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## Therapeutic studies of ruminal acidosis in Goats

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### Abstract

Goats that were presented to the Teaching Veterinary Clinical Complex, Campus Veterinary Hospital and Veterinary Ambulatory Clinic, Mylardevpally, College of Veterinary Science, Rajendranagar, Hyderabad with the history of dietary abnormalities were screened and of which, thirty clinical cases of goats suffering with ruminal acidosis were selected. These thirty goats were assessed for clinical, ruminal, urine and haematological parameters. Based on ruminal fluid pH and severity of clinical signs, they were divided into 3 different groups, each consisting of 10 goats. The therapeutic efficacy of the different drugs used against various types of ruminal acidosis in goats was assessed. Group I goats were given sodium bicarbonate @ 1 g/kg body weight, single dose orally daily for 5 days. Group II goats were given 'Bufzone' @ 50 g single dose orally daily for 4 days. Whereas, goats of group III were administered 'Bufzone' @ 50 g single dose orally daily for 4 days and Sodium bicarbonate @ 1 g/kg body weight orally for 5 days. In addition, goats of all the three groups were administered with Chlorphenarmine maleate @ 0.5 mg/kg body weight im, Tribivet @ 2ml im and Ringer's lactate @ 25 ml, 50-75 ml, 75-100 ml iv in group I, II and III respectively. It was concluded that ruminal acidosis is a common disease of goats and its severity can be effectively reduced by combination of Bufzone and sodium bicarbonate along with supportive therapy.

**Keywords:** Ruminal acidosis, Goats, Therapeutic, Bufzone

### 1. Introduction

India has the largest population of goats in the world [7] estimated that there are around 920 million goats in the world out of which 154 million goats are found in India and 150.7 million goats in China [9]. The goats play a vital role in livelihood security of marginal and landless farmers in India. They provide household nutritional security and family income through meat, milk, wool/fibres, skin, and manure with little or no feed supplementation. Mostly goats are reared under free range system and have the history of accidental ingestion of large amount of highly fermentable carbohydrates such as wheat grain, stale chapattis and roti, stale rice, mangoes, banana, vegetables waste, ceremonial waste, vegetables market waste, hotel waste, fed with excessive amount of jowar grains, corn, wheat flour and let-out for grazing in their surroundings for few hours and these goats develop ruminal acidosis resulting in heavy economic losses due to high morbidity and mortality.

Therefore, present study was planned with emphasis on therapeutic aspects of different groups of ruminal acidotic goats.

### 2. Materials and Methods

Goats brought to the Teaching Veterinary Clinical Complex, Campus Veterinary Hospital, and Veterinary Ambulatory Clinic, Mylardevpally, College of Veterinary Science, Rajendranagar, Hyderabad with the history of dietary abnormalities, clinical manifestations of anorexia, distension of rumen, and diarrhoea were selected and screened for ruminal acidosis basing on ruminal fluid pH. Ruminal fluid was collected by following aseptic precaution from left paralumbar fossa (Ruminocentesis) as per procedure described [19]. Thirty goats were found suffering with ruminal acidosis and basing on clinical signs and ruminal fluid pH, they were divided into three different groups viz, mild, moderate and severe with rumen fluid pH as 5.5 - 6.5, 4.5 - 5.5 and 4.0 - 4.5 respectively consisting of 10 goats in each. Blood samples were collected from jugular vein aseptically for haematological analysis, in a sterile tube containing K3 Ethylene Diamine Tetra Acetic Acid (EDTA) from the thirty (30) acidotic and ten (10) healthy goats before and five days after therapy. Haemoglobin (g/dl), packed cell volume (percentage), Total leukocyte count ( $\times 10^3/\mu\text{l}$ ) and Differential leukocyte count (percentage) were estimated as per the method described [7].

Urine samples from all the affected goats were collected during normal micturation or by induction of urination by closing of nose and eyes for some time. The pH of collected urine sample from affected and healthy goats was measured with help of standard pH indicator papers (range 2-10.5). Then urine sample was subjected to Benedict's test as per the procedure described [7].

The group I (mild acidosis), group II (moderate acidosis), and group III (severe acidosis) goats were subjected to the therapeutic trials and compared against ten apparently healthy goats. The following therapy was instituted for 5 days.

**Group I:** Sodium bicarbonate + Ringers lactate (Claris)<sup>a</sup>

**Group II:** Bufzone (Intas)<sup>b</sup> + Ringers lactate (Claris)

**Group III:** Sodium bicarbonate + Bufzone (Intas)<sup>b</sup> + Ringers lactate (Claris)

All groups of acidotic goats were treated injection (Inj.) Chlorphenarmine maleate (Anistamin)<sup>c</sup> @ 0.5 mg/kg body weight im, Inj. Tribivet (Intas)<sup>d</sup> @ 2 ml im for 5 days.

**Group IV:** Apparently healthy goats (n=10) were comprised of similar mixed breed, age, sex and managemental practices and served as a healthy control for a comparative study.

- A proprietary product of M/s. Claris Lifesciences Ltd., Ahmedabad. Each 100 ml solution contains Sodium lactate 0.32 g, Sodium Chloride 0.6 g, Potassium chloride 0.04 g and Calcium chloride 0.027 g.
- A proprietary product of M/s. Intas Pharmaceuticals, Ahmedabad. Each 200 g contains a rumen buffer enriched with metabolic boosters and yeast.
- A proprietary product of M/s. Intas Pharmaceuticals, Ahmedabad. Each 1 ml solution contains Chlorphenarmine maleate 10 mg.
- A proprietary product of M/s. Intas Pharmaceuticals, Ahmedabad. Each 1 ml solution contains Vitamin B1 50 mg, Vitamin B6 50 mg and Vitamin B12 500 mcg.

Goats of group I were treated with Sodium bicarbonate @ 1 g/kg body weight orally and Ringers lactate @ 25 ml/kg body weight IV for 5 days. Goats of group II were treated with Bufzone 50 g orally and Ringers lactate @ 50 - 75 ml/ kg body weight IV for 5 days. Goats of group III were treated with Sodium bicarbonate @ 1 g/kg body weight and Bufzone 50 g orally and Ringers lactate @ 75 - 100 ml/ kg body weight IV for 5 days.

The statistical analysis of the data was subjected to one way ANOVA using statistical package for social sciences (SPSS) version 15. Differences between means were tested using Duncan's multiple comparison test and significance was set at 5 percent ( $P < 0.05$ ). The values were represented as Mean  $\pm$  Standard Error.

### 3. Results

Goats of mixed breed, age and sex were presented to Teaching Veterinary Clinical Complex, Campus Veterinary Hospital, Ragendranagar and Veterinary Ambulatory Clinic, Mylardevpally, College of Veterinary Science, Rajendranagar, Hyderabad for period of 9 months from September 2012 to July 2013 with history of dietary abnormalities, clinical manifestations of anorexia, distension of rumen, and diarrhoea were considered for the present study.

The present clinical study was carried out to ascertain the therapeutic efficacy of different regimens for ruminal acidosis in goats. The results obtained are presented as follows.

In the present study, 30 clinical cases of ruminal acidosis

were selected, based on rumen fluid pH, the goats were divided in three different groups as group I (mild ruminal acidosis), group II (moderate ruminal acidosis) and group III (severe ruminal acidosis) consisting of ten goats in each. Group I (mild), group II (moderate) and group III (severe) had mean rumen fluid pH of  $5.60 \pm 0.07$ ,  $5.10 \pm 0.07$  and  $4.0 \pm 0.17$  respectively.

Ten apparently healthy goats served as healthy control for the comparative study. Clinical signs exhibited by mild acidotic goats (Group I) were inappetence, mild bloat, reduced rumen motility, reduced rumination, semisolid faeces, firm and doughy condition of rumen on palpation of left flank and dull sound on percussion of left flank. The signs observed in moderate acidotic goats (Group II) were anorexia, distended abdomen, absence of rumination, dull appearance, absence of ruminal motility, grinding of teeth, frequent bleating, thick nasal discharge, pasty faeces, dehydration, fluid flashing sound on percussion and gurgling sound on auscultation of rumen. Whereas in severe acidotic goats (Group III), the signs were observed anorexia, severe depression, sunken eyes, staggering gait, lameness, absence of rumination, ruminal motility absent, watery diarrhoea, dehydration, oliguria to anuria, dyspnoea, tachycardia, subnormal body temperature, sternal and lateral recumbency. Clinical signs after treatment in all acidotic goats disappeared.

The haematological parameters were studied before and after therapy in different group of ruminal acidotic goats, The mean haemoglobin concentration in group I, II and III goats before and after treatment were  $13.40 \pm 0.27$  and  $11.60 \pm 0.22$ ,  $14.80 \pm 0.39$  and  $11.80 \pm 0.39$ , and  $16.20 \pm 0.33$  and  $12.10 \pm 0.31$  g%, respectively. There was a significant increase ( $p < 0.05$ ) in haemoglobin concentration of ruminal acidotic goats before treatment when compared to apparently healthy ones ( $11.20 \pm 0.39$  g %). These values decreased among respective groups following therapy. Similarly, there was a no significant difference in haemoglobin concentration after treatment between group I, II, and III. The results are presented in table 2. The mean PCV in goats belonging to group I, II and III before and after treatment were  $41.20 \pm 0.85$  and  $32.90 \pm 1.12$ ,  $45.30 \pm 1.05$  and  $35.50 \pm 1.28$ , and  $49.10 \pm 1.08$  and  $35.70 \pm 1.05$  per cent, respectively. There was a significant increase ( $p < 0.05$ ) in PCV count of group I, II and III goats before treatment when compared to apparently healthy (Group IV), it was  $32.60 \pm 1.01$  per cent. These values decreased among respective groups following therapy. Similarly, there was a no significant difference in PCV after treatment between groups I, II and III. The results are presented in table 2. The mean total leukocyte count in goats belonging to groups I, II and III before and after treatment were  $12.83 \pm 0.37$  and  $9.24 \pm 0.34$ ,  $14.01 \pm 0.39$  and  $9.45 \pm 0.32$  and  $16.23 \pm 0.36$  and  $9.78 \pm 0.26$  ( $\times 10^3$   $\mu$ L), respectively. There was a significant increase ( $p < 0.05$ ) in total leukocyte count of all affected goats before treatment when compared to apparently healthy goats (Group IV) was  $9.11 \pm 0.31 \times 10^3$   $\mu$ L. These values decreased among respective groups following therapy. Similarly, there was no significant difference in total leukocyte count following treatment between group I, II and III goats. The results are presented in table 2. The mean differential leukocyte count in group I, II and III goats before and after treatment revealed  $60.00 \pm 0.47$  and  $38.90 \pm 0.69$ ,  $62.10 \pm 0.48$  and  $39.00 \pm 0.52$ , and  $64.10 \pm 0.67$  and  $39.10 \pm 0.64$  per cent Neutrophils,  $30.30 \pm 0.40$  and  $53.70 \pm 0.73$ ,  $27.90 \pm 0.54$  and  $53.50 \pm 0.43$ , and  $25.00 \pm 0.70$  and  $53.10 \pm 0.60$  per cent Lymphocytes, respectively.

Eosinophils were  $5.6 \pm 0.37$  and  $4.40 \pm 0.16$ ,  $5.90 \pm 0.23$  and  $4.60 \pm 0.27$ , and  $6.2 \pm 0.20$  and  $4.70 \pm 0.26$  per cent and Monocytes  $4.00 \pm 0.26$  and  $3.00 \pm 0.21$ ,  $4.10 \pm 0.23$  and  $3.00 \pm 0.21$ , and  $4.70 \pm 0.21$  and  $3.10 \pm 0.23$  per cent, respectively. Neutrophils were significantly ( $p < 0.05$ ) increased in goats of group I, II, and III before treatment when compared to apparently healthy goats ( $38.80 \pm 0.87$  per cent). This parameter decreased in group I, II, and III following 5 days therapy. Lymphocytes were significantly ( $p < 0.05$ ) decreased in group I, II, and III before treatment when compared to apparently healthy goats ( $53.90 \pm 0.75$  per cent). These values increased in group I, II, and III following therapy by day 5. Eosinophils were significantly ( $p < 0.05$ ) increased in goats of groups I, II and III before treatment when compared to apparently healthy goats ( $4.3 \pm 0.30$  per cent). These values decreased in group I, II and III after therapy. Monocytes were significantly altered in group I, II, and III before treatment when compared to apparently healthy goats ( $3.00 \pm 0.21$  %). The values were decreased in group I, II and III which was not significant after therapy. The results are presented in table 2.

The therapeutic efficacy of the drugs used against various types of ruminal acidosis in goats was assessed based on clinical improvement, resumed appetite, reduction in the degree of dehydration, and normal consistency of faeces. It was also assessed based on time taken for improvement in haematological parameters to reach near or normal. The various therapeutic regimens (Table-1) were continued for 5

consecutive days for all the goats in three groups. Group I (mild acidosis) goats which received sodium bicarbonates @ 1 g/kg body weight, single dose orally daily for 5 days. Whereas, the group II (moderate acidosis) goats were given 'Bufzone' 50 g single dose orally daily for 4 days. The ruminal acidic goats of group III (severe ruminal acidosis) were administered 'Bufzone' 50 g single dose orally daily for 4 days and sodium bicarbonates @ 1 g/kg body weight orally for 5 days. The affected goats of all the three groups were administered same therapy Chlorphenarmine maleate @ 0.5 mg/kg body weight intramuscular, Tribivet @ 2ml intramuscular and Ringer's lactate @ 25 ml, 50-75 ml and 75-100 ml / kg body weight intravenously in group I, II and III respectively. The results are presented in table 2.

Goats belonging to group I, II and III were observed during the therapy. Improvement in appetite, rumination and general condition parameters was noticed in group II and III next day after treatment. Whereas, the group I goats receiving Sodium bicarbonate had shown slow recovery in symptoms as compared to group II and III goats. Group III goats showed marked improvement in appetite, general condition and physical activity, along with absence of diarrhoea after receiving Bufzone 50 g orally and Sodium bicarbonate @ 1 g/kg body weight orally. Improvement in clinical, ruminal fluid pH, haematological and urine parameters, their reversal to normalcy and overall clinical recovery was also evaluated after 5 days of treatment within and between groups.

**Table 1:** Comparative treatment schedules in goats affected with ruminal acidosis

Group	No. of goats	Oral treatment	Parenteral treatment	Schedule
I	10	Sodium Bicarbonate @ 1 g/kg body weight.	Injection Ringer's lactate @ 25 ml / kg body weight intravenously (i/v), Inj. Tribivet @ 2ml intramuscular (i/m), Inj. Chlorphenarmine maleate @ 2ml i/m.	Institution of oral and parenteral treatment was undertaken once daily as per clinical evaluation.
II	10	Bufzone @ 50g.	Inj. Ringer's lactate @ 50-75 ml / kg body weight intravenously, Inj. Tribivet @ 2ml i/m, Inj. Chlorphenarmine maleate @ 2ml i/m.	Institution of oral and parenteral treatment was undertaken once daily as per clinical evaluation.
III	10	Sodium Bicarbonate @ 1g/kg body weight + Bufzone@50g.	Inj. Ringer's lactate @ 75- 100 ml / kg body weight i/v, Inj. Tribivet @ 2ml i/m, Inj. Chlorphenarmine maleate @ 2ml i/m.	Institution of oral and parenteral treatment was undertaken once daily as per clinical evaluation.
IV	10	Healthy Control	.....	.....

**Table 2:** Therapeutic efficacy of different regimens evaluated based on the comparative means of parameters as per ANOVA results.

Sr. No.	Parameters	Ruminal acidotic goats						Group IV (Healthy goats)
		Group I (mild)		Group II (moderate)		Group III (severe)		
		Before Treatment	After Treatment	Before Treatment	After Treatment	Before Treatment	After Treatment	
<b>Rumen fluid Ph</b>								
1	pH	$5.6^* \pm 0.07$	$6.75 \pm 0.17$	$5.1^* \pm 0.07$	$6.70 \pm 0.08$	$4.0^* \pm 0.17$	$6.55 \pm 0.14$	$7.05 \pm 0.12$
<b>Haematological parameters</b>								
1	Hb (g/%)	$13.40^* \pm 0.27$	$11.60 \pm 0.22$	$14.80^* \pm 0.39$	$11.80 \pm 0.39$	$16.20^* \pm 0.33$	$12.10 \pm 0.31$	$11.20 \pm 0.39$
2	PCV (%)	$41.20^* \pm 0.85$	$32.90 \pm 1.12$	$45.30^* 1.05$	$35.50 \pm 1.28$	$49.10^* 1.08$	$35.70 \pm 1.05$	$32.60 \pm 1.01$
3	TLC ( $\times 10^3$ /Cumm)	$12.83^* \pm 0.37$	$9.24 \pm 0.34$	$14.01^* \pm 0.39$	$9.45 \pm 0.32$	$16.23^* \pm 0.36$	$9.78 \pm 0.26$	$9.11 \pm 0.31$
4	DLC							
	i. Neutrophils (%)	$60.00^* \pm 0.47$	$38.90 \pm 0.69$	$62.10^* \pm 0.48$	$39.00 \pm 0.52$	$64.10^* \pm 0.67$	$39.10 \pm 0.64$	$38.80 \pm 0.87$
	ii. Lymphocytes (%)	$30.30^* \pm 0.40$	$53.70 \pm 0.73$	$27.90^* \pm 0.54$	$53.50 \pm 0.43$	$25.00^* \pm 0.70$	$53.10 \pm 0.60$	$53.90 \pm 0.75$
	iii. Eosinophils (%)	$5.60^* \pm 0.37$	$4.40 \pm 0.16$	$5.90^* \pm 0.23$	$4.60 \pm 0.27$	$6.20^* \pm 0.20$	$4.70 \pm 0.26$	$4.30 \pm 0.30$
	iv. Monocytes (%)	$4.00^* \pm 0.26$	$3.00 \pm 0.21$	$4.1^* \pm 0.23$	$3.00 \pm 0.21$	$4.70^* \pm 0.21$	$3.10 \pm 0.23$	$3.00 \pm 0.21$

Urine parameters								
1	Urine pH	6.45* ± 0.14	7.15 ± 0.11	6.30* ± 0.13	7.10 ± 0.15	5.60* ± 0.15	7.05 ± 0.12	7.20 ± 0.08
2	Benedicts test	Positive	Negative	Positive	Negative	Positive	Negative	Negative

\* Significant at (p<0.05)

#### 4. Discussion

The present study was carried out for a period of 9 months from September 2012 to July 2013 among goats that were presented to the Veterinary Ambulatory Clinic, Mylardevpally and Teaching Veterinary Clinical Complex, Campus Veterinary Hospital, Rajendranagar, College of Veterinary Science, Rajendranagar, Hyderabad, with a history of dietary abnormalities, accidental ingestion of carbohydrate rich diet and clinical manifestations of anorexia, distension of rumen, and diarrhoea. In goats, the digestive disorders particularly rumen dysfunctions are the most common encountered problems under peri-urban area among the various diseases. Ruminal acidosis occur in goats which gain access to large quantities of readily digestible carbohydrates, particularly grain, apples, sugar beets, mangoes, bakery products, market and household waste. It is characterized by indigestion, rumen stasis, dehydration, diarrhea, toxemia, in coordination and death.

In the present study, clinical efficacy of Sodium bicarbonate and Bufzone in the management of ruminal acidosis was evaluated. Ruminal acidosis is an emergency disorder of fore-stomach which requires immediate treatment to prevent the death of the affected animals. Ruminal acidotic goats were treated according to the severity of the disease. The various therapeutic regimens were continued for 5 consecutive days for all the goats in three groups. Group I (mild acidosis) goats received sodium bicarbonate @ 1 g/kg body weight, single dose orally daily for 5 days. Whereas, group II (moderate acidosis) goats were given 'Bufzone' 50 g single dose orally daily for 4 days. Group III (severe ruminal acidosis) were administered 'Bufzone' 50 g single dose orally daily for 4 days and sodium bicarbonate @ 1 g/kg body weight orally for 5 days. In addition, the affected goats of all the three groups were treated with Chlorphenarmine maleate @ 0.5 mg/kg body weight intramuscularly, Tribivet @ 2ml intramuscularly and Ringer's lactate @ 25 ml, 50-75 ml and 75- 100 ml / kg body weight intravenously in group I, II and III respectively. Administration of oral Sodium bicarbonate neutralized the lactic acid produced locally inside the rumen to prevent chemical ruminitis and to restore normal ruminal pH, which reduced the effect of metabolic / systemic acidosis. Similar treatment was advocated by many earlier researchers [1, 2, 3, 4, 5, 8, 10, 11, 13, 14, 15, 16, 17, 19, 20, 21, 22, 23, 24, 25, 26, 27]. Bufzone with supportive therapy and Sodium bicarbonate were used in the management of rumen acidosis in cows (4). Bufzone powder is a buffering oral drug containing ideal ruminal buffers, metabolic booster and yeast for the management of ruminal acidosis. It is composed of alkalinizing substances which increases rumen pH greater than Sodium bicarbonate alone. Its buffering efficacy has been evaluated [4, 8, 12, 21]. A course of antihistaminic drug, Chlorphenarmine maleate was given to all the groups of goats to counteract histamine release due to chemical ruminitis and also reduce the rumen and blood histamine levels. Ringer's lactate fluid was given intravenously to correct the acidosis and dehydration and to restore renal function. It also maintains the sodium, potassium and chloride levels of acidotic goats. Intramuscular injection of Tribivet was administered to acidotic goats to correct

thiamine deficiency caused by abnormal growth of thiaminase enzyme producing bacteria inside the rumen. Thiamine helps in metabolism of lactic acid and thus helps in preventing further systemic lactic acidosis.

Goats belonging to group I, II and III were observed during the therapy. Improvement in appetite, rumination and general condition was noticed in group II and III a day after treatment. Whereas, group I goats which received Sodium bicarbonate had shown slow recovery in symptoms as compared to group II and III goats which received Bufzone orally. Group III goats showed marked improvement in appetite, general condition and physical activity, along with absence of diarrhoea after receiving Bufzone @ 50 g orally and Sodium bicarbonate @ 1 g/kg body weight orally. The therapeutic efficacy of the drugs used against various types of ruminal acidosis in goats was assessed based on clinical improvement, resumed appetite, reduction in the degree of dehydration, consistency of faeces normal, normal heart rate, respiration rate and conjunctival mucous membrane. Improvement in clinical, ruminal fluid, urine, haematological and biochemical parameters, their reversal to normalcy and overall clinical recovery was observed after 5<sup>th</sup> days of treatment within and between groups.

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