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Prevalence of Ruminal Lactic Acidosis and Clinical Assessments of Four Therapeutics in Goats of Bangladesh

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Abstract : Acidosis conditions either acute or chronic following ingestion of excessive amounts of readily fermented carbohydrate are great production problems for goat in Bangladesh. This study designed to investigate the prevalence of lactic acidosis and then response to different therapeutic agents. For this purpose, 1,128 goat were examined at outdoor District Veterinary Hospital, Faridpur, Bangladseh for treatment of which 40 goats were found positive for lactic acidosis showing 3.55% prevalence of disease. The highest occurrence found in female (4.64%) of over 3 years age (4.64%) in indigenous goat (2.7%). For therapeutic assessment the forty affected goats were divided into four groups A, B, C and D comprising of 10 animals each. Group A were given magnesium hydroxide 8% w/v at 1 g/kg body weight orally. In group B magnesium hydroxide 8% w/v at a dose as group A combination with 7.5% sodium bicarbonate at the rate of 0.9 ml/Kg body weight intravenously administered. Goat in group D were treated with mixture of ginger, nuxvomica, sodium carbonate, cobalt sulphate, dried ferrous sulphate and thiamin mononitrate at the rate of 1 g/kg body weight orally. Goat of group C treated with combination drugs of group A, B and D. The rectal temperature, pulse rate, respiration rate, was performed before and after treatment. It was found that the highest recovery in group C with an average period of 21 ± 1.8 hours. It was concluded that lactic acidosis is a common disease of goats and its severity can be effectively reduced by using combination drugs.

Key words **:** Prevalence, acidosis, goat, therapeutics.

Introduction

Veterinary hospitals and clinics help in understanding the geographic and environmental source of diseases and their natural history (8). The goat is the most commercially important species of small ruminants to the rural people of Bangladesh. Carbohydrate engorgement is one of the most commonly encountered gastrointestinal disorders of the goat (1). The disease is clinically characterized by anorexia, depression, abdominal distension, diarrhea, weakness and inactivity. The disease is commonly encountered due to unintended ingestion of large quantities of cereal grains or their flour kept for human consumption (12). In clinically affected animals morbidity rate varies from 10-50 percent and case mortality in lactic acidosis may reach to 90 percent in untreated cases whereas it may be 30-40 percent in treated cases (13). In carbohydrate engorgement, there are abnormal distension of rumen, lactic acidosis and atony of the rumen leading to the retention of fermented gases and finally death of the affected animal (2).

Sodium bicarbonate has been well researched, with the product having been on the market for the past 40 years. The ginger has got carminative and antizymotic effects on the gastrointestinal tract (14). It increases gastric motility and corpus motor response in human and animals (4). Cobalt is an essential trace element, which is present in each molecule of vitamin B_{12} (18). In the animals and human cobalt is used to prevent and treat cobalt deficiency and to improve blood profile (9). The ferrus sulphate has got hematinic effect in the animal body (18). Thiamine derivatives and thiamine depended enzyme are present in all tissues of the body. Thiamine is normally synthesized by the rumen microbes (bacteria, protozoa etc). In carbohydrate engorgement the acidic rumen pH resulting decrease in the population of rumen microbes, this ultimately leads to the fall in biosynthesis of thiamine. The oral administration of thiamine, however, restores the function of the cells and tissues by replenishing thiamine deficiency (17).

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Therefore, this clinical study was done to study the following objectives-

i) To evaluate therapeutic efficacy of certain drugs alone or in combination for the treatment of clinical cases of carbohydrate engorgement in goats.

ii) To study the Occurrence of clinical cases of carbohydrate engorgement in terms of age, sex and breed in goats.

iii) To study the postmortem changes of the carbohydrate engorgement in this species.

Materials and Methods

This study was conducted to study the effect of various treatments regimes on clinical cases of carbohydrate engorgement in goats, brought to the District Veterinary Hospital, Faridpur, Bangladesh. A total of 1, 1,128 goats were examined at outdoor District Veterinary Hospital, Faridpur, Bangladseh for treatment of which 40 goats were found positive for lactic acidosis and treated during study period.

Occurrence of carbohydrate engorgement in goats

The occurrence of carbohydrate engorgement in goats in terms of age (3 months to less than 1.5 years, between 1.5 and 3 years, and above 3 years), sex (male & female), and breed indigenous (Black Bengal) goats, Jamunapari and others) were recorded during the study period.

Experimental design:

The affected goats (n = 40) were randomly divided into 4 groups (each 10) and were treated with different drugs. The therapeutic efficacies of drugs were assessed on the basis of rumen deflatation, return of appetite, rumination, normal defecation, urination and normal posture of the animal.

Group A

Consisted of 10 animals with clinical cases of carbohydrate engorgement which were administered only Magmil® (100 ml bottle, Pacific Pharmaceuticals, Bangladesh) containing magnesium hydroxide 8% w/v). The drug was administered orally 1 g/kg body weight orally.

Group B

Also consisted of 10 clinically affected goats with carbohydrate engorgement. A combination of two drugs (i) Magmil® and (ii) Sodib® inj 25 ml vial (Jayson Pharmaceuticals, Bangladesh containing 7.5% sodium bicarbonate). The Magmil® was administered similar doses with group A and Sodib® were injected 0.9 ml/kg body weight intravenously.

Group C

Consisted of 10 clinically affected goats with carbohydrate engorgement. In this group a combination of 3 drugs (i) Magmil® (ii) Sodib® and (iii) Rumenal® 20 g sachet (FnF Pharmaceuticals, Bangladesh), which contain ginger, nuxvomica, sodium carbonate, cobalt sulphate, dried ferrus sulphate and thiamin mononitrate). The Magmil® and Sodib® were used similar doses with group A and B. The Rumenal® was administered orally at the dose rate of one pack per 20 kg twice daily for two days.

Group D

This group also consisted of 10 clinical cases of carbohydrate engorgement which were treated administering only Rumenal® one pack per 20 kg body weight twice daily for two days.

Clinical parameters

The respiration rate, pulse rate, rectal temperature and rumen motility were recorded routinely before the administration of drugs and post treatment until recovery. The progress of recovery of carbohydrate engorgement in animals in each group was monitored daily. The changes were recorded in various treatment groups until recovery.

Postmortem findings

The post-mortem examination was performed only in the animals that died from per acute cases of carbohydrate engorgement. The gross changes in the different organs were recorded. The specimen collected included rumen content, rumen, abomasum, intestine, heart, kidney, liver, lungs *etc*.

Statistical Analysis

The data were collected, calculated and presented as mean ± SD. the student's *t*-test was done to analyze the data and $p < 0.05$ or less was considered as statistically significant.

Results

Occurrence of carbohydrate engorgement

During the study period a total of 1,128 goats were brought to the District Veterinary Hospital, Faridpur, Bangladseh for treatment, out of which 40 goats were found to be affected with carbohydrate engorgement, the occurrence being 3.55%.

The occurrence of carbohydrate engorgement on the basis of age, sex and breeds of the affected goats

Among the 3 age groups the highest occurrence (4.91%) of carbohydrate engorgement was observed in the goats over 3 years of age, whereas the lowest occurrence (2.55%) was recorded in the age group between 3 months to 1.5 years. The occurrence was 3.04% in age group between 1.5 to 3 years (Table 1). The highest occurrence of carbohydrate engorgement was recorded in females as 4.64% in comparison to that of the males which was recorded as 2.19% (Table 2). Out of 1054 indigenous goats, 38 were affected with carbohydrate engorgement, the occurrence being recorded as 3.61%. Among 74 Jamunaprai goats, 2 cases of carbohydrate engorgement were recorded. The occurrence was calculated as 2.7%. The occurrence of carbohydrate engorgement was higher in the indigenous goats in comparison to that of

Table 1. Occurrence of carbohydrate engorgement in goats of different age groups

Age groups	No. of goats surveyed	No. of animals affected with carbohydrate engorgement	Occurrence (%)
3 months to 1.5 years	314	8	2.55
Between 1.5 and 3 years	427	13	3.04
More than 3 years	387	19	4.91
Total mean	1128	40	3.55

Table 2. The occurrence of carbohydrate engorgement on the basis of sex and breed variation

Parameters	Specific parameter	No. of goats surveyed	No. of clinical cases of carbohydrate engorgement	Occurrence (%)
Sex	Male	503	11	2.19
	Female	625	29	4.64
Breed	Indigenous	1054	38	3.61
	Jamunapari	74	2	2.70

Table 3. Effects of various drugs on respiration rate during carbohydrate engorgement affected goats (n = 40)

Groups	Drugs	Before treatment '0' hour	After treatment		
			24 hours	48 hours	72 hours
A (n = 10)	Magmil®	47.8 ± 10.737	43.7 ± 13.913	34.8 ± 21.678*	34.6 ± 21.864*
B (n = 10)	Magmil® + Sodib®	47.40 ± 5.621	37.00 ± 3.640	35.44 ± 3.005	35.67 ± 2.872*
C (n = 10)	Magmil® + Sodib® + Rumenal®	54.60 ± 5.48	40.20 ± 8.02	35.40 ± 3.17*	35.30 ± 2.95*
D (n = 10)	Rumenal®.	57.60 ± 13.327	44.22 ± 13.92	42.25 ± 15.09	37.00 ± 2.89*

the Jamunaprai goats (Table 2).

Evaluation of therapeutic efficacy of different drugs

In group A, 7 animals recovered in average period of 31.4 ± 4.6 h which represents 70% of animals. In group B, 8 animals out of 10 recovered in average period of 30 ± 4 h which represents 80% of animals). In group C, 10 animals out of 10 recovered in average period of 21 ± 1.8 h which represents 100% of animals. In group D, 5 animals out of 10 recovered in average period of 29 ± 3.4 h which represents 50% of animals (Fig 1).

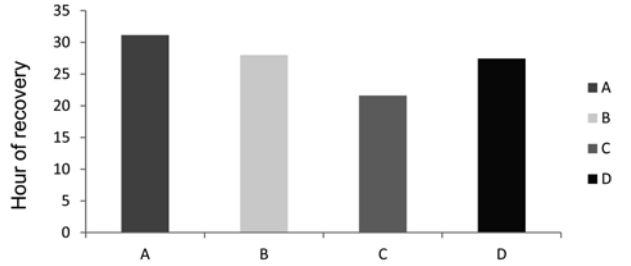

Fig 1. Recovery period (hours) of carbohydrate engorgement treated with different drugs A, B, C and D. before and after treatment, A: Magmil® (magnesium hydroxide 8% w/v), B: Magmil®-Sodib® (7.5% sodium bicarbonate) C: Magmil®-Sodib®-Rumenal® D: Rumenal® (mixture of ginger, nuxvomica, sodium carbonate, cobalt sulphate, dried ferrus sulphate and thiamin mononitrate).

Clinical parameters

Effects on respiration

The pre-treatment respiration rates in the Magmil®, Magmil®-Sodib® combination, Magmil®-Sodib®-Rumenal® combination and Rumenal® alone groups were 47.8 ± 10.73, 47.40 ± 5.61, 54.60 ± 5.48 and 57.60 ± 13.32 per min respectively (Table 3). These values at 24 hours post-treatment decreased to 43.7 ± 13.91, 37.00 ± 3.64, 40.20 ± 8.02, and 44.22 ± 92 per min respectively. Respiration rates continued to decrease and at 48 hours of treatment these values reduced to 34.8 ± 21.67, 35.44 ± 3.00, 35.40 ± 3.17 and 42.25 ± 15.09 per min, respectively. These decreases at various stages of treatment were significant ($p < 0.05$) as compared to pre-treatment values.

Effects on heart rate

The heart rates prior to treatment with Magmil®, Magmil®-Sodib® combination, Magmil®-Sodib®-Rumenal® combination and Rumenal® alone were 74.00 ± 5.29, 73.00 ± 3.90, 80.20 ± 12.88, 80.20 ± 9.77 per min, respectively (Table 4). These values at 24 hours post-treatment decreased to 70.70 ± 7.13, 66.44 ± 4.187, 67.30 ± 5.29 and 70.22 ± 11.82 per min, respectively (Table 4). Heart rates continued to decrease and after 48 hours of treatment these values decreased to 68.71 ± 5.78, 66.89 ± 3.33, 65.89 ± 4.76 and 68.00 ± 11.22 per min respectively. These changes at various stages of treatment were significant ($p < 0.05$) when compared with the pre-treatment values.

Table 4. Effects of various drugs on heart rate in carbohydrate engorgement affected goats (n = 40)

Groups	Drugs	Before treatment '0' hour	After treatment		
			24 hours	48 hours	72 hours
A (n = 10)	Magmil®	74.00 ± 5.292	70.70 ± 7.134	68.71 ± 5.794	68.86 ± 6.414*
B (n = 10)	Magmil® + Sodib®	73.00 ± 3.801	66.44 ± 4.187	66.89 ± 3.333	66.22 ± 2.774*
C (n = 10)	Magmil® + Sodib® + Rumenal®.	80.20 ± 12.88	67.30 ± 5.29	65.80 ± 4.76*	65.90 ± 4.46*
D (n = 10)	Rumenal®.	80.20 ± 9.773	70.22 ± 11.82	68.00 ± 11.22	64.86 ± 5.79*

Table 5. Effects of various drugs on rectal temperature in Carbohydrate engorgement affected goats (n = 40)

Groups	Drugs	Before treatment '0' hour	After treatment		
			24 hours	48 hours	72 hours
A (n = 10)	Magmil®	102.47 ± 1.058	102.44 ± 0.809	102.21 ± 1.222	102.43 ± 1.163
B (n = 10)	Magmil® + Sodib®	101.95 ± 1.235	101.87 ± 0.596	102.08 ± 0.460	102.06 ± 0.464
C (n = 10)	Magmil® + Sodib® + Rumenal®.	102.47 ± 1.61	101.72 ± 0.92	102.16 ± 0.51	102.26 ± 0.47
D (n = 10)	Rumenal®.	103.07 ± 1.318	102.40 ± 0.87	102.39 ± 0.95	102.09 ± 0.52

Table 6. Effects of various drugs on rumen motility in carbohydrate engorged goats (n = 40)

Groups	Drugs	Before treatment '0' hour	After treatment		
			24 hours	48 hours	72 hours
A (n = 10)	Magmil®	0.47 ± 0.05	0.49 ± 0.08	1.33 ± 0.39*	1.33 ± 0.40*
B (n = 10)	Magmil® + Sodib®	0.47 ± 0.06	0.57 ± 0.07	1.46 ± 0.05*	1.49 ± 0.03*
C (n = 10)	Magmil® + Sodib® + Rumenal®.	0.47 ± 0.05	1.46 ± 0.05	1.47 ± 0.04*	1.47 ± 0.03*
D (n = 10)	Rumenal®.	0.48 ± 0.05	1.32 ± 0.37	1.33 ± 0.37*	1.48 ± 0.03*

Effects on rectal temperature

The rectal temperature prior to treatment with Magmil®, Magmil®-Sodib® combination, Magmil®-Sodib®-Rumenal® combination and Rumenal® alone were 102.47 ± 1.05, 101.95 ± 1.23, 102.47 ± 1.61 and 103.07 ± 1.318°F, respectively (Table 5). At 24 hours post-treatment these values deceased to 102.44 ± 0.80, 101.87 ± 0.59, 101.72 ± 0.92 and 102.39 ± 0.95°F respectively. Rectal temperature continued to normal and at 48 hours of treatment these values were recorded as 102.21 ± 1.22, 102.08 ± 0.46, 102.16 ± 0.51 and 102.39 ± 0.95°F, respectively. However, the changes in the rectal temperature were no statistically significant ($p > 0.05$).

Effects on rumen motility

The pre-treatment rumen motility rates with Magmil®, Magmil®-Sodib® combination, Magmil®-Sodib®-Rumenal® combination and Rumenal® alone were 0.47 ± 0.05, 0.47 ± 0.06, 0.47 ± 0.05 and 0.48 ± 0.05 per min, respectively (Table 6). These values at 24 hours post-treatment increased to 0.49 ± 0.08, 0.57 ± 0.07, 1.46 ± 0.05 and 1.32 ± 0.37 per min respectively. Rumen motility rate continued to increase and at 48 hours of treatment these values increased to 1.33 ± 0.39, 1.46 ± 0.05, 1.47 ± 0.04 and 1.33 ± 0.37 per min, respectively. These increases at various stages of treatment were significant ($p < 0.05$) as compared to pre-treatment control values.

Postmortem findings

The post mortem was done in the peracute cases of carbohydrate engorgement affected goats. The goats were brought to the District Veterinary Hospital, Faridpur, Bangladesh for treatment and died of the diseases before giving any treatment. The gross changes in the rumen, rumen content, reticulum, intestine, heart, lungs, liver and kidney were recorded. Undigested rice and paddy were found in the rumen content

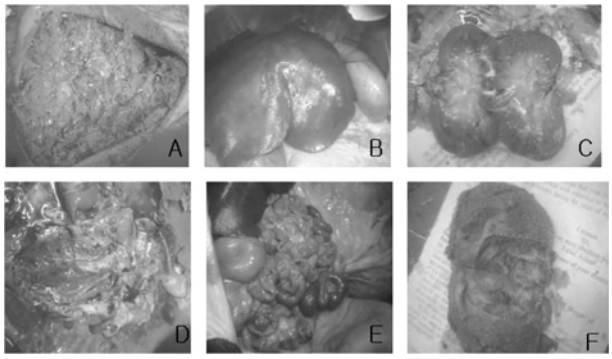

Fig 2. The post mortem was done in the peracute cases of carbohydrate engorgement affected goats. (A) Presence of undigested rice in rumen content, (B) Congestion in liver, (C) Severe congestion in kidney, D: Severe congestion and hemorrhage in lungs, (E) Congestion and reddish discoloration of intestine and F: Severe congestion in omasum.

(Fig 2A). The rumen was filled with fluid. Severe congestion and patechial hemorrhage were found in the liver (Fig 2B), kidney (Fig 2C), lungs (Fig 2D), intestine (Fig 2E) and omasum (Fig 2F).

Discussion

During the study period a total of 1,128 goats were brought to the District Veterinary Hospital, Faridpur, Bangladesh out of which 40 goats were affected with carbohydrate engorgement, the occurrence being recorded as 3.55%. The highest (4.91%) and the lowest (2.55%) occurrence were recorded in the animals of the aged group more than 3 years and less than 1.5 years, respectively. These findings are in agreement with the report of Blood and Johnston (2). The highest occurrence of the disease in the aged goats may be associated with weak digestion capability, larger volume of the rumen and voluminous ingesta as compared to that of the young animals. In this study the highest occurrence of the disease was observed in the females (4.64%) in comparison to that of the males (2.19%), which is similar to the report of Jani *et al* (10). In our country context the meat of the male goats is preferred to that of the females. That is why the male goats are very often slaughtered for different purposes, resulting in the decrease the population of the male goats in comparison to that of the female goats. On the other hand, the female goats are usually reared for production purpose. During pregnancy and immediately after parturition the females need increased amount of nutritional demand. Therefore, during these periods they may take indiscriminately larger volume of carbohydrate rich feed. These might explain why the occurrence of carbohydrate engorgement is found to be higher in the females in comparison to that of the male goats. The carbohydrate engorgement was recorded more in the indigenous goats (3.61%) in comparison to that of the Jamunapari and other breeds (2.70%). These findings cannot be compared and contrasted because of the lack of the similar reports. However, the increased occurrence of the disease in the indigenous goats may be due to the higher population in comparison to the other breeds of goats.

The recovery percentage of carbohydrate engorgement was higher in case of drugs used in combination, Magmil® + Sodib® + Rumenal® (100%), and Magmil® + Sodib® (90%), respectively in comparison to the drugs used alone Magmil® (60%) and Rumenal® (70%). The commonly used oral antacids in veterinary practice include relatively non-absorbable salts of aluminum, calcium or magnesium. The antacids increase pH of the ruminal contents through neutralization of gastric acids. The Magmil® contains magnesium hydroxide 8% w/v. In ruminants 20% of the oral dose of magnesium can be absorbed. Magnesium hydroxide has potent alkalinizing effect on rumen pH (15). In ruminant, magnesium hydroxide is generally used to increase rumen pH and as a laxative/purgative which helps to evacuate the rumen contents in case of rumen engorgement, rumen acidosis, grain overload rumen impaction *etc*. The Magmil® used in this study helps to recovery from carbohydrate engorgement through increasing the rumen pH and evacuating the rumen contents through increased vowel movement.

Increased blood pH and metabolic acidosis also observed in carbohydrate engorgement which needs to be neutralized. The Sodib® (7.5% sodium bicarbonate) used to neutralize the blood pH in this study. Suzuki K *et al* (16) also used sodium bicarbonate to neutralize metabolic acidosis in carbohydrate engorgement.

The Rumenal® contains ginger, nuxvomica, sodium bicarbonate, cobalt sulphate, dried ferrous sulphate and thiamine mononitrate. The nuxvomica has similar tonic effects with strychnine on the gastric mucous membrane. It stimulates vasomotor and motor centre in the cord, increasing the activity of the circulation and promoting general systemic tone. The ginger has good carminative and antizymotic effects on the gastrointestinal tract (14). It increases gastric motility and corpus motor response in human and animals (4). Cobalt is an essential trace element, which is present in each molecule of vitamin B_{12} (18). In the animals and human cobalt is used to prevent and treat cobalt deficiency and to improve blood profile (9). The ferrous sulphate has got hematinic effect in the animal body (18). Thiamine derivatives and thiamine depended enzyme are present in all tissues of the body. The deficiency of which seems to adversely affect various systems. However, the nervous system and cardiovascular system are particularly sensitive to thiamine deficiency, because of their high oxidative metabolism. Thiamine is normally synthesized by the rumen microbes (bacteria, protozoa etc). In carbohydrate engorgement the acidic rumen pH resulting decrease in the population of rumen microbes, this ultimately leads to the fall in biosynthesis of thiamine. The oral administrations of thiamine, however, restore the function of the cells and tissues by replenishing thiamine deficiency (17).

The increased respiratory rate recorded during the pretreatment period in carbohydrate engorgement may be due to metabolic and respiratory acidosis, which became normal during post-treatment period, because of buffering effect of sodium bicarbonate and other drugs (13).

The significantly increased ($p < 0.05$) heart rate recorded on the pre-treatment period and became gradually normal, during the post treatment period. In carbohydrate engorgement, metabolic acidosis activates sympathetic nervous system and causes trachycardia (13). The oral and iv administration of sodium bicarbonate has buffering effects that neutralizes acidosis and restore the blood and ruminal pH , leading to the decrease in the heart rate (6).

In this study there was no significant change in the rectal temperature, during the pre-treatment and post-treatment periods. However, in some cases subnormal temperature was recorded during pretreatment period, which become normal after post-treatment. The fall in the temperature might be due to the absorption of endotoxin in the circulation in case of carbohydrate engorgement (5). This finding is in agreement

with the previous reports of the Blood and Johnston.

Usually the rumen motility becomes decreased or ceased completely in carbohydrate engorgement. This is due to muscle atony resulting from the depression of sympathetic and sympathomymetic ganglion. The drugs and combination of drugs used in this study contains several constituent which have buffering and sympathomymetic effects (Sodium bicarbonate, nuxvomica, magnesium hydroxide etc). These drugs help to re-established the rumen motility through restoration of the intraruminal and metabolic acidosis (7).

Congestion in the rumen and intestinal wall was recorded. The rumen wall also demonstrated patchy mucosal desquamation. These changes might result from exerts corrosive action of the rumen wall and this may cause sloughing of mucous membrane (11). There is protrusion and congestion of the tongue, marked congestion and haemorrhages of lymph nodes to the head and neck, epicardium and upper respiratory tract, friable kidneys. The lungs are compressed and there is congestion and haemorrhage of the cervical portion of the oesophagus but the thoracic portion of the oesophagus is pale and blanched (13). Usually, the liver is pale because of displaced blood and interruption of blood supply (3,13). The rumen and exfoliation of the cornified epithelium of the rumen with marked congestion of submucosal tissues (13).

It was concluded that lactic acidosis is a common disease of goats and its severity can be effectively reduced by using magnesium hydroxide, sodium bicarbonate and mixture of ginger, nuxvomica, sodium carbonate, cobalt sulphate, dried ferrous sulphate and thiamin mononitrate.

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방글라데시 염소에서 유산증의 분포 및 4가지 치료법의 임상적 적용

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요 약 : 쉽게 발효되는 탄수화물의 과도한 양의 섭취에 따른 급성 또는 만성의 산증은 방글라데시에서 염소의 생산성 문제로 나타나고 있다. 본 연구는 유산증의 분포와 다른 치료제간의 반응을 조사하였다. 본 연구를 위해, 야외 지역 동물 병원, Faridpur, Bangladseh에서 조사 한 1,128마리의 염소가 검사 되었으며, 그 중 40마리의 염소(3.55%의 분포율)가 유산증에 대해 양성으로 확인되었다. 토종 염소 (2.7%)에서는 3 년 이상된 연령(4.64%)의 암컷 (4.64%)에서 가장 높은 발병을 보였다. 40마리 염소의 치료 평가를 위해서 염소는 그룹당 10마리씩 4개의 그룹 A, B, C와 D로 분류 하였다. 그룹A는 경구, 8% 수산화 마그네슘(v/w)을 체중 1 g/kg으로 경구 투여 하였다. 그룹 B에서는 그룹 A와 같은 량의 8% 수산화 마그네슘에 더하여 체중 0.9 ml/kg 비율로 7.5%의 중탄산 나트륨을 정맥 내 투여 하였다. 그룹 D에서 염소는 생강, nuxvomica, 탄산나트륨, 황산 코발트, 분말 형태의 황산제1철 과 티아민 질산염의 혼합물을 1 g/kg 체중의 비율로 경구 투여하였다. 그룹 C의 염소는 그룹 A, B와 D의 조합 약물로 치료하였다. 각 그룹은 치료 전후에 직장 온도, 맥박수, 호흡 수를 검사하였다. 평균 21 ± 1.8 시간으로 그룹 C가 가장 높은 회복률을 보였다. 결론적으로 유산증은 염소에서 흔한 질병이며 치료효과는 약물의 조합을 통해서 효과적으로 증상을 감소 시킬 수 있었다.

주요어 : Prevalence, acidosis, goat, therapeutics