



ISSN: 2456-2912

VET 2024; 9(1): 1150-1154

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www.veterinarypaper.com

Received: 03-11-2023

Accepted: 08-12-2023

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Effect of ruminal acidosis on clinical, ruminal and hematological parameters in goats

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Abstract

The present study was undertaken to find out the changes in clinical, ruminal fluid and hematological parameters in Ruminal acidosis Goats presented to Veterinary College, Bidar. In the present study, 18 goats presented to outpatient ward, suffering from acute ruminal acidosis (based on ruminal pH less than 5.5) were selected. The important clinical signs observed in majority of the affected goats were complete anorexia, depressed attitude, abdominal distension with fluid flashing sounds, diarrhea, regurgitation and sternal recumbency. There was no significant variation found in rectal temperature whereas There was significant increase in the mean heart rate and respiration rate in all the affected animals compared to apparently healthy animals. The chemical properties of rumen liquor showed reduced pH, absence of live protozoa, raised MBRT values with increased per cent of Gram +ve bacteria and decreased per cent of Gram -ve bacteria in the rumen liquor in all the affected goats. Among all the haematological parameters Hb, PCV, TEC and TLC values were significantly increased in all the affected goats and DLC showed no significant variation in the values of Lymphocytes, Neutrophils, Monocytes and Eosinophils.

Keywords: Ruminal acidosis, goat, rumen fluid, MBRT, hematological

Introduction

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 fibre 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, abdominal distension, diarrhea, toxemia, acidosis incoordination, collapse and frequently death in untreated cases. Systemic changes occurring during lactic acidosis require greater understanding for proper treatment and preventive measures to reduce the risk of grain engorgement in ruminants. Clinical, ruminal and Hematological changes in ruminal acidosis are important to assess the severity of the disease. Severe dehydration and cardiovascular involvement are common (Shihabudeen *et al.*, 2003) [27] in addition to biochemical changes (Sarma and Nath, 2005) [24]. The most common carbohydrate rich easily digestible feedstuffs easily accessible to goats are ragi, rice, wheat, jowar, grams and other fruits and vegetables and ingestion of which accidentally by the animal would be disastrous on their health and production. Hence, the present study was undertaken to study the changes related to clinical, ruminal and hematological parameters in ruminal acidotic goats.

Materials and Methods

The study was conducted at Department of Veterinary Medicine, Veterinary College, Bidar and APMC hospital (VHDD&IC) Bidar for a period of two years from October 2011 to June 2013. Six clinical cases of acute ruminal acidosis were selected for the present study and Six healthy goats from the herds of small farmers nearby Veterinary College, Bidar were used for studying normal parameters and kept as control Group. The temperature, heart rate and respiration rate were recorded in all the goats diagnosed for ruminal acidosis. The respiration rate was calculated by counting the movements of the rib cage and abdomen (Chakrabarti, 2006) [4] and represented in breaths/ minutes.

The rectal temperature of the animal was measured with a digital clinical thermometer by gently inserting the thermometer into rectum in rotatory manner. The rectal temperature was recorded after two minutes (Chakrabarti, 2006) [4]. The recordings were mentioned in °F.

The heart rate was recorded with the help of stethoscope at 3rd to 5th left intercostal space. The heart rate was measured in beats/minute. 2 ml of blood for hematological examination was collected from Jugular vein in a EDTA vial and Haematological parameters such as Total erythrocyte count (TEC), Total leucocyte count (TLC), haemoglobin (Hb), Packed cell volume (PCV) and Differential leucocyte count (DLC) were estimated as described by (Schlam *et al.*, 1976) [25].

The collection of rumen fluid was done with the help of rumen fluid collection apparatus (Plate - 1, 2). And it was transferred to laboratory for carrying out the routine rumen fluid examination. The physical examination of rumen fluid such as the colour, consistency and odour of rumen fluid were evaluated as described by Gnanaprakasam (1970) [11]. The pH of ruminal fluid was estimated immediately after collection with the help of digital pH meter (Plate - 8) and was expressed in single decimal (*viz.*, 7.1, 7.2....). The Gram positive to gram Negative ratio of ruminal bacteria was done by making a smear stained with Gram's staining and around 100 bacteria were counted and Gram + ve to Gram - ve ratio was noted (Rogosa, 1964) [23] and was expressed in per cent value. Total protozoal count was estimated as per the method described by Moir (1951) [15]. Methylene blue reduction time of rumen fluid was estimated by adding 1.0 ml of 0.03 per cent Methylene blue dye to 20ml of rumen fluid. Time taken for the dye to get reduced was taken as Methylene blue reduction time (Smith, 1996) [28] and was expressed in minutes.

The values were expressed in minutes. Statistical analysis of data was carried out by employing paired "t" test and ANOVA, as per Snedecor and Cochran (1994) [29].

Results and Discussions

Important outcome of the present study was recording the frequency of clinical signs in acidosis affected goats which indicated that complete anorexia (94.45%), depressed attitude (88.89%) and abdominal distension with fluid flashing sounds (83.34%) and tachycardia (83.34%). Diarrhoea with pasty sour smelling faeces (50%), regurgitation of ruminal contents (33.34%) and sternal recumbency (11.12%) were also observed in affected goats. Signs of profound dullness, recumbency, polypnoea, tachycardia in ruminal acidosis had been attributed to the toxemia associated with distention of abdomen. Regurgitation of ruminal contents and fluid splashing sounds on abdominal ballottement were due to accumulation of fluid in rumen. Similar clinical findings in acidotic goats were also observed by Tanwar and Mathur (1983) [30], Darwin *et al.* (2007a) [5], Sharma *et al.* (2010) [26], Tufani *et al.* (2013) [31] and Ullah *et al.* (2013) [32]. Hyperosmolality of ruminal content due to increased lactic acid concentration attracts extra cellular fluid in to rumen, is the important reason for over distention of abdomen in animals affected with ruminal acidosis (Dunlop, 1965 and Radostits *et al.*, 2007) [9, 21].

Rectal temperature (101.22±0.30°F) in this study revealed no significant difference in between the affected and healthy goats, this observation suggested that body temperature was not affected but fluctuated within the normal physiological limits which is in agreement with the findings of Braun *et al.*

(1992) [3] and Sharma *et al.* (2010) [26]. On the contrary Ullah *et al.* (2013) [32] observed significant decrease in rectal temperature in affected goats. The heart rate (127.50±3.18/min) in acidotic goats was significantly increased compared to healthy goats, these findings are in accordance with the observations of Tanwar and Mathur (1983) [30], Braun *et al.* (1992) [3], Patra *et al.* (1996) [18] Metkari *et al.* (2001) [14] and Tufani *et al.* (2013) [31]. Tachycardia, recorded in ruminal acidosis could be in response to ongoing dehydration, systemic absorption of lactic acid and low circulatory plasma volume (Radostits *et al.*, 2000) [20]. There was significant increase in respiration rate (54.50±2.29/min) of all the affected goats compared to healthy animals, which was also observed by Tanwar and Mathur (1983) [30], Radostits *et al.* (2007) [21], Tufani *et al.* (2013) [31] and Ullah *et al.* (2013) [32]. Huber (1976) [12] attributed elevation of respiratory rate due to stimulation of respiratory Centre by increased carbon dioxide tension of blood and decreased blood pH.

Rumen fluid analysis

The physical examination of the ruminal fluid of the affected goats revealed milky white color with watery consistency and sour odour. similar changes were reported by Braun *et al.* (1992) [3], Basak *et al.* (1993) [2], Metkari *et al.* (2001) [14], Kasaralikal *et al.* (2007) [13], Darwin *et al.* (2007b) [6], Rahima *et al.* (2012) [22] and Tufani *et al.* (2013) [31].

Chemical changes in ruminal fluid

The chemical changes observed in the ruminal fluid of affected goats were significant decrease in pH of the rumen fluid (5.13±0.14), which has been attributed to increased production of lactic acid by Gram +ve bacteria which predominate in acidic pH. Similar changes were also reported by Kasaralikal *et al.* (2007) [13], Padmaja and Praveena (2011) [16], Tufani *et al.* (2013) [31] and Ullah *et al.* (2013) [32]. The time taken for Methylene blue reduction test (MBRT) (55.00±1.86/min) was significantly increased in all the affected animals compare to healthy animals. The total protozoal count in the rumen fluid of affected goats was totally nil. Sensitivity of ruminal protozoa to the change in ruminal pH is well documented and their number declines as the pH falls below 6. Absence of protozoa in ruminal fluid with pH ≤ 5.5 has been reported by earlier workers *viz.*, Garry (1990) [10], Padmaja and Praveena (2011) [16], Rahima *et al.* (2012) [22], Tufani *et al.* (2013) [31] and Ullah *et al.* (2013) [32]. The present study observed more number of gram positive bacteria as compared to gram negative bacteria in rumen liquor of all the acidotic goats. Similar results were observed by Desai *et al.* (1999) [7], Padmaja and Praveena (2011) [16], Arora *et al.* (2011) [1] and Tufani *et al.* (2013) [31] in ruminal acidosis.

Hematological changes

The study revealed significant increase in Haemoglobin, Packed cell volume and Total erythrocyte count in the blood of acidosis affected goats. Similar hematological changes were reported by Shihabudhin *et al.* (2003) [27], Sarma and Nath (2005) [24], Sharma *et al.* (2010) [26] and Tufani *et al.* (2013) [31]. It could be due to haemoconcentration as a result of mild (4-6%) to severe (up to 10-12%) dehydration following drawing of systemic fluid in the rumen and profuse diarrhoea (Radostits *et al.*, 2000) [20]. The total leucocyte count showed significant increase in acidotic goats compare to healthy goats. Similar results were also observed by Parrah

et al. (2010) [17] and Sharma *et al.* (2010) [26]. Dunlop (1971) [8] suggested that the elevated TLC in ruminal acidosis could be due to release of endotoxins in rumen. Lymphocyte,

Neutrophils, Monocytes and Eosinophils counts in the affected goats were within the physiological limits.

Table 1: Frequency of predominant clinical signs in acute ruminal acidosis in goats

Sl. No.	Clinical signs	No. of acidotic goats showing the respective clinical signs	Frequency of predominant clinical signs in Percentage
1	Complete anorexia	17	(94.45%)
2	Depression	16	(88.89%)
3	Abdominal distension	15	(83.34%)
4	Tachycardia	15	(83.34%)
5	Diarrhoea	9	(50.00%)
6	Regurgitation	6	(33.34%)
7	Recumbency	2	(11.12%)

(n=18)

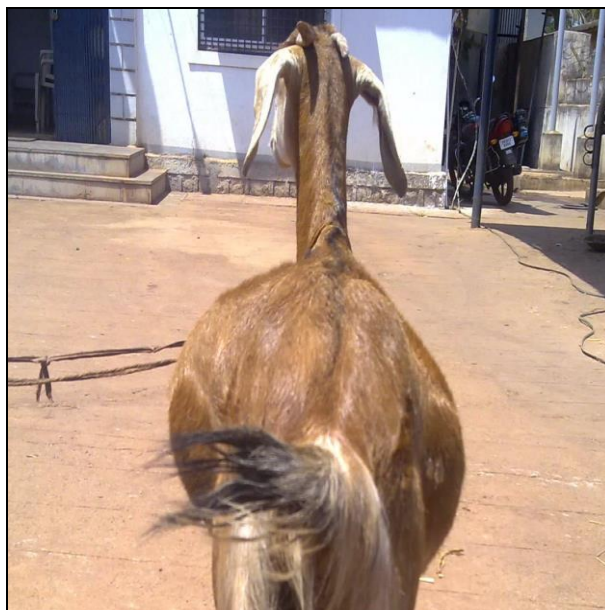


Fig 1: Prominent distension of left flank in a clinical case of acute ruminal acidosis

Table 2: Clinical, Rumen liquor and Hematological values in healthy (n=6) and Ruminal acidosis Goats

Parameters	Unit	Goats affected with Ruminal Acidosis (n=18)	Apparently Healthy Goats (n=6)
Clinical			
Rectal Temperature	^o F	101.22±0.30 ^a	101.55±0.41 ^a
Heart rate	Beats/min	127.50±3.18 ^a	75.83±0.65 ^b
Respiration rate	Breaths/min	54.50±2.29 ^a	38.83±3.33 ^b
Rumen liquor			
Ruminal pH		5.13±0.14 ^a	6.67±0.05 ^b
MBRT	Minutes	55.00±1.86 ^a	8.17±0.48 ^b
SAT	Minutes	Absent	10.17±0.45
TPC	×10 ⁵ /ml	Nil	1.03±0.18
Gram +ve Bacteria	%	77.33±4.20 ^a	27.01±1.15 ^b
Gram -ve Bacteria	%	22.67±4.20 ^a	74.50±1.20 ^b
Hematological			
Hb	Gm%	12.10±0.22 ^a	9.43±0.17 ^b
PCV	%	44.50±0.65 ^a	28.57±0.37 ^b
TLC	×10 ³ /μl	15.53±0.42 ^a	12.01±0.62 ^b
TEC	×10 ⁶ /μl	17.39±0.33 ^a	11.56±0.32 ^b
Lymphocytes	%	70.33±0.49 ^a	70.50±0.43 ^a
Neutrophils	%	24.17±0.31 ^a	23.33±0.33 ^a
Monocytes	%	2.50±0.45 ^a	3.00±0.37 ^a
Eosinophils	%	2.33±0.56 ^a	2.83±0.42 ^a

Value bearing different superscripts (a, b) within a row differ significantly ($p < 0.05$)



Fig 2: Diarrhea seen in a clinical case of ruminal acidosis in a goat.



Fig 5: Milky white coloured rumen liquor collected in a clinical case of acute ruminal acidosis in goat



Fig 3: Collection of rumen liquor in an acidotic goat at TVCC, Veterinary College, Bidar



Fig 6: Acidic pH of rumen liquor in a clinical case of acute ruminal acidosis



Fig 4: Collection of rumen liquor in an acidotic goat at field level

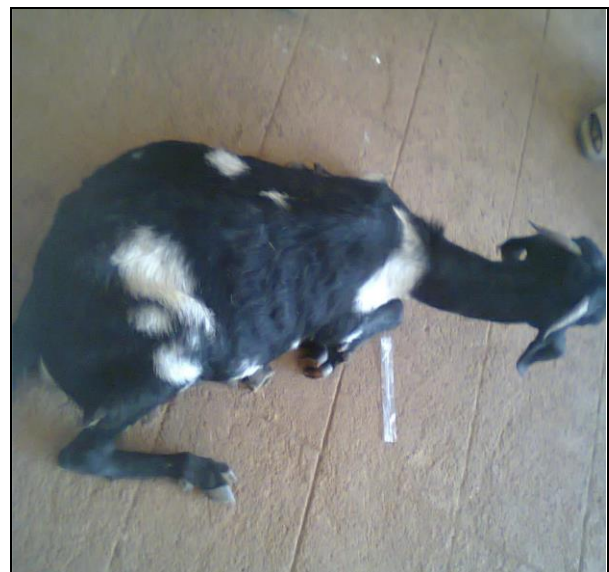


Fig 7: Acidotic goat in recumbent position on the day of presentation

Conclusion

From the above study it can be concluded that, The clinical signs like - complete anorexia, distended abdomen with fluid flashing sound, tachycardia were more frequent and the significant changes with respect to heart rate, respiration rate, the physico-chemical properties of rumen liquor and hematological parameters in the ruminal acidosis affected goats, could be helpful in diagnosing and assessing the prognosis of the case.

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