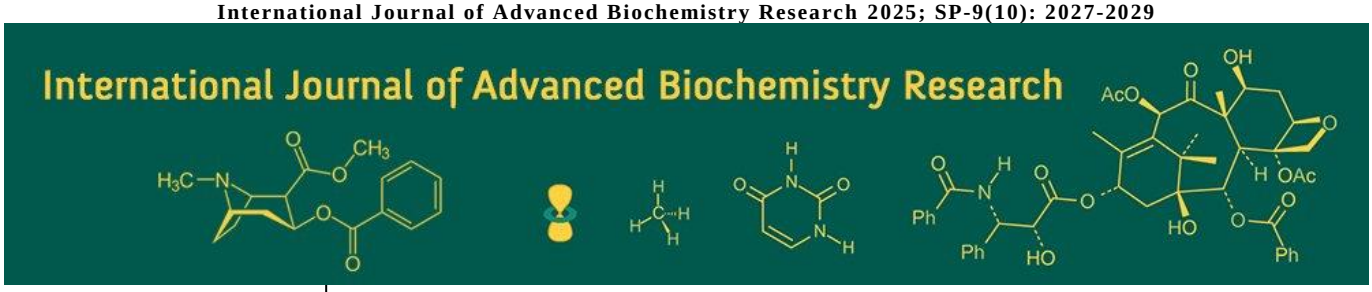

ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2025): 5.29
IJABR 2025; SP-9(10): 2027-2029
www.biochemjournal.com
Received: 11-07-2025
Accepted: 13-08-2025

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Therapeutic management of acid indigestion in cattle: A comparative study

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DOI: https://www.doi.org/10.33545/26174693.2025.v9.i10Sy.6148

Abstract
This study evaluates the therapeutic efficacy of two treatment protocols for ruminal acid indigestion in cattle. Twelve affected animals were divided into two groups of six each. Group I received conventional therapy, while Group II underwent rumen lavage and transfaunation in addition to conventional therapy. The comparative outcomes were assessed based on clinical recovery and hematological and biochemical parameters.

Keywords: Acid indigestion, Cattle, Rumen lavage and transfaunation

Introduction
Acute acid indigestion is considered as life threatening and needs an emergency therapy. Therapeutic management of lactic acidosis in cattle involves specific therapy and should be focused on correction of plasma volume deficits and treatment of local (rumen) and systemic acid-base disturbances, restoration of normal rumen microenvironment, and treatment/prevention of potential secondary complications (Snyder and Credille, 2017) [10].
Rumen lavage technique is a non-surgical method employed for removal of rumen contents (Sasikala *et al.*, 2018) [9]. Transfaunation is believed to improve rumen function and has been used as a biotic treatment for ketosis, anorexia and several causes of indigestion such as rumen acidosis (Depeters and George, 2014) [4].
The present study was conducted between February 2023 and June 2023 on cattle presented to the Primary Veterinary Centre, Kasipet Mandal, Mancherial District, and its surrounding villages. The therapeutic findings are summarized as follows.

Materials and Methods
Study Design:Twelve cattle diagnosed with ruminal acid indigestion were randomly assigned to two groups. Each group received treatment for five consecutive days.
Treatment Protocols:

- Group I (Conventional Therapy):
- This included intravenous administration of 8.4% $NaHCO_3$ (5 mL/kg body weight [b.wt.]) over 20-30 minutes, followed by 1.3% isotonic sodium bicarbonate (50-150 mL/kg b.wt. for 6-12 hours). Additional interventions included:

1. Inj. Normal Saline (NS): 10-50 mL/kg IV
2. Inj. Ringer's Lactate (RL): 10-50 mL/kg IV
3. Inj. Zeet: 0.4 mg/kg b.wt. OD, IM
4. Inj. Tribivet: 10 mL/450 kg b.wt. OD, IM
5. Inj. Megludyne: 1 mg/kg BID, IM
6. Inj. Ceftriaxone: 5 mg/kg BID, IM
7. Oral $NaHCO_3$: 1 g/kg b.wt. initially, followed by 0.25 g/kg BID for 3-5 days
8. PulvisBufzone: 200 g OD, PO for 3-5 days

- Group II (Conventional Therapy + Rumen Lavage and Transfaunation):
- In addition to the aforementioned therapy, rumen lavage was performed using gravity and suction methods, followed by transfaunation to restore normal rumen microflora.

Results and Discussion

Clinical Observations

Group II cattle exhibited quicker improvements in appetite, rumination, and general condition compared to Group I. By the third day of therapy, 66% of Group II cattle showed clinical improvement, with full recovery (100%) achieved by the fifth day. In contrast, only 17% of Group I animals improved by the third day, with 83% recovering by day five. One animal in Group I (16.67%) succumbed to the condition, whereas all Group II cattle survived.

Hematological Findings

- **Group I:** Pre-treatment mean hemoglobin (Hb), packed cell volume (PCV), total erythrocyte count (TEC), and total leukocyte count (TLC) were significantly elevated compared to healthy controls. Post-treatment, Hb, PCV, and TEC values showed a significant reduction ($p<0.05$), while TLC reduced non-significantly.
- **Group II:** Similar pre-treatment elevations were noted. Post-treatment, all parameters reduced significantly ($p<0.01$) and aligned closely with healthy control values.

Table 1: Mean values of Haematological parameters in different Groups of Cattle affected with Acid Indigestion

Parameters	Group I			Group II			Healthy Group III
	Before Therapy	During Therapy	After therapy	Before Therapy	During Therapy	After therapy	
	0 Day	3rd Day	5th Day	0 Day	3rd Day	5th Day	
Hb (g/dl)	17.18 ± 0.22**	16.12 ± 0.26	14.78± 0.32*	17.21 ± 0.32**	13.12 ± 0.32*	10.95± 0.35**	10.75 ± 0.32
PCV%	49.68 ± 0.15**	42.76 ± 0.13*	38.97 ±0.16*	49.70 ± 0.14**	34.75 ± 0.15**	33.94 ± 0.11**	33.92 ± 0.11
TEC ($x10^6$µL)	10.52 ± 0.26**	9.97 ± 0.05	8.96 ± 0.25*	10.47 ± 0.20**	8.05 ± 0.20*	7.05 ± 0.05**	7.03 ± 0.05
TLC ($x10^3$µL)	18.80 ± 0.09**	17.47 ± 0.26	16.61 ± 0.13	18.81 ± 0.09**	12.41 ±0.14*	9.14 ± 0.25**	8.42 ± 0.25

*Significant at ($p<0.5$). ** significant at ($p<0.01$)

Table 2: Mean values of Biochemical parameters in different Groups of Cattle affected with Acid Indigestion

Parameters	Group I			Group II			Healthy Group III
	Before Therapy	During Therapy	After therapy	Before Therapy	During Therapy	After therapy	
	0 Day	3rd Day	5th Day	0 Day	3rd Day	5th Day	
Lactate (mmol/L)	4.50 ± 0.02**	3.59 ± 0.05	2.96 ± 0.74*	4.52 ±0.09**	2.04 ± 0.03*	1.44 ± 0.13**	1.31 ± 0.31
ALT (U/L)	50.65 ± 0.74*	49.36 ± 0.39	48.92 ± 0.59	50.67 ± 0.45*	29.42 ± 0.31*	28.15 ± 0.38*	28.49 ± 0.41
AST (U/L)	131.80 ± 0.71**	129.10 ± 0.43	127.40 ± 0.66	132.05±0.54**	79.51 ± 0.66*	54.40 ± 0.35**	53.37 ± 0.35
Albumin mg/Dl	1.75 ± 0.12	1.98 ± 0.12	2.19 ± 0.12	1.76 ± 0.11	2.18 ± 0.18	2.50 ± 0.16	2.85 ± 0.14

*Significant at ($p<0.5$). ** Significant at ($p<0.01$)

Biochemical Alterations

Blood Lactate

The mean blood lactate levels (mmol/L) on day 0 were significantly elevated ($p<0.01$) in Group I (4.50 ± 0.02) and Group II (4.52 ± 0.09) compared to the healthy group (1.31 ± 0.31). In Group I, the lactate levels showed a non-significant reduction to 3.59 ± 0.05 on day 3 and a significant decrease ($p<0.05$) to 2.96 ± 0.74 by day 5. In Group II, there was a significant decrease in blood lactate levels ($p<0.05$ and $p<0.01$) to 2.04 ± 0.03 and 1.44 ± 0.13 on days 3 and 5, respectively, compared to baseline (day 0).

Alanine Aminotransferase (ALT)

Baseline alanine aminotransferase (ALT) levels (U/L) were significantly higher ($p<0.05$) in Group I (50.65 ± 0.74) and Group II (50.67 ± 0.45) compared to the healthy group (28.49 ± 0.41). In Group I, ALT levels decreased non-significantly to 49.36 ± 0.39 on day 3 and 48.92 ± 0.59 on day 5. However, in Group II, ALT levels decreased significantly ($p<0.05$) to 29.42 ± 0.31 and 28.15 ± 0.38 on days 3 and 5, respectively, compared to baseline.

Aspartate Aminotransferase (AST)

The aspartate aminotransferase (AST) levels (U/L) on day 0 were significantly elevated ($p<0.01$) in Group I (131.80 ± 0.71) and Group II (132.05 ± 0.54) compared to the healthy group (53.37 ± 0.35). In Group I, AST levels showed a non-significant reduction to 129.10 ± 0.43 on day 3 and 127.40 ± 0.66 on day 5. In Group II, AST levels significantly decreased ($p<0.05$ and $p<0.01$) to 79.51 ± 0.66 and 54.40 ± 0.35 on days 3 and 5, respectively, compared to baseline.

Albumin: Blood albumin levels (mg/dL) were slightly lower in Group I (1.75 ± 0.12) and Group II (1.76 ± 0.11) on day 0 compared to the healthy group (2.85 ± 0.14), but the difference was not statistically significant. In Group I, albumin levels increased non-significantly to 1.98 ± 0.12 on day 3 and 2.19 ± 0.12 on day 5. Similarly, in Group II, albumin levels increased non-significantly to 2.18 ± 0.18 on day 3 and 2.50 ± 0.16 on day 5, compared to baseline.

Therapeutic Efficacy: Group II demonstrated superior therapeutic outcomes, with faster normalization of clinical signs and hematological parameters. These findings underscore the efficacy of integrating rumen lavage and transfaunation into the treatment regimen for ruminal acid indigestion.

This study evaluated the clinical efficacy of two treatment regimens for managing ruminal acidosis in cattle, emphasizing the therapeutic benefits of sodium bicarbonate, Bufzone, and magnesium hydroxide in combination with supportive measures. Sodium bicarbonate, when administered orally, neutralized locally produced lactic acid in the rumen, preventing chemical ruminitis and restoring normal ruminal pH. This action mitigates the effects of systemic acidosis, consistent with findings by Snyder and Credille (2017) [10], Bashir *et al.* (2015) [2], and others. Sodium bicarbonate's reaction with hydrogen ions in lactic acid to form carbon dioxide, water, and sodium acetate exemplifies its role in facilitating alkalinization (Hindman, 1990) [8].

Bufzone, a blend of ruminal buffers, metabolic boosters, and yeast, proved effective in rapidly increasing ruminal pH when used alongside sodium bicarbonate (Gupta *et al.*, 2023) [7]. Studies suggest that magnesium hydroxide is an even more potent alkalinizing agent, providing superior efficacy in raising rumen pH (Snyder and Credille, 2017) [10].

Supportive intravenous fluids, such as Ringer's lactate (RL) and normal saline (NS), corrected dehydration and electrolyte imbalances, aligning with protocols by Arora *et al*. (2011) [1] and Choudhary *et al*. (2011) [3]. RL, in particular, addressed metabolic acidosis while enhancing renal function. Alternatives like oral electrolyte solutions have also been reported by Elnady *et al*. (2019) [5].

The administration of antihistamines, such as chlorpheniramine maleate, reduced histamine levels associated with chemical ruminitis, a common consequence of lactic acidosis. Previous studies (e.g., Tufani *et al*., 2013; Snyder and Credille, 2017) [11, 10] also support the use of antihistamines to mitigate rumen inflammation.

To address thiamine deficiency and prevent complications like polioencephalomalacia, B-complex injections containing thiamine were administered. Thiamine plays a crucial role in lactic acid metabolism, a finding corroborated by earlier studies (Bashir *et al*., 2015; Snyder and Credille, 2017) [2, 10].

Antibiotic therapy, including ceftriaxone, prevented secondary infections like liver abscesses and vena caval thrombosis. Although systemic antibiotics like penicillin are widely used for similar conditions (Snyder and Credille, 2017) [10], care must be taken to minimize disruption to rumen microflora.

Flunixin meglumine, administered intramuscularly, reduced inflammation and prevented complications such as laminitis and endotoxemia. Other anti-inflammatory agents like meloxicam and dexamethasone have been similarly employed in managing ruminal acidosis (Tufani *et al*., 2013) [11].

Enhanced Efficacy of Rumen Lavage and Transfaunation

Group II cattle underwent conventional therapy combined with rumen lavage and transfaunation, significantly enhancing recovery outcomes. Rumen lavage, facilitated by specialized equipment such as the Rajendranagar Tippu-mouth gag (RTMG) and suction apparatus, removed acidotic contents and high-energy carbohydrates, thereby addressing the root cause of acid indigestion (Arora *et al*., 2011) [1]. Warm water flushing through a large-bore stomach tube, as described by Snyder and Credille (2017) [10], further supported ruminal clearance.

Following lavage, rumen transfaunation provided a direct microbial inoculum from healthy donor cattle, expediting the re-establishment of normal rumen function. Studies have shown that even small volumes (3-6 liters) of donor rumen fluid significantly improve feed intake and microbial activity (Galbat and Keshta, 2020; Snyder and Credille, 2017) [10].

In the present study, Group II cattle showed early improvements in appetite, rumination, and overall condition, with 66% recovering by the second day and 100% by the fifth day. This contrasts with slower recovery in Group I, which received conventional therapy alone. Transfaunation's cost-effectiveness and lack of withdrawal periods further underscore its practicality as a supportive therapy in veterinary practice.

Conclusion

The study highlights the advantages of combining conventional therapy with rumen lavage and transfaunation in managing ruminal acid indigestion in cattle. The combined approach significantly enhances recovery rates and normalizes physiological parameters more effectively than conventional therapy alone. The combined use of rumen lavage and transfaunation alongside conventional therapy demonstrated superior efficacy in treating ruminal acidosis, as reflected in improved clinical signs, normalized biochemical parameters, and enhanced rumen fluid analysis. These findings highlight the need to integrate advanced techniques such as transfaunation into routine management practices for ruminal disorders, offering a sustainable and effective approach to improving animal health and productivity.

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