(g/dl)	7.1±0.20	6.15±0.05**
Sodium (mmol/l)	180.31±0.10	175.63±0.20**
Potassium (mmol/l)	8.01±0.01	7.77±0.01**

** Significant different from control at $P<0.01$

Table 2: Least squares means ± standard error of hematological parameters in healthy and sub-clinical ketotic goat

Parameters	Healthy	Diseased
Hemoglobin (g/dl)	7.03±0.015	6.86±0.03**
Total leucocyte count	14.07±0.056	11.47±0.14**
Total erythrocyte count	8.45±0.02	7.96±0.01**

** Significant different from control at $P<0.01$

Discussion

The significant increased level of blood ketone ($P<0.01$) observed in diseased goat might be due to ineffective gluconeogenic response to the continued, preferential demands for glucose by the growing fetuses resulting in hypoglycemia, lipid metabolism and the accumulation of ketone bodies and cortisol, Radostits *et al.* (2009) [14]. Earlier report of increase in ketone level was also recorded by Gupta *et al.* (2005) [7] in sheep, Sailo (1993) [15], in goat in India and abroad Ismail *et al.* (2008) [10] in goat, Moghaddam *et al.* (2008) [12] in sheep. Glucose level of sub-clinically affected goats was significantly lower ($P<0.01$) in comparison to healthy goats which might be attributed to developing fetuses. Insulin level in the late pregnant doe are decreased due to which glucose is not efficiently utilized to meet the fetal needs, while at the same time lipolysis and gluconeogenesis are stimulated (Smith and Sherman 2009) [16]. A similar finding was also recorded by Gupta *et al.* (2005) [7] and Moghaddam *et al.* (2008) [12] in sheep, Sailo (1993) [15] and Ismail *et al.* (2008) [10] in goat. The significant reduction in total serum protein ($P<0.01$) in the diseased goat may be attributed to decrease in the quantity of albumin, which is produced in the liver as the liver is in stress due to production of ketone bodies. Sailo (1993) [15], Gupta *et al.* (2007) [4] and Vihan (2010) [18] also reported decrease in total serum protein in sub-clinical ketotic goat. Total cholesterol level was significantly lower ($P<0.01$) in the entire diseased animal compared to healthy group. Increase level of total cholesterol occurs in well fed condition. In the present study decrease level of cholesterol might be due to insufficient glucose in the body. As sodium-potassium level maintenance is a complex phenomenon no pin point explanation can be forwarded for

the decrease in level. Decrease level of sodium and potassium in sub-clinically affected goats was also reported by Gupta *et al.* (2007) [4].

Haemoglobin value of diseased goats were significantly lower ($P<0.01$) as compared to healthy animal. Similar finding were also reported by Gupta *et al.* (2008) [5, 6]. The decrease in the hemoglobin might be due to suppression of erythropoiesis in this metabolic disorder. In the present study, it was observed TEC was significantly lower ($P<0.01$) in the sub-clinical ketotic goat compared to the group as healthy control. Similar finding were also reported by Gupta *et al.* (2008) [5, 6]. The decrease in the TEC might be due to indicative of suppression of erythropoiesis in this metabolic disorder. TLC in all the diseased groups were significantly lower ($P<0.01$) as compared to healthy control group. Similar finding were also reported by Gupta *et al.* (2008) [5, 6]. The decrease in TLC might be suggestive of the disease has a suppressing effect on the protective mechanism of the body.

Conclusion

Sub-clinical ketosis of the goats affect the haemato-biochemical parameters. The affected goats have higher value of ketone and lower value of glucose, total serum protein, sodium, potassium, Hb, TEC and TLC. Haemato-biochemical analysis can aid in the diagnosis of sub-clinical ketosis in goats.

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