Original Research

Changes in Bench Mark Parameters in Ruminal Fluid and Blood of Goats Affected with Acute Ruminal Acidosis

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Abstract

The study was conducted at department of Veterinary Medicine, Veterinary College, Bidar and APMC hospital (VHDD and IC) Bidar. Two groups were selected for the study group first is the healthy control and group second is the acidotic goats presented to the clinics. Each group consisted of six animals each. Present investigation was undertaken to study the changes in ruminal fluid and blood of goats affected with acidosis e.g. pH of rumen liquor, gram positive bacterial count, TPC and VpCO2, VpO2, VpH, HCO_3^-, H^+, serum glucose and serum AST. The physical changes in the rumen liquor in affected goats observed were, sour smell, milky white colour and watery consistency whereas normal green colour aromatic odour and viscous-to-thick consistency was observed in healthy animals. The rumen liquor pH of healthy control group was 6.67 ± 0.05 compared to affected goats which was significantly decreased to 5.13 ± 0.14.

Key words: Acute Ruminal Acidosis, Aspartate Transaminase, Goat, Rumen Liquor pH

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Introduction

Goats significantly contribute to Indian economy and play a vital role in lively hood security of marginal and landless farmers. They provide household nutritional security and family income through meat, milk and manure with little or no feed supplementation. Mostly these animals are reared under free range system and termed as anytime money (ATM) for the rural house hold. Ruminal lactic acidosis is a carbohydrate fermentation disorder of the rumen that can affect any ruminant species including goats. Acidosis is caused by the feeding of highly fermentable carbohydrates, feeding of low fiber diet, poor management practices or a combination of these. Manifestations of acidosis vary from a slight drop in feed intake (mild) to death

(severe). Acute form of the disease in goats is characterized by indigestion, rumen stasis, dehydration, toxaemia, acidosis in coordination, collapse and frequently death in untreated cases.

Ruminal lactoacidosis is one of the most important clinical emergencies of small ruminants (sheep and goats) resulting in high mortality (Radostits *et al.,* 2007). Lactic acid is known to increase in the rumen from 1 to 1500 mg/100 mL (Uhart and Carroll, 1967) and in the blood from 4.5 to 90 mg/100 mL (Heuter *et al*., 1956; Dunlop and Hammond, 1965) following consumption of large quantity of fermentable carbohydrates. Systemic changes occurring during lactic acidosis require greater understanding for proper treatment and preventive measures to reduce the risk of grain engorgement in ruminants. Changes in blood gas parameters like VpH, H+, HCO3-, and base deficit in ruminal acidosis are important to assess the severity of disease along with the changes in rumen liquor and biochemical parameters.

Materials and Methods

Six clinical cases of acute ruminal acidosis were selected for the present study. Six healthy goats from the herd of small farmers nearby Veterinary College, Bidar were used for studying normal parameters and kept as control group. Ruminal motility was observed manually with stethoscope, for other investigations 40-50 mL rumen liquor was collected with the help of "stomach tube aspiration".

Samples were strained with the help of four fold muslin cloth and samples were kept at 4 degree centigrade in refrigerator till analysis of the following parameter. Blood samples were collected in NaEDTA vials and stored at 4 degree Celsius in refrigerator and pH of rumen liquor was estimated immediately after the collection with the help of digital pH meter and was expressed in single decimal (*viz.* 7.1, 7.2). Gram positive bacterial count was done by taking ten drops of strained rumen liquor and evenly spread on a clean glass slide and heat fixed. The smear was stained with grams staining solution and around 100 bacteria were counted and gram positive to gram negative ratio was noted (Rogosa, 1964) and it was expressed in % values. Total protozoan count was estimated as per the method described by the Moir (1951). Total protozoa were counted by taking 5 mL of strained rumen liquor and was diluted with 10 per cent formal saline to make total volume 20 mL from this 10 mL of mixed rumen liquor was taken and 10 drops of 2 per cent eosin was added to colour the protozoa. The diluted rumen liquor was then charged in a Neubauer-hemocytometer. The total protozoan count was expressed as counts per mL ($nx10^5$).

Glucose was estimated by glucose oxidase paraoxidase (op) method as described by Henry (1963) and was expressed in mg/dL. AST levels were estimated by modified IFCC method as described by Reitman and Frankel (1957) and was expressed in IU/L. Statistical analysis of data was carried out by employing paid't' test and ANOVA as per Snedecor and Cochran (1994).

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Results and Discussions

The pH of healthy control group was 6.67 ± 0.05 compared to affected goats which was significantly decreased to 5.13 ± 0.14. Similar changes were observed by Tanwar and Mathur (1983), Braun *et al.* (1992), Basak *et al.* (1993) and Shah *et al.* (2018) in goats. The gram positive bacterial count was 27 ± 1.15 percent (%) in health group which was significantly increased to 72.67± 4.19 % in affected goats this was in agreements with reports of Choudhary *et al.* (2011), Padmaja and Praveena (2011), Tufani *et al.* (2013) and Ullah e*t al.* (2013). The decrease in pH of the ruminal fluid may be due to increase production of volatile fatty acids like acetic, proprionic and butyric acid. The decrease in pH of the rumen favours the growth of streptococci with decline in the number of normal Gram negative bacteria and protozoa which further aggravates the process of lactic acid production.

The TPC (Total protozoan count) was 2.67 ± 0.21×10^5/ml of rumen liquor in healthy groups whereas in case of acidotic goats it was observed nil. The absence of protozoa in ruminal fluid of pH < 5.5 may be due to increased acid produced in rumen, which has been also reported by earlier workers Choudhary *et al.* (2011), Padmaja and Praveena (2011), Rahima *et al.* (2012), Tufani *et al.* (2013) and Ullah *et al.* (2013).

Table 1: Comparison of healthy control with acidotic goats

S. No.	Parameters	Healthy Control Animals	Acidotic Goats
1	Rumen liquor pH	6.67±0.05^a	4.88±0.07^b
2	Gram +ve bacteria	27±1.15^a	72.67±4.19^b
3	VpH	7.39±0.02^a	7.14±0.01^b
4	Base deficit	4.12±0.13^a	13.97±0.31^b
5	H+	45.62±0.66^a	110.62±2.18^b
6	HCO3-	24.85±0.21^a	11.43±0.47^b
7	Glucose	51.95±2.93^a	112.03±3.14^b
8	AST	21.62±0.93^a	99.51±2.45^b

The values bearing same superscript do not differ significantly within the each row

The blood gas analysis of healthy goats showed the values of VpH 7.39 ±0.02 which was significantly decreased to 7.14±0.01 in affected goats. This was in agreement with Angelov *et al.* (1996) and Ullah *et al.* (2013). The decrease in the pH may be due to over-distention of rumen which impedes venous return to heart. This factor impairs hepatic perfusion and poorer lactic acid utilization which in turns leads to systemic lactic acidosis, manifesting decrease blood pH (Ullah *et al.*, 2013). The values of $VpCO_2$and VpO_2 of healthy animals showed significant difference compared to the values of affected goats but both the values were within the normal physiological limits (Rahima *et al*., 2012).The HCO_3 level of healthy goats was 24.85 ±0.21mmol/L which was significantly decreased to 11.43±0.47mmol/L in affected goats this was in accordance with Rahima *et al.* (2012). The H+ of healthy goat was 45.62 ± 0.66nmol/L which showed significant increase to 110.62±2.18nmol/L in affected goats as it was also observed by Rahima *et al.* (2012). Base deficit of healthy goats was 4.12 ± 0.13mmol/L which was significantly increased to

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13.97±0.31mmol/L in affected goats. Increase in the base deficit, H+ level and reduction in the level of HCO3- were suggestive of metabolic acidosis.

Serum level of glucose in healthy goats was 51.95± 2.93mg/dl which showed significant increase to 112.03±3.14 mg/dl in affected goats. AST (Aspartate transaminase) of healthy goats was 21.62 ± 0.93 IU/L which was significantly increased to 99.51±2.45 IU/L in affected goats. These elevated levels of serum glucose and AST in acidotic goats might be due to hepatocellular damage as a result of toxic product like alcohol, histamine, thiaminase and other endotoxins produced in the rumen epithelium and thus entering the portal circulation or due to dehydration resulting in to liver damage.

Conclusion

Ruminal acidosis hampers the fermentative capacity of rumen by inhibiting the microflora and fauna. Blood gas analyzer assisted parameters like blood pH, bicarbonate, H^+ concentration and base deficit showed significant change in affected goats which was suggestive of metabolic acidosis.

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