

**STUDIES ON INDIGESTION IN BUFFALOES
WITH PARTICULAR
REFERENCE TO THERAPY**

By

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No part of the thesis has been submitted for any other degree or diploma. The published part has been fully acknowledged. All assistance and help received during the course of the investigations have been duly acknowledged by the author of the thesis.

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LIST OF ABBREVIATIONS AND SYMBOLS

%	-	Per cent
@	-	at the rate of
<	-	Lesser than
>	-	Greater than
°C	-	Degree Celsius
°F	-	Degree Fahrenheit
µg	-	Micrograms
ALT	-	Alanine amino transferase
AST	-	Aspartate amino transferase
AT	-	After therapy
BT	-	Before therapy
dl	-	Decilitre
DLC	-	Differential leucocyte count
EDTA	-	Ethylene diamine tetra acetic acid
et al	-	and all
etc.,	-	Etcetera
Fig.	-	Figure
g	-	grams
i/m	-	intramuscular
i/v	-	intravenous
IU/l	-	International units/ litre
Kg	-	Kilogram
M/s	-	Manufactured by

mg	-	milligram
mg/dl	-	milligrams/deciliter
ml	-	milliliter
mm ²	-	square millimeter
nm	-	Nanometers
no.	-	Number
P	-	Probability level
RFU/ml	-	Reitman and Frankel Units/milli litre
ROS	-	Reactive oxygen species
rpm	-	Revolutions per minute
SRL	-	Strained rumen liquor
SE	-	Standard Error
SGOT	-	Serum glutamic oxaloacetic transaminase
SGPT	-	Serum glutamate pyruvate transaminase
Spp	-	Species
Tab	-	Table
viz.,	-	namely
w/v	-	weight/volume

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ABSTRACT

During the period of study i.e. from January 2002 to June, 2003 , out of a total of 26514 buffaloes admitted to the various veterinary clinics in and around Tirupati with different ailments, the incidence of indigestion was found to be 35.46%. Among these, the incidence of simple indigestion, acid indigestion, alkaline indigestion, impaction and tympany were observed as 82.13%, 0.56%, 11.61%, 4.41% and 1.09% respectively. The per cent of incidence of digestive disorders was more in summer when compared to other seasons.

Six apparently healthy buffaloes were selected to serve as control group to delineate the normal physiological values. Six cases each with acid and alkaline indigestion were selected and subjected to detailed clinical examination, rumen liquor evaluation, haematological and biochemical analysis. These findings of the fermentative disorders were compared with that of healthy control group, to assess the extent of alterations. Buffaloes with acid indigestion exhibited signs of anorexia, decrease in milk yield, rumen hypermotility, mild tympany. There was significant increase in pulse rate, SAT, MBRT, TVFA and decrease in pH, protozoan motility, iodophilic activity and gas production time found on rumen liquor evaluation. Hematological analysis revealed significant increase in the values of Hb, PCV and WBC. There was significant increase observed in inorganic phosphorus, glucose, BUN and no changes were observed in Ca, Mg, protein and albumin - globulin ratio. On clinical examination buffaloes with alkaline indigestion were showing various symptoms viz., anorexia, decrease in milk yield, suspended rumen motility, hard and scanty dung. The rumen liquor was dark brown with putrid smell. There was no significant change in temperature and respiration rate. There was significant increase in the mean values of pH, SAT, MBRT, rumen ammonia nitrogen and decrease in protozoan concentration and motility, gas production time, TVFA. In haematological analysis there was significant increase in haemoglobin, PCV and WBC. Biochemical analysis revealed significant alteration in Ca, P, glucose, BUN total protein values in affected animals.

Six buffaloes with indigestion in the post-parturient state were investigated and compared with healthy control group. The buffaloes with PPI exhibited partial to complete loss of appetite followed by decrease in rumen motility and scanty and pasty faeces in some animals. There was no significant change in the temperature, pulse and respiratory rates. There was significant increase in SAT, MBRT, rumen ammonia nitrogen, and decrease in total protein count, TVFA. Biochemical analysis revealed significant increase in AST, ALT, total bilirubin and decrease in Ca, P, Mg, glucose and total protein.

For therapeutic evaluation, 18 buffaloes which were suffering from indigestion were selected and divided into 3 groups of 6 animals each. Group I animals were treated with Suruchi powder. Group II was treated with gastricare boli and group III with yeasacc and ovine rumen liquor. Apart from above drugs all animals were given supportive therapy with rumenototics. In the present trial, there was improvement in all the parameters studied in buffaloes, treated with different herbal products. However therapeutic response was comparatively more favourable in group III there was improvement in appetite, rumen motility and other parameters in all six animals of the group III, where as improvement in all the parameters studied could be observed only in some animals of group I and II.

CHAPTER - I

INTRODUCTION

Livestock makes significant contribution towards alleviation of food insecurity and poverty. Livestock production is increasing at a faster rate than any other subsectors of agriculture. The buffalo occupies an important position in livestock production particularly in Asia. Fifty seven per cent world buffalo population is present in India and they contribute fifty five per cent of milk production in India during the year 2000 (Singh *et al.*, 2003).

Greater the nutritional demand of the animal with regard to high milk yield and weight gain, graver is the risk involved and digestive disorders such as indigestion ensue that go far beyond the specific disease conditions in terms of economic gain (Dirksen, 1987).

Rumen disorders are associated with immense economic drain to the dairy industry through decreased production, low milk fat, uneconomic feed conversion, cost of treatment, care and nursing in addition to mortalities, yet the losses remain unassumed. In India, enormous economic loss of 500 crores was estimated in bovines due to ruminant indigestion (Joshi and Mahesh Kumar, 1995). The complex nature of rumen dysfunctions is evident from the diversity of nomenclature. All of these diseases, inspite of exhaustive research over a period of decade still remain diagnostic and therapeutic challenge for the buiatrician.

Since this group of diseases are influenced by multifactorial etiology an indepth analysis of agro-ecological and husbandry patterns is needed to understand their epidemiology. During the recent past, indigestion in the post parturient stage is also emerging as one of the most economically important diseases.

No one standard mode of treatment strategy has been found efficacious for these diseases, under different circumstances, with different biometeorological conditions and husbandry, feeding and agriculture practices.

Hence it is imperative to formulate a rational therapeutic plan with selection of drugs from the long range of plant stomachics, bitters, rumenotonic drugs centrally acting appetitogens and other orexic formulations. Therapy with many herbal preparations is also gaining momentum and many such drugs are credited with replenishing the disturbed reticulo rumen function.

As not much work appears to have been undertaken on these aspects in buffaloes in this part of Andhra Pradesh, the research work is planned with the following objectives.

1. To investigate the incidence of different types of primary indigestion arising due to fermentative dysfunctions and motility disorders, among buffaloes in and around Tirupathi.
2. To study symptomatology, haematological parameters and biochemical alterations in serum and rumen liquor of the buffaloes with fermentative dysfunctions.
3. To find out rumen liquor and liver profile in cases of post-parturient indigestion.
4. To assess the comparative efficacy of certain herbal preparations in the treatment of simple indigestion.

CHAPTER - II

REVIEW OF LITERATURE

2.1 INCIDENCE OF DIGESTIVE DISORDERS

Joshi (1970) reported the incidence of indigestion as 74.7 per cent, impaction 18.5 per cent and tympany 6.8 per cent among 126 cows and 123 buffaloes during the period from March 1967 to February 1968.

The incidence of indigestion was found to be more in summer season than in rainy season.

Misra *et al.* (1972) observed that 45.5 per cent of the total bovine cases registered at Veterinary College Hospital, Bhubaneswar had primary indigestion.

Prasad *et al.* (1972) studied 82 clinical cases of primary indigestion (35 cattle and 47 buffaloes) and reported that incidence was higher in buffaloes (57.6%) than in cattle (42.4%). Among the various forms of indigestion the incidence of simple indigestion was 26.8 per cent, acid indigestion 17.07 per cent, alkaline indigestion 15.85 per cent, impaction 25.63 per cent and bloat 14.63 per cent.

Joshi and Misra (1974) undertook a study to find out the incidence of simple, acid, and alkaline indigestions in cattle and buffaloes. The pattern of distribution of these dysfunctions was similar in both the species. Simple indigestion was most common (58.5 and 49.1%), followed by alkaline indigestion (20.9 and 29.7%) and acid indigestion (20.6 and 21.1%) in cattle and buffaloes respectively.

Month wise analysis of the data revealed maximum incidence during June and July in both the species.

Singh *et al.* (2003) reported incidence of alkaline indigestion (80%), impaction (12%), acid indigestion (4%) and bloat (2%) from among 840 cases of digestive dysfunctions in buffaloes.

2.2 SYMPTOMATOLOGY

Misra and Tripathy (1963) observed the symptoms such as arched back, putrified odour from mouth, constipation and pelleted dung in experimentally induced alkaline indigestion .

De Alonso *et al.* (1969) observed ruminal atony, anorexia, hyperesthesia in cattle with alkaline indigestion.

Clinical symptoms such as putrified fishy smell from mouth, anxious painful look, regurgitation, decreased pulse and respiratory rates were observed in cases of alkaline indigestion by Dash *et al.* (1972).

Nagarajan and Rajamani (1973) recorded symptoms of total anorexia, slight tympany, distension of left flank in cross - bred cows with indigestion.

Singh and Thakur (1974) observed symptoms such as restlessness, dyspnoea, grunting, colic, staggering gait, slight tympany and extensive salivation due to urea toxicity in a heifer.

Prasad (1976) studied cases of alkaline indigestion in cattle and buffaloes at Mathura, Uttar Pradesh and reported decreased rumen motility and bloat as common symptoms in cases of stress on the liver in all these animals.

Experimental cases

Blood and Henderson (1968) observed clinical symptoms such as pasty or sticky, clay or dark coloured brown dung with repulsive odour,

offensive smell from oral cavity, mucoid salivation, champing of jaws and impacted hard rumen in cases of indigestion after normal calving.

Davidovish *et al.* (1977) observed clinical symptoms such as marked reduction in rumen motility, loss of appetite and increased heart rate in experimental toxicity.

Sethuraman and Rathor (1979) observed symptoms like anorexia, tympany, salivation, lacrimation, passage of semisolid dung and nasal discharge, severe bloat, grinding of teeth, groaning, arched back and putrid odour from mouth in experimentally induced alkaline indigestion.

Choudhuri *et al.* (1981) described symptoms such as anorexia, total reduction of milk yield, rough coat, passing of scanty faeces with decreased rumen motility in clinical cases of alkaline indigestion.

Kadvekar and Murkibhavi (1981) noticed slightly dry and dark coloured faeces, sluggish ruminal contractions, dull coat, listlessness with lack of interest in surroundings, refusal of concentrates in buffaloes with indigestion.

Hedaoo *et al.* (1982) observed dullness, depression reduced rumen motility, decreased milk yield, partial to complete anorexia in buffaloes suffering from clinical indigestion.

Samad *et al.* (1984) noticed loss of appetite and non-specific hypogalactia in recently calved buffaloes. Ten animals had normal appetite, 6 animals had reduced appetite for concentrates and 5 buffaloes were anorectic. Sudden onset of hypogalactia was predominant sign in all the cases.

Choudhuri (1986) observed typical clinical symptoms of anorexia, mild tympany, salivation, kicking at the belly, groaning, arched back, ataxia, tremors and convulsions in acute cases and

anorexia, lower milk yield, suspended rumination and pasty scanty faeces in chronic cases of alkaline indigestion.

Mahanta *et al.* (1988) reported normal body temperature, pulse and respiration rates without discolouration of conjunctival mucosa in buffaloes with the history of post parturient indigestion. They further observed partial to complete anorexia, depression, loss of condition, indigestion and gradual drop in milk production in post-parturient animals associated with hepatic dysfunction.

Pillai (1992) observed reduced rumen motility, dullness, depression, pasty and scanty dung, rough coat, lacrimation, nasal discharges and cough in cows and buffaloes with post parturient indigestion.

Pradhan (1995) reported that indigestion in cattle caused marked decrease in rumen protozoa leading to anorexia and agalactia.

Ramesh Kumari *et al.* (1995) reported depressed rumination and milk yield in 144 buffaloes suffering from indigestion.

Pillai *et al.* (1995) observed partial to complete loss of appetite, decreased milk yield, dullness and depression, scanty and pasty faeces, reduced rumen motility, rough coat, lacrimation, nasal discharge and cough in buffaloes with post parturient indigestion.

Stocker *et al.* (1999) reported that the principal clinical signs in calves with chronic indigestion were general malaise and depression, poor appetite, poor body condition, dehydration, dull and scaly hair coat, alopecia and clay like faces.

Zust *et al.* (2000) observed clinical symptoms of indigestion and intoxication characterised by severe inappetance, ruminal stasis and general weakness in lactic acidosis in bovines.

Singh *et al.* (2003) observed that all the clinical cases with primary indigestion had a history of dullness, depression absence of feed intake, suspended rumination and decreased milk production.

2.3 EXAMINATION OF RUMEN LIQUOR

2.3.1 pH of rumen liquor

The normal pH of rumen liquor in healthy cattle was reported to vary from 6.83-7.01 (Manroe and Perkins, 1939), 6.7 to 7.3 (Fairbank and Kider, 1944), 6.3 to 7.0 (Jones, 1965), 6.0 to 7.5 (Barnet and Reid, 1957), 6.7 to 6.9 (Misra *et al.*, 1972), ± 0.005 (Alikutty, 1981) and 6.5 to 7.0 (Radostitis *et al.*, 1994).

Hoflund (1967) recorded variation in pH i.e., between 4.5 to 5.0 in acid indigestion, 7.5 to 9.5 in alkaline indigestion.

Vihan *et al.* (1973) observed the mean pH of rumen fluid as 7.0 in simple indigestion, 5.3 in acid indigestion and 8.3 in alkaline

indigestion in cattle and in buffaloes the corresponding values were 7.0, 5.5 and 8.1.

Misra and Singh (1974) found that the mean rumen fluid pH varied from 4 to 4.6 in clinical cases of acid indigestion and in alkaline indigestion the values ranged from 7.5 to 9.5.

Rajasekharan and Venkataswamy (1981) recorded the value of pH in apparently healthy buffaloes as 7.2 whereas in clinical cases of post parturient indigestion the pH varied between 7.9 and 8.3.

Kirshnamurthy *et al.* (1985) recorded normal pH of the rumen liquor as 7.07 ± 0.33 in healthy buffaloes whereas in indigestion it was 6.94 ± 0.4 . The values were 6.27 ± 1.26 and 7.54 ± 0.54 in cases of impaction and tympany respectively.

Vijay Kumar (1985) reported the mean pH value of rumen liquor as 7.75 ± 0.13 in clinical cases of alkaline indigestion in cattle.

Venkateswarlu (1990) found that the mean pH of rumen liquor in clinical cases of indigestion in cattle was 8.30 ± 0.06 and pH value of 6.92 ± 0.04 was recorded in healthy buffaloes.

Radostits *et al.* (1994) reported high pH value of the rumen liquor in the range of 8 to 10 in case of urea toxicity.

Venkateswarlu *et al.* (1998) recorded pH of 7.5 in rumen fluid sample collected from buffaloes with clinical alkalosis.

Physical characteristics of rumen fluid :

2.3.2 Colour, consistency and odour

Joshi (1969) noticed the rumen liquor to be froathy, pungent smelling, golden yellow coloured in buffaloes with acid indigestion.

Ramaswamy (1972) observed dark green coloured rumen liquor thick in consistency with aromatic odour in healthy buffaloes. In acid indigestion, rumen fluid was yellow or grey in colour with pungent odour.

Misra and Singh (1974) noted dark brown rumen liquor with thin watery consistency and putrid fishy smell in seventy cases of bovines suffering from alkaline indigestion and thin yellow rumen liquor with pungent smell in acid indigestion.

Srinivasan (1983) observed brownish green coloured rumen fluid in healthy animals on different feeding practices and high percentage of putrid and slightly putrid odour in rumen liquor of sick animals.

Krishna Murthy *et al.* (1985) stated that the colour of rumen liquor varied with the nature of feed given i.e, the colour was pale brown to yellowish brown in primary indigestion, light brownish black in impaction and brownish in cases of tympany. The odour was aromatic in healthy animals, faintly aromatic in cases of indigestion, pungent in cases of impaction and putrid in cases of tympany. The consistency was viscous in normal cases and thin in indigestion. It was watery with quick sedimentation and foamy in tympany.

Venkateswarlu (1990) reported the colour, consistency and odour of the rumen liquor in healthy cattle and buffaloes as yellowish brown, viscous and aromatic respectively, which changed to dark brown, watery and with either ammonical or putrid odour in clinical cases of alkaline indigestion.

Randhawa *et al.* (1992) recorded change in colour from green to dark brown, odour from aromatic to putrid and consistency from thick to thin and watery in paddy straw induced alkaline indigestion in buffalo calves.

Chinnaiah (1992) observed that colour of the rumen liquor in healthy animals varied from green to greenish yellow which became brownish yellow with ammonical odour in the urea induced ruminal alkalosis and the consistency was slightly watery.

Manjula *et al.* (1995) noted that rumen liquor samples were grey to dark brown coloured and had a pungent odour in digestive disorders in bovines.

2.3.3 Protozoan motility

Misra and Tripathy (1963) studied the changes in rumen liquor of 10 bullocks and two heifers which were fed exclusively on paddy straw for 4 weeks and reported that protozoan motility was very poor.

Joshi (1969) noted that the large protozoa were dead and others were feebly motile in a clinical case of acid indigestion.

Misra *et al.* (1972) reported sluggish motility of protozoa in the rumen liquor in clinical cases of primary indigestion resulting from change in quality of feed.

Misra and Singh (1974) observed that the protozoan motility in cases of alkaline indigestion varied from + to +++.

Cakala *et al.* (1975) noticed decreased motility and viability of rumen protozoa in early stages of acute, sub-acute and chronic ruminal acidosis.

Choudhuri *et al.* (1981) observed absence of the protozoan motility and dead protozoa in clinical cases of alkaline indigestion.

Venkateswarlu (1990) reported that the protozoan motility in clinical cases of alkaline indigestion in crossbred cows and buffaloes was found to be nil to sluggish.

Randhawa *et al.* (1992) observed decrease in the protozoal motility from vigorous (+++) to moderate and sluggish (++) after induction of alkaline indigestion in buffalo calves.

Radositis *et al.* (1994) stated that the infusoria were feebly motile, dead or absent in extreme cases of alkaline and acid indigestions.

Singh *et al.* (2003) observed that rumen motility decreased almost in all cases of primary indigestion.

2.3.4 Protozoal concentration

Dirksen (1965) reported significant decrease in the rumen protozoal concentration in ruminal acidosis.

Sethuraman (1968) observed significant decrease in protozoal concentration and change in bacterial flora in animals with indigestion.

Dash *et al.* (1972) reported that gross protozoal concentration in the rumen liquor of cattle suffering from indigestion varied from (+) to (++) with sluggish motility.

Rosenberger (1979) described the protozoan concentration of rumen liquor in cattle as abundant (+++), moderate (++) few (+) and nil or absent (0) and normal range varied from ++ to +++. In ruminal alkalosis and in urea toxicity protozoan concentration was + / +++ and in rumen decomposition protozoan concentration was - to +.

Randhawa and Singh (1982) reported decrease in protozoan concentration in cases of urea toxicity.

Venkateswarlu (1990) found that protozoal concentration in healthy cattle and buffaloes ranged from ++ to +++ and in clinical cases of alkaline indigestion, the protozoan concentration was 0 / +.

Gaikwad *et al.* (1993) reported decrease in protozoan concentration and live protozoa with increase in dead protozoa in cases of primary indigestion.

2.3.5 Iodophilic activity

Misra *et al.* (1972) found that iodophilic activity of protozoa in healthy cows ranged from ++ to +++. In subacute primary indigestion due to poor to good ration it was 0 / + and in good to poor ration fed cows there was no iodophilic activity.

Alikutty (1981) reported that rumen protozoa comprised of iodophilic and acidophilic type which were more or less equal to '0' h and more of iodophilic by the 4th hour and mostly of acidophilic at 8th hour in experimentally induced alkalosis in crossbred calves.

Ahuja *et al.* (1989) observed non-significant alteration in the iodophilic and anidophilic activity of rumen protozoa in healthy calves as compared to that of urea induced buffalo calves.

Venkateswarlu (1990) reported the iodophilic activity in clinical cases of indigestion in buffaloes to range from + (25%) to ++++ (95%) as against ++ (50%) to +++ (75%) in control group.

Misra (1992) observed that the iodophilic activity was significantly less (+) in case of simple indigestion as against normal calves (+++).

2.3.6 Sedimentation activity time (SAT)

Misra *et al.* (1972) studied primary indigestion in 68 cases and stated that the sedimentation activity time was significantly increased to 39.9 min in affected animals.

Misra *et al.* (1972) studied the rumen liquor of 51 healthy adult cattle and observed that SAT varied from to vary from 8 to 18 minutes with an average of 12.8 minutes.

Prasad *et al.* (1973) observed increased SAT in experimental cases of alkaline indigestion.

Nagarajan (1985) reported that SAT of normal healthy cattle was 4 to 8 minutes and further stated that rapid sedimentation and retarded or absence of flotation indicated the inactivity of infusoria, inferior feed, starvation and inappetance.

Venkateswarlu (1990) reported the sedimentation activity in healthy buffaloes as 6.50 ± 0.46 minutes and in clinical cases of alkaline indigestion it was 23.4 ± 1.58 minutes.

Randhawa *et al.* (1992) observed rapid sedimentation and absence of floatation activity in experimental alkaline indigestion.

Radostitis *et al.* (1994) stated that normal sedimentation activity time in healthy animals varies between 3 and 9 minutes.

2.3.7 Methylene blue reduction time (MBRT)

Nagarajan (1985) reported that MBRT increased to 15 minutes when rumen infosuria were inactivated as a result of ingestion of spoiled feed and subsequent death of rumen microbes.

Thirunarayanan *et al.* (1985) reported that in clinical cases of primary indigestion the methylene blue reduction time was prolonged to 16.2 ± 2.76 minutes.

Venkateswarlu (1990) observed that the methylene blue reduction time in healthy buffaloes was 5.30 ± 0.50 mts and in alkaline indigestion it was 16.30 ± 1.07 mts.

Randhawa *et al.* (1992) observed increased MBRT (14.25 ± 2.45 mts) and reduced microbial activity in paddy straw induced alkaline indigestion in buffalo calves.

Misra (1992) reported that methylene blue reduction time was increased (7.58 ± 0.28) in case of simple indigestion as against in normal buffaloes (4.6 ± 6.4).

2.3.8 Total protozoal count

Joshi (1969) observed that there was a negative correlation between pH and total protozoal count in primary ruminal dysfunctions in bovines.

Dash *et al.* (1972) studied the effects of acute indigestion on the rumen microbes and stated that the rumen protozoa disappeared when pH of rumen fluid was below 5.5. Some of the diplomonads spp. survived at pH 7.4 while holotrichs completely disappeared from the rumen fluid. They reported total protozoal count as 0.77×10^5 / ml of rumen fluid.

Rajasekharan and Venkataswami (1981) reported the protozoal concentrations as 3.86×10^5 / ml and 2.0×10^5 / ml in normal and post-parturient anorectic animals respectively.

Sapori and Prasad (1986) reported an increase in pH and simultaneously decrease in protozoal population from 2.73×10^5 / ml on '0' day to 1.54×10^5 / ml on 11th day in experimental ruminal atony in calves engorged with wheat straw.

Ahuja *et al.* (1989) recorded an average total rumen protozoa count at '0' minute as $2.92 \pm 0.16 \times 10^5$ / ml of rumen liquor which

significantly decreased to $1.36 \pm 0.08 \times 10^5$ / ml at 150 min. of induction of experimental acute ruminal alkalosis in buffaloes.

Venkateswarlu (1990) reported that total protozoal count in healthy buffaloes as $3.11 \pm 0.14 \times 10^5$ / ml and in clinical cases of alkaline indigestion it was significantly reduced ($0.95 \pm 0.06 \times 10^5$ ml to $0.88 \pm 0.06 \times 10^5$ / ml).

Randhawa *et al.* (1992) observed significant decrease in total rumen protozoal count from $2.15 \pm 0.41 \times 10^5$ / ml in healthy buffalo calves to $0.46 \pm 0.23 \times 10^5$ / ml in alkaline indigestion induced by *ad lib* feeding of paddy straw as a sole ration.

2.3.9 Rumen ammonia nitrogen

Prasad *et al.* (1972) studied 82 clinical cases of alkaline indigestion in buffaloes and recorded mean rumen ammonia nitrogen levels of 21.9 ± 1.1 per cent .

Prasad *et al.* (1973) conducted experiments on alkaline and acid indigestion in buffaloes and recorded decrease in the concentration of rumen ammonia nitrogen in acid indigestion with increased levels of total volatile fatty acids. In alkaline indigestion, increase in rumen ammonia nitrogen and decrease in total volatile fatty acids (41.8 to 83.8 meq/L) influenced the pH of rumen fluid and contributed to ruminal dysfunctions.

Joshi and Misra (1975) studied ruminal fluid of Zebu and buffaloes in clinical cases of alkaline indigestion and recorded the rumen ammonia nitrogen values of 22.15 ± 3.3 mg% and 21.95 ± 3.46 mg% respectively.

Prasad (1977) studied primary anorexia in 33 cattle and 41 buffaloes. He observed a negative correlation between the pH of rumen fluid and total volatile fatty acid content and between TVFA

and ammonia nitrogen. Similar findings were noted in cases of experimental alkaline indigestion also .

In post parturient alkaline indigestion in buffaloes the rumen ammonia nitrogen value was 91.28 mg/litre. (Rajasekharan and Venkataswamy, 1981).

Desai and Dave (1987) observed increased rumen ammonia nitrogen values (34.65 ± 1.81 mg%) in 11 cases of alkaline indigestions in lactating buffaloes with a history of abrupt change in feed.

2.3.10 Total volatile fattyacids

Prasad (1976) found that total volatile fatty acids levels were less than normal in cases of alkaline indigestion.

Randhawa *et al.* (1992) reported increase in the concentration of total volatile fatty acids with an increase in molar proportion of

propionic acid in case of paddy straw induced alkaline indigestion in buffalo calves.

Kaur *et al.* (1994) reported that increase in concentration of total volatile fatty acid in buffaloes which were on concentrate feeds.

2.4 Haematology

Naurial and Baxi (1981) reported that moderate rise in Hb level was accomplished in acid indigestion.

Patil (1992) observed that haematological parameters were within the normal range except for the observation of neutrophilia (50.67 ± 1.17) and lymphopenia (44.19 ± 0.63) in cases of primary indigestion.

Basak *et al.* (1993) observed that increased values of PCV, Hb and TLC in case of induced acid indigestion. The mean increased values

of PCV ($41.40 \pm 0.6\%$), Hb (10.76 ± 2.50 g/dl) and TLC (10.20 ± 0.320 thousands / μl).

2.5 BIOCHEMICAL ANALYSIS

2.5.1 Serum calcium

Prasad *et al.* (1972) studied 82 clinical cases of anorexia and the mean serum calcium levels were found to be 9.24 ± 0.35 mg and 10.51 ± 0.26 mg per cent in cattle and buffaloes respectively in cases of simple indigestion.

Singh *et al.* (1972) observed mean serum calcium in healthy lactating animals as 11.139 ± 0.178 mg per cent in Rathi breed, 10.775 ± 0.141 mg per cent in Sahiwal breeds of cattle and 10.77 ± 0.254 mg per cent in Murrah buffaloes.

Blood and Radostits (1989) stated that the decline in serum calcium level as one of the causes for secondary anorectic condition of dairy cows.

Gupta *et al.* (1995) studied post parturient anorexia in 34 cows and 59 buffaloes. They recorded mean serum calcium level in cows as 8.04 ± 1.09 mg/dl and 8.27 ± 0.99 mg/dl in sub-clinical ketotic group (Group I) and ketotic negative group (Group II) respectively. In buffaloes the values were 9.20 ± 0.72 mg/dl and 9.34 ± 0.73 mg/dl in group I and II respectively.

Shrikande *et al.* (1999) estimated serum calcium in ante-partum and post-partum Nagpuri buffaloes and stated that there was no significant difference in calcium levels.

2.5.2 Serum inorganic phosphorus

Prasad *et al.* (1972) studied 82 clinical cases of anorexia in cattle and buffaloes and reported the serum inorganic phosphorus levels as 4.24 ± 0.33 mg/100 ml and 4.47 ± 0.19 mg/100 ml respectively.

Singh *et al.* (1972) recorded serum inorganic phosphorus level in clinically healthy animal as 5.112 ± 0.246 mg per cent in Rathi, 4.55 ± 0.36 mg per cent in sahiwal breeds and 4.65 ± 0.201 mg per cent in Murrah buffaloes.

Gupta *et al.* (1995) studied post parturient anorexia syndrome in 34 cows and 59 buffaloes and recorded phosphorus concentration as 2.98 ± 0.96 mg/dl in sub-clinical ketotic cows (Group I) and 3.18 ± 0.65 mg/dl in ketone negative cows (Group II). In buffaloes the values were 3.37 ± 0.54 mg/dl and 3.34 ± 0.52 mg/dl in group I and II respectively.

Shrikhande *et al.* (1999) estimated inorganic phosphorus in early lactating animals and stated that there was significant rise in phosphorus levels from day 7th post-partum (4.24 ± 0.09 mg/dl) to day 21st post-partum (4.76 ± 0.09 mg/dl).

2.5.3 Serum Magnesium

Dayne *et al.* (1974) reported serum magnesium level in healthy milch cattle to be 2.4 to 2.6 gm%.

Srikhande *et al.* (1999) determined serum magnesium in early lactating Nagpuri buffaloes and stated that Magnesium levels decreased from day 7th (2.8 ± 0.25 gm/dl) to day 30th (3.05 ± 0.07 mg/dl) post partum.

2.5.4 Serum / Blood glucose

Mullen (1976) stated that in early lactation when animal's production requirement exceeds the dietary intake, hypoglycemia and depleted glycogen stores occur which may lead to ketosis.

Rosenberger (1979) determined glucose in whole blood by semi quantitative method and also compared the glucose content of blood and serum by orthotoludine method and the enzymatic glucose oxidase method. He further stated that blood cells contain practically no glucose and recommended to measure glucose in serum.

Randhawa and Singh (1982) examined a clinical case of acute ammonia toxicity due to accidental ingestion of urea in crossbred cattle and recorded an increase in the blood glucose level (96.64 mg%).

Mahanta *et al.* (1988) determined serum / blood glucose of post - parturient dyspepsia in 12 buffaloes and reported that there was no marked change in glucose concentration.

Pillai (1992) determined serum glucose in 12 buffaloes and 12 cows having post -parturient indigestion with hepatic dysfunction. The mean serum glucose values were ranging from 41.43 ± 3.42 mg% to 46.56 ± 2.95 mg.

Paul and Vani Prasad (1994) reported the mean serum / blood glucose concentration as 43.04 ± 4.41 mg per cent in healthy murrah buffaloes.

Ramesh Kumari *et al.* (1995) reported the average blood glucose value in 120 healthy lactating Murrah buffaloes as 41.93 ± 0.49 mg/dl and the average blood glucose concentration in buffaloes with indigestion was 80.40 ± 0.51 mg/dl.

Akhtar and Anjum (1997) reported that blood glucose concentrations were significantly higher (86.0 ± 7.89) in buffaloes with indigestion than in healthy buffaloes (59.42 ± 8.94).

Venkateswarlu *et al.* (1998) observed that there was significant increase in the levels of blood glucose in clinical cases of alkaline indigestion in Murrah buffaloes.

Shrikande *et al.* (1999) estimated serum glucose in 24 Murrah buffaloes on 7th, 15th, 21st and 30th day post-partum and concluded

that glucose levels were lowered significantly from day 7 post-partum onwards.

2.5.5 Blood urea nitrogen (BUN)

Sethuraman and Rathore (1979) recorded the blood urea nitrogen values as 20.28 ± 0.22 and 20.66 ± 1.93 mg% in healthy cattle and buffalo respectively. Blood urea nitrogen levels were increased in experimentally induced alkaline indigestion from 15.3 ± 0.9 and 15.6 ± 1.1 at 0 hour to 68.6 ± 2.3 and 70.0 ± 2.8 mg% at 96 hours in cattle and buffaloes respectively.

Choudhuri *et al.* (1981) induced urea toxicity in buffalo calves and observed an increase in blood urea nitrogen from initial level of 17.46 ± 0.766 to 30.42 ± 1.79 mg% after induction.

Choudhuri (1986) observed increase in BUN level from 15.3 to 70 mg% in experimental and 52 mg% in clinical cases of alkaline indigestion.

Akhtar and Anjum (1997) found higher blood urea nitrogen levels (48.33 ± 8.63 mg%) in buffaloes with indigestion than in healthy buffaloes (32.86 ± 5.7 mg%).

Venkateswarlu *et al.* (1998) reported that there was significant increase in the levels of blood urea nitrogen than those in healthy controls, in clinical cases of alkaline indigestion in Murrah buffaloes.

2.5.6 Aspartate Amino Transferase (AST)

Hedaoo *et al.* (1982) studied 56 cases of buffaloes suffering from indigestion and found elevated levels of SGOT.

Mahanta *et al.* (1988) found that in buffaloes with post-parturient dyspepsia the serum AST values showed marked increase (95.65 ± 8.16 μ /ml).

Pillai *et al.* (1995) determined serum AST activity in 12 buffaloes with post-parturient indigestion and recorded the values ranging from $59.3 \pm 2.15 \mu/\text{ml}$ to $59 \pm 3.15 \text{ U/ml}$.

Ramesh Kumari *et al.*(1995) reported mean serum AST value in 144 buffaloes with indigestion as $17.98 \pm 0.08 \text{ 10 u/ml}$ and in 120 healthy lactating buffaloes as $10.35 \pm 0.07 \text{ IU/ml}$.

Haloi *et al.* (1997) studied post-parturient indigestion in 27 dairy cows and recorded the mean serum AST level as $89.50 \pm 8.33 \text{ U/ml}$ whereas in healthy animals the value was $41.92 \pm 0.79 \text{ U/ml}$.

2.5.7 Serum alanine amino transferase (SGPT)

Singh *et al.* (1972) reported the normal mean values of SGPT in non-lactating cows and buffaloes as 17.75 ± 1.5 and $16.00 \pm 2.30 \text{ RF}$ units respectively.

Hedaoo *et al.* (1982) noted elevated SGPT levels in all types of indigestion.

2.5.8 Serum total bilirubin

Mohanta *et al.* (1988) found marked increase in serum bilirubin (1.74 to 0.32 mg/dl) in buffaloes with post-parturient dyspepsia.

Akhtar *et al.* (1997) reported that total bilirubin concentrations were higher (1.76 ± 0.49 mg/dl) in buffaloes with indigestion than in healthy buffaloes (0.85 ± 0.11 mg/dl).

2.5.9 Total protein and A/G ratio

Rajora and Pachuri (1994) observed total protein & A/G ratio values in pre-partum cattle as 67.714 ± 2.91 and 0.930 ± 0.05 respectively, and in post-partum animals, these values were 70.714 ± 2.48 and 0.713 ± 0.026 respectively.

Jani *et al.* (1995) reported total protein values as 9.88 ± 0.3 in buffaloes of an organised farm and 7.87 ± 0.3 in field cases of normal buffaloes.

2.6 THERAPY

Kadvekar and Murkibhavi (1971) recommended vitamin B complex and liver extract 1 ml each per 50 kg body weight upto a course of 5 injections in bovines suffering from anorexia and observed that the animals recovered after the fifth injection.

Joshi (1970) used a rumevite system for treating anorexia and reported that the result of therapy was 90.9% in Zebu, 94.1% in buffalos with an average of 92.8% respectively.

Mahanta *et al.* (1988) treated 12 buffaloes suffering from post-parturient dyspepsia with Beekam L (10 ml I/m) Rintose (500 ml I/V), Thiocal (200 I/V), Anthisan (5 ml I/m) daily Liv. 52 (50 g) orally twice

daily. All the buffaloes recovered as evident from improvement in general condition, milk yield and resumption of normal appetite.

Misra (1992) induced simple indigestion in 5 cow calves and treated them successfully by oral administration of 2 boluses of Rumbion for 3 days.

Ashok Kumar and Joshi (1993) treated 36 cattle and 63 buffaloes suffering from primary and secondary indigestion with Bovirum. The results were evaluated on the basis of revival of appetite, reituclo rumen motility, changes in pH, specific gravity, viscosity and surface tension of rumen liquor and the drug was more effective in 89.2% buffaloes and 87.5% cows.

Venkateswarlu and Muni Reddy (1993) treated six cross bred cattle suffering from indigestion with 50 grams Dige-vet orally as an electuary once daily for 3-4 days. The animals appetite returned to normal by 4th - 5th day.

Pal *et al.* (1994) induced simple indigestion in 8 healthy male cross bred calves and treated them with Ruchamax @ 75 g orally bid for 3 days and observed improvement in ruminal movements and appetite within 72 hrs. which indicated beneficial effects of Ruchamax in speedy restoration of primary rumen dysfunction in calves.

Singh *et al.* (1999) observed that certain herbals viz., *Laptadena reticulata*, *Nigella sativa*, *Foenicolon vulgare*, *Pueraria tuberosa* and *Asparagus racemosus* cured 95 per cent of indigestion cases in ruminants.

CHAPTER-III

3. MATERIALS AND METHODS

The materials utilized and the procedures (clinical and laboratory) adopted in the present study on rumen dysfunctions are described in this chapter.

3.1 MATERIALS

The following material were utilized to study the incidence of rumen dysfunctions, to find out the alterations in diseases of buffaloes and to evolve therapy for cases of simple indigestion.

3.1.1 Hospitals records

The data on number of cases of primary indigestion in buffaloes was collected from the patient registers of veterinary dispensaries/hospitals of Department of Animal Husbandry (Andhra Pradesh) at Pudipatla, M.R.Palli, Tiruchanoor around Tirupati and at Veterinary clinics of College of Veterinary Science, Tirupati located in college

campus and in the town of Tirupati during the period of January 2002 to June 2003.

3.1.2 Healthy buffaloes

Dairy unit of Department of Livestock Production and Management, College of Veterinary Science, Tirupati has provided healthy buffaloes for utilization as control group of animals.

Incidence of different types of primary indigestion:

The total number of primary indigestion cases of buffaloes admitted to the veterinary dispensaries in and around Tirupathi. The data collected from January 2002 to June 2003, from the patient registers of clinics.

Incidence of cases of acid indigestion, alkaline indigestion, simple indigestion, indigestion with impaction and indigestion with tympany in relation to total number of buffaloes admitted to the clinics and the percentage of cases of each condition was calculated.

3.1.2 CLINICAL CASES:

Drug trials for simple indigestion cases:

For this total number of 24 animals were taken. Out of these 6 apparently healthy buffaloes served as the control group for working out the normal values.

Group I : Consisting of six healthy buffaloes as control group.

Group II: Consisting of six buffaloes with simple indigestion, subjected to therapy as follows.

Bitter stomachis + Rumenotorics + Suruchi bolus.

Group III: Six buffaloes with simple indigestion with following therapy.

Bitter stomachics + Rumenotorics + Gastricare.

Group IV: Six buffaloes with simple indigestion with following therapy.

Bitter stomachics+ Rumenotorics + Yea sacc bolus+ strained ovine rumen liquor from healthy sheep.

From among the cases of indigestion, 6 cases of post-parturition indigestion cases were selected to study the rumen liquor and serum parameters.

And also from the cases of fermentative disorders the following parameters were studied.

Clinical examination

Haematology: Hb, PCV, DLC, RBC & WBC.

Rumen liquor parameters.

Serum parameters.

3.1.3 Diseased buffaloes

Twelve (12) buffaloes with fermentative disorders and 6 animals with postparturient indigestion were taken up to study the clinical, haematological and biochemical parameters for a comparative study with healthy animal. Eighteen (18) buffaloes with simple indigestion were selected for a therapeutic trial.

3.1.4 Clinical material

Blood samples and rumen liquor collected from healthy and diseased buffaloes constituted the clinical material for the study.

3.1.5 Therapeutic agents

1. Bitter stomachis comprising of

Pulvis ginger

Pulvis gention

2. Rumenotorics

3. Gastricare (M/s with the following composition)

(Guduchi 0-7.5 mg, Shunti - 0.60 mg , Haritaki 0.54 mg, Lasuna - 0.48 mg, Jiraka - 0.36 mg, Vidanga - 0.15 mg, Maricha - 0.12 mg)

4. Yeasacbolus (M/s with the following composition)

(contains live yeast cells of proprietary strain of *Saccharomyces cerevisiae*¹⁰²⁶ 25 billion (25x 10⁹) cells per bolus.

5. Suruchi bolus

(each 5 gm bolus containing chitraka 1 gm, pippali 100 mg, sunti 100 mg, mareecha 100 mg, hingu 175 mg, ajavana 375 mg, shankha bhasme 750 mg)

5. Rumen fluid from healthy sheep

3.2 METHODS

Initially general clinical examination was performed on all the experimental animals by inspection, recording temperature, pulse rate, respiration and the rumen motility. Then the presence of

infectious diseases was ruled out by thorough examination of digestive system.

3.2.1 Clinical examination

Detailed history was obtained from all the clinical cases brought for treatment to the hospital and were subjected to preliminary general clinical examination with recording of vital parameters. Then, detailed or specific clinical examination pertaining to digestive system was conducted in all suspected buffaloes as described by Rosenburger (1979).

3.2.2 Sampling of Materials

3.2.2.1 Acquisition of rumen fluid

Rumen fluid samples were collected using a rumen fluid extraction pump as per the method described by Rosenberger (1979).

After collection, the fluid was preserved in tightly sealed glass bottles under a thin layer of liquid paraffin in order to prevent exposure to air until the laboratory examination is completed.

3.2.2.2 Collection of blood and serum

Blood samples were collected from the jugular vein using eighteen gauge sterilized needles. Approximately 10 ml of blood was collected into sterilized test tubes and were allowed to clot completely in slanting position. The test tubes were incubated at 37⁰ C for one hour and then placed in refrigerator for one hour for the clot to retract. The separated serum was transferred to sterilized vials for analysis.

Some sample of blood was taken into sterile vials, containing anti-coagulant. This was used for hematological examination.

3.2.3 Analysis of rumen fluid

3.2.3.1 Rumen pH

The rumen liquor was strained immediately after collection with the four fold muslin cloth and the pH of rumen liquor was determined by pH indicator strips and later confirmed by digital pH meter.

Color, consistency and odour of this strained rumen liquor (SRL) were recorded as per Rosenberger (1979).

3.2.3.2 Protozoal motility

A drop of strained rumen liquor was examined under low power of the microscope with a coverslip for protozoal motility. The motility was assessed according to methods of Misra and Singh(1974) as vigorous (+++), moderate(++), sluggish(+) and no motility(0).

3.2.3.3 Protozoal concentration

Protozoal concentration in the rumen liquor was estimated as per the methods of Misra et al.,(1972b) and was classified as

- +++ when more than 30 protozoa were observed per low power field.
- ++ when 10 to 30 protozoa were observed per low power field.
- + when rumen protozoa 1 to 10 were encountered per low per field.
- 0 when rumen protozoa nil or 0 per low power field.

3.2.3.4 Iodophilic activity:

Iodophilic activity of protozoa was recorded by taking one drop of strained rumen liquor on a clean slide to which a drop of lugol's iodine was added, mixed well and examined under microscope.

The iodophilic activity was graded as per Misra et al., (1972b) as 0% (nil), 25%(+), 50%(++), 75%(+++), and 100%(++++).

3.2.3.5 Total protozoal counts

The total protozoal count of rumen liquor was done as per the methods of Naga and Elshazly (1969).

Average count of rumen protozoa per microscopic field was calculated after counting the protozoa in 30 low power microscopic fields.

Multiplying the average count by number of fields on counting slide derives the rumen protozoal count in 0.1 ml of diluted sample.

Rumen protozoa/ ml of rumen fluid =

Volume x dilution x mean protozoan count. Expressed as 1×10^5 /ml of SRL.

3.2.3.6 Methylene blue reduction time

This was described by Dirksen (1969) and Rosenberger(1979). A suitable aliquot (20 ml) of SRL was taken into clean flat bottomed glass

specimen tube, 1ml of 0.03% methylene blue added to this and mixed well. Initially the solution became greenish blue. The discoloration of rumen liquor to its normal color was read by comparing with normal rumen liquor sample. The time taken from the moment of adding methylene blue solution to the SRL, until disappearance of color of the sample was recorded as methylene blue reduction time.

3.2.3.7 Sedimentation activity time

Sedimentation activity time of the rumen liquor was noted as per the method of Nicholus and Penn(1958) into a flat bottomed glass tube and placed at room temperature and observed from time to time. The time in minutes that intervenes between completion of sedimentation and floatation of particles of ingesta on the surface of the ruminal fluid was read as sedimentation activity time.

3.2.3.8 Rumen ammonia nitrogen

Rumen ammonia nitrogen was estimated as per microdiffusion method of Conway (1957) . To carry out this test, special Conway discs were employed .

One ml of boric acid (2%) was placed in the innermost chamber of conwaycell to which one drop of modified indicator was added consisting of 0.1 g of bromocresol green, 0.07 g of methyl red, 0.01 g of thymol blue in 100 ml of 95% alcohol). One ml of standard rumen liquor was placed at one end of the outer chamber and one ml of saturated potassium carbonate solution at the other end of the outer chamber of Conway cell.

The lid was immediately and carefully placed slightly compressing and then gently rotating so as to the fluids in the outer chamber well mixed by slightly tilting and rotating of the Conway cell and was incubated at 37⁰c for 30 minutes.

A blank was run simultaneously. The boric acid solution was titrated with 0.0143 N sulfuric acid solution after 30 minutes.

The nitrogen in mg per 100 ml of SRL =

The quantity of 0.0143 N sulfuric acid used for titration x 0.2
x100

(1ml of 0.0143 N sulfuric acid normally corresponds to 0.2 ml nitrogen present in ammonia)

3.2.3.9 Total volatile fatty acids

Exactly 2ml of SRL was placed in the Markhem's distillation apparatus, followed by 2ml of Scaris brick buffer and 1ml 2% caprylic alcohol and about 170 ml distillate was collected in a conical flask at the rate of 90 to 120 drops per minute and the distillate was titrated against N/50 NaOH using phenolphthalein indicator. A blank was also run using distilled water in place of SRL.

REAGENTS:

1. 10% Potassium oxalate : It is prepared by dissolving 10 g of reagent potassium oxalate in 100 ml of distilled water.

2. 5% Oxalic acid: 5 g of pure dry oxalic acid dissolved in water to make up to 100 ml.

Scarific buffer was prepared by the addition of equal parts of potassium oxalate solution(10%) and oxalic acid(5%).

3. Caprylic acid (2%): 2ml of caprylic alcohol added to 98 ml of liquid paraffin.

4. NaOH : N/50 standard solution was prepared by titration with N/50 oxalic acid.

$TVFA = X \times 0.02 \times 100/2 = \text{meq of TVFA per litre of SRL.}$

3.2.3.10 Microbial activity by gas production:

Reagents:

A. phosphate buffer:

potassium phosphate mono (KH_2PO_4) 61.20 g

Magnesium sulfate (MgSO_4) 3.00 g

Sodium chloride (NaCl) 7.59 g

Calcium chloride ($\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$) 0.75g

The above items were dissolved in 15 liters of water and the pH adjusted to 6.8 by bubbling CO₂ gas through the solution or with saturated K₂CO₃. The solution was warmed to 39 degree centigrade before adding to bottles.

PROCEDURE:

1. The water bath, bottles, tubing and cylinder were settled as per the procedure and the bottle B was filled with water. Stoppers and tubing were checked for tight seal to prevent gas leakage.
2. To bottle A added 4 g of ground samples, 100 ml phosphate buffer and 50 ml rumen fluid.
3. Return bottle A to the water bath and seal to stopper. Swirled bottle A to mixed the sample and empty graduated cylinder (applied a good seal to have forced some water into the cylinder).

4. Recorded the volume of water in the cylinder even 30 minutes for 4 hours. Gently mixed the bottle A before each reading cylinder was emptied after each reading or as needed.

3.2.4 Biochemical estimation in serum

The glassware used in the experiment were cleaned with chromic acid and rinsed thoroughly in tap water, followed by demineralised water and then with double distilled water.

3.2.4.1 Serum calcium

The calcium level in serum was estimated as per O-Cresolphthalein complex, one method described by Gitelam (1967). The values were expressed in mg per 100ml of serum.

Reagents:

Diagnostic reagent kit supplied by Qualigens-Diagnostics was used for determination of serum calcium.

1. Buffer solution
2. Color reagent
3. Calcium standard 10mg %

Preparation of working reagent: Equal volumes of buffer solution & color reagent were mixed as per daily requirements.

Test procedure:

Three test tubes labeled blank(B), standard(S) & test(T) were taken and 2.5ml of working reagent was added. To the test tube(S) 0.02ml of calcium standard was added and to the tube(T) 0.02ml of serum was added, mix well, allowed them to stand at room temperature for 5 minutes. Then absorbance of standard(S) and test(T) were measured against blank(B) on a spectrophotometer at 570nm with in 30 minutes.

Calculations:

$$\text{Serum calcium concentration(mg\%)} = \frac{\text{OD of (T)}}{\text{OD of (S)}} \times 10$$

3.2.4.3 Serum phosphorus

Serum phosphorus level was estimated as per modified metol Method described by Gomorri (1942). The values were expressed in mg per 100ml of serum.

Reagents:

Diagnostic kit supplied by Qualigens-Diagnostics was used for determination of serum phosphorus.

1. Catalyst reagent
2. Molybdate reagent
3. Metol reagent
4. Standard 5mg%

Test procedure

Three test tubes labeled blank (B), standard (S) and test (T) were taken and 1ml of catalyst reagent (1) was added. To these 3 tubes, 1ml of Molybdate reagent (2) was added. To the test tube labelled blank(B), 0.1ml of deionized water was added, to the tube(S) 0.1ml of standard was added and to the tube(T) 0.1ml of serum was added. Then 1ml of metal reagent(3) was added to all three test tubes, mixed well, allowed to stand at room temperature for 5 minutes. The absorbance of test(T) and standard(S) were measured against blank(B) on a spectrophotometer at 680nm with in 30 minutes.

Calculations:

$$\text{Serum phosphorus concentration (mg\%)} = \frac{\text{OD of (T)}}{\text{OD of (S)}} \times 5$$

3.2.4.3 Serum magnesium

The magnesium level in serum was estimated as per the method described in clinical methods manual spectronic-20 Bausch and Lomb(1965) (USA) (Titan yellow)

Principle

Titan yellow and magnesium hydroxide in an alkaline environment will combine to form a red lake, the intensity the magnesium concentration. This color produced in the presence of poly vinyl alcohol as stabilizer is measured photometrically.

Preparation of reagents

Trichloro acetic acid 10% w/v was prepared by dissolving 100g of trichloro acetic acid in water and diluting it to exactly one liter with distilled water.

Polyvinyl alcohol 0.2%w/v was prepared by dissolving 0.2g of polyvinyl alcohol by gently heating in distilled water, cooling and diluting to make the volume up to 100ml.

The stock solution of titan yellow of 0.5% aqueous solution, which stored in dark bottle was stable for weeks. A working standard containing 0.15% of titan yellow was prepared every few days by diluting 3ml stock standard solution with 7ml of distilled water.

Stock standard of magnesium sulphate was prepared by dissolving 0.0240g of magnesium sulphate in water and diluting to exactly 100ml in volumetric flask. This solution contained 4.0meq/l (4.8mg/100ml) and was stable indefinitely. Two additional standard solutions containing 2.0meq/l (2.4mg/100ml) and 1meq (1.2mg/100ml), respectively were prepared by diluting the stock standard 1:1 and 1:3 with distilled water.

These three standard solutions were also prepared by dissolving 20gm of sodium hydroxide in 100ml of distilled water. Sodium hydroxide solution 20% w/v was prepared by dissolving 20g of sodium hydroxide in 100ml of distilled water.

Test procedure

To a series of test tubes labeled unknown containing 3.0ml of 10% trichloro acetic acid and 0.5ml of each serum sample was added allowed to stand for 10minutes. A blank containing 0.5ml of distilled water and three standard containing 0.5ml of each 4meq, 2meq and 1meq per ml were also prepared and processed similarly as for the serum.

Then the test tubes were centrifuged rapidly for 5 minutes. Exactly 2 ml of supernatant fluid was taken in separate test tubes and 0.5ml of polyvinyl alcohol, 2,5ml of titan yellow and 1ml of sodium hydroxide were taken against the blank at 540nm in a spectrophotometer.

Calculations

$$\text{Serum magnesium (mg) = } \frac{\text{OD of unknown}}{\text{OD of standard}} \times \text{concentration of standard (mg\%)}$$

3.2.4.4 Blood glucose

The serum glucose was estimated by the (GOD/POD method) supplied by Qualigens-Diagnostics was utilized for determination of serum glucose. The following reagents were used in the procedure.

1. Enzyme reagent
2. Buffer solution
3. Glucose standard 100mg%

One vial of the enzyme reagent(1) was diluted in one bottle of buffer solution(2) and mixed gently to dissolve. The prepared working enzyme reagent was stable for at least a month at 2-8 °C.

Test procedure:

Three test tubes were labeled blank(B), standard(S) and test(T) were taken and 1ml of working enzyme reagent was added to each of them. To the test tube labeled blank(B) 10ul of distilled water was added, to the test tube(S) 10ul of glucose standard was added and to the test tube(T) 10ul of serum was added, mixed well and the tubes were incubated at 37⁰c for 10 minutes. Then the absorbance of test(T) and standard(S) were measured against blank(B) on a spectrophotometer.

Calculations:

$$\text{Serum glucose concentration (mg\%)} = \frac{\text{OD of (T)}}{\text{OD of (S)}} \times 100$$

3.2.4.5 Serum AST:

Serum AST was estimated by Reitman and Frankel method (1957) using the diagnostic reagent kit supplied by M/s Qualigens fine chemicals, Mumbai.

Reagents:

1. Buffered substrate, pH 7.4
2. DNPH color reagent
3. Sodium hydroxide 4N
4. Pyruvate standard 2mM

Preparation of working solution

One ml of sodium hydroxide was diluted to 10ml with distilled water before use.

A standard curve was prepared by using 5 clean dry test tubes to which reagents, buffered substrate, distilled water and DNPH reagent were added as described below.

Tube no	1	2	3	4	5
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Enzyme activity	0	24	61	114	190
Buffered substrate	0.5ml	0.45ml	0.4ml	0.35ml	0.3ml
Pyruvate standard		0.05ml	0.1ml	0.15ml	0.2ml
Distilled water	0.1ml	0.10ml	0.1ml	0.1ml	0.1ml
DNPH color reagent	0.5ml	0.5ml	0.5ml	0.5ml	0.5ml

Test tubes were mixed well and allowed to stand at RT for 20 minutes. Exactly 5ml of working sodium hydroxide was added to all the test tubes. Again these test tubes were mixed well and allowed to stand at RT for 10 minutes and the absorbance's of tubes 2 to 5 were measured at 505nm against tube No 1. the graph was plotted by taking the absorbance of test tubes 2,3,4 and 5 on Y-axis and the corresponding enzyme activity enzyme activity on Y-axis.

Test procedure:

Two test tubes labelled blank(B) and test (T) were taken and 0.5ml of buffered substrate was added to both and incubated at 37⁰c for 3 minutes after which 0.1ml of serum was added to the 'T' mixed well and incubated at 37⁰c for 60 minutes. Exactly 0.5ml of DNPH color

reagent was added to both. These tubes were mixed well and allowed to stand at RT for 20 minutes.

After this 5ml of working sodium hydroxide was added to both the tubes, mixed well and allowed to stand at RT for another 10 minutes. The absorbances of test (T) against blank (B) was measured on spectrophoto-meter at 505nm; the corresponding enzyme activity was noted on the standard curve prepared.

3.2.4.6 Serum ALT:

Serum ALT was estimated by Reitman and Frankel method(1957) using the diagnostic reagent kit supplied by M/s Qualigens fine chemicals, Mumbai.

Reagents:

1. Buffered substrate, pH 7.4
2. DNPH color reagent
3. Sodium hydroxide 4N
4. Pyruvate standard 2mM

Procedure :

Calibration curve:

5 clean test tubes: were taken and numbered as them 1,2,3,4 and 5 respectively and pipetted into each as shown below.

Tube no	1	2	3	4	5
Enzyme activity	0	28	57	97	150
Buffered substrate	0.5ml	0.45ml	0.4ml	0.35ml	0.3ml
Pyruvate standard		0.05ml	0.1ml	0.15ml	0.2ml
Distilled water	0.1ml	0.10ml	0.1ml	0.1ml	0.1ml
DNPH color reagent	0.5ml	0.5ml	0.5ml	0.5ml	0.5ml

Mix well and allow to stand at RT for 20 minutes

Working sodium hydroxide	5ml	5ml	5ml	5ml	5ml
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Mixed well and allowed to stand at RT for 10 minutes and then read absorbances of tubes 2 to 5 respectively against tube 1 (reagent blank) on spectrophotometer at 505nm. Then plotted the graph of absorbances of test tubes 2,3,4,and 5 on Y-axis versus corresponding enzyme activity.

Assay:

Two test tubes were taken and labelled blank(B) and test(T). 0.5ml of buffer substrate is added to the both tubes. And incubated at 37⁰c for 3 minutes. The 0.1 ml of serum is added to the test(T) and mixed well and incubated at 37⁰c for 30 minutes. After that 0.5ml of DNPH color reagent(2) was added to both tubes and then mixed well and allowed to stand at RT for 20 minutes. 0.1 ml of distilled water is added to blank(B) and 5.0 ml of working sodium hydroxide is added to both tubes.

Mixed well and allowed to stand at RT for 10 minutes and measured the absorbance for test(T) against blank(B) on

spectrophotometer at 505nm on calibration curve read the absorbance of test(T) on Y-axis and corresponding enzyme activity on X-axis.

3.2.4.7 Total protein

Biuret and BCG Dye binding method. (Qualigens diagnostics).

Principle:

Proteins bind with copper ions in an alkaline medium of the biuret reagent and produce a purple colored complex, whose absorbance is proportional to the protein concentration. Albumin in a buffered medium binds with Bromocresol(BCG) and produce a green color whose absorbance is proportional to the albumin concentration.

Reagents:

1. Biuret reagent
2. Buffered dye reagent
3. Protein standard
4. Albumin standard

Procedure:

Three test tubes were taken and labelled as blank(B), standard(S) and test(T). biuret reagent and distilled water was added to all three test tubes 1ml and 2ml respectively. Then 0.05ml of protein standard was added to standard(S) tube, and 0.05ml of serum to the test(T).

Mixed well and incubated at 37°C for 10 minutes. Measured absorbance of standard and test against blank on spectrophotometer.

Calculations:

A of (T)

$$\text{Total proteins in gm\%} = \frac{\text{—————}}{\text{A of (S)}} \times 6$$

3.2.4.8 Albumin globulin ratio

Albumin assay:

Three test tubes were labelled as blank(B),standard(S) and test(T). First 1ml of buffered dye reagent was added to all three test tubes. And then 2ml distilled water was added to all tubes. For the standard, 0.01 ml of albumin standard was added and for the test, 0.01ml of serum was added.

Mixed well and immediately measured the absorbance of standard and test against blank on a spectrophotometer at 630nm.

Calculations:

$$\text{Albumin in gm\%} = \frac{\text{A of (T)}}{\text{—————}} \times 4$$

A of (S)

Globulin in gm% = total proteins in gm% - albumin in gm%

Albumin globulin ratio = $\frac{\text{Albumin in gm\%}}{\text{Globulin in gm\%}}$

3.2.4.9 Serum total bilirubin

The total bilirubin in serum was measured by the method described by Malloy and Evelyn (1937), utilizing the diagnostic reagent kit supplied by span diagnostics for determination of total bilirubin was employed. The diazo reagent was prepared by mixing 3.3 ml of diazo-A with 0.1ml of diazo-B just before use. For measuring bilirubin, 0.1ml of serum was taken into each of two test tubes. The volume was made up to 1ml by adding 0.9ml of distilled water in each tube and mixed thoroughly. Exactly 0.25ml of diazo blank and 0.25 ml of diazo

reagent were added in blank and test tubes respectively and 1.25ml of methanol was added to each tube. The tubes were allowed to stand in dark at RT for 30 minutes. The absorbance was read at 540nm in spectrophotometer against distilled water as blank.

The optical density of standard was obtained by reading artificial standard (10mg bilirubin) against distilled water.

Calculations

$$\text{Total bilirubin concentration} = \frac{\text{OD of test} - \text{OD of blank}}{\text{OD of standard}}$$

3.2.4.10 Blood urea nitrogen

Principle:

Urea reacts with DAM in an acidic medium to produce a colored complex. The color is intensified by using thiosemicarbazide and a

cadmium salt. The absorbance of the colored complex is proportional to the urea concentration.

Reagents:

1. Urea reagent
2. Dam reagent
3. Urea standard

Procedure:

Three test tubes were labeled as blank(B), standard and test(T). 4ml of distilled water is added to all tubes. 1ml of urea reagent is added to all three tubes. 1ml of Dam reagent is also added to all three test tubes. 0.02ml of urea standard is added to standard (S). 0.02ml of serum is added to test (T).

After each addition, mixed them well kept the test tubes in a water bath at 100⁰c for exactly 10 minutes. Cooled them under running tap water and then measured the absorbance of standard and test against blank on spectrophotometer at 520nm.

Calculations :

$$\text{Serum urea in mg \%} = \frac{\text{A of T}}{\text{A of S}} \times 40$$

3.2.5 Haematological examination

The haematological examination of the blood sample was carried out as follows:

3.2.5.1 Total erythrocyte count:

Total erythrocyte count was estimated by utilizing the neubaur counting chamber as per the method described by Jain (1986) and expressed as millions per cubic millimeter (cmm).

3.2.5.2 Haemoglobin (Hb)

Haemoglobin estimation was done by acid hematin method using Sahli haemoglobinometer. 0.1N HCL was pipetted out up to the mark 2 of haemometer tube and about 0.02ml of freshly collected whole blood was taken into haemometer tube. The acid was gently mixed and left for 10 min (Kolmer 1959). Adding more N/10 HCL so as to obtain a colour, which matches with the standard colour tubes provided on both the sides, diluted the acid haematin formed. The results were directly read and expressed as gram percent.

3.2.5.3 Packed cell volume (PCV):

Packed cell volume was determined by using clay Adam microhaematocrit centrifuge @14,000 rpm for 5 min. The microhaematocrit tubes were removed and read in a microhaematocrit reader as per procedure of Jain (1986). The packed cell volume was expressed in per cent (%).

3.2.5.4 Total leucocyte count

Total leucocyte count was estimated as per the method described by Jain (1986) and expressed in $\times 10^3 / \mu\text{l}$.

3.2.5.5 Differential leucocyte count

Freshly prepared, thin, air - dried, methanol fixed blood smears were stained with Leishman's stain and differential Leucocyte count was carried out according to Jain (1986).

3.2.6 Statistical analysis

Statistical analysis was carried out using the procedure as prescribed by Snedecor and Cochran (1967). The control values of different parameters were compared to those of before and after treatment values using student "t" test.

CHAPTER - IV

4. RESULTS

Data pertaining to the incidence, values recorded on clinical examination conducted, estimations carried out in different types of indigestion and result of clinical trials undertaken in the present study are dealt in this chapter.

4.1 INCIDENCE OF INDIGESTION

Hospital records revealed that a total number of 26514 buffaloes were admitted to the Veterinary Clinics at Pudipatla, M.R.Palli and Veterinary hospitals at Tirupati for various ailments during the period of study i.e., from January 2002 to June 2003. Out of the above, 9404 were treated for digestive disorders. Among them 7741 had simple indigestion 53 were affected with acid indigestion and 1092 buffaloes were treated for alkaline indigestion. Impaction was observed in 415 buffaloes and 103 buffaloes developed tympanitis. The number of cases recorded and per cent incidence are presented hospital wise in Table No. 1 and Fig. 1.

The data on seasonal incidence revealed that during winter out of a total of 2310 cases recorded 824 cases of indigestion were treated. Among them 667 cases were of simple indigestion, 2 of acid indigestion, 113 had alkaline indigestion, 29 cases were of impaction and in 13 cases tympany was noted.

In summer season out of 1820 cases recorded in buffaloes for indigestion 859 were treated for indigestion. Among them 741 cases were cases of simple indigestion, 3 cases were of acid indigestion, 85 cases had alkaline indigestion, 21 were cases of impaction and 9 cases were of tympany.

In rainy season among 2434 ailing animals, 875 were treated for indigestion. Among them simple indigestion was noted in 728, acid indigestion in 11, alkaline indigestion in 95, impaction in 32 and tympany in 9 were observed. The data revealed that out of a total of 6564 cases recorded in 3 different seasons, 2558 were treated for indigestion comprising of 2136 cases of simple indigestion, 16 of acid indigestion, 293 of alkaline indigestion, 82 of impaction and 31 for

tympany. The above data along with per cent incidence is presented in Table 2.

4.2 OBSERVATIONS ON HEALTHY BUFFALOES

Clinical parameters of six healthy buffaloes (control group) are presented in Table No. 3. The mean body temperature, pulse, respiration rate and rumen motility were $100 \pm 0.25^{\circ}\text{F}$, 49.83 ± 1.20 /min, 20.83 ± 1.01 /min and 7.35 ± 0.35 / 5 min respectively. The conjunctival mucous membrane was red in all these animals. These buffaloes were fair in physical condition with normal demenaour.

The results of rumen fluid examination are presented in Table 4. The colour of the rumen fluid was greenish and all the samples had aromatic odour. Motility of the protozoa was found to be vigorous and the iodophilic activity was +++ in 5 samples and ++ in one sample.

The mean values of pH, SAT (min), MBRT (min), gas production time (ml/hr.), total protozoal count (1×10^5), rumen ammonia nitrogen (mg%), and TVFA (meq/L) were 7.0 ± 0.52 , 7.5 ± 0.34 , 5.33 ± 0.49 ,

13.41 ± 0.54, 3.45 ± 0.20, 12.52 ± 1.32 and 86 ± 3.14 respectively (Table 4).

Haematological values of healthy animals are presented in Table 5. The mean values of Hb(g/dl), PCV (%), TEC ($\times 10^6/\mu\text{l}$) and WBC ($\times 10^3/\mu\text{l}$) in healthy animals were 10.80 ± 0.14 g; 32.7 ± 0.88%, 5.33 ± 0.22, and 8.85 ± 0.26. The values ranged from 9.43 to 12.6 g% (Hb), 29 to 38% (PCV), 4.63 to 6.23 millions (RBC) and 8.03 to 9.8 thousands (WBC). The mean values of neutrophils, lymphocytes, eosinophils, monocytes and basophils in healthy animals were 45.66 ± 0.56, 51.16 ± 0.09, 3.33 ± 0.18, 1.3 ± 0.22 and 0.17 ± 0.13 % respectively.

Estimation of biochemical parameters indicated that the mean values of Calcium, Phosphorus, Magnesium, Glucose, BUN, Total proteins, A/G ratio were 10.58 ± 0.54 mg%, 4.80 ± 0.37 mg%, 2.45 ± 0.13 mg%, 48.70 ± 1.26 mg%, 10.35 ± 0.54 mg%, 8.06 ± 0.53 gm%, and 1.01 ± 0.10 respectively and the mean AST, ALT and Bilrubin values were found to be 43.6 ± 2.34, 9.6 ± 1.17 and 0.12 ± 0.19 mg% respectively. These values are depicted in Table No. 6.

4.3 OBSERVATIONS ON FERMENTATIVE DISORDERS

4.3.1 Alkaline indigestion

Clinical examination revealed partial to complete anorexia in all cases with foetid odour from the mouth in two animals. Ruminal atony was found in 4 animals and mild tympany was observed in 2 cases. Reduction of milk yield was noticed in 5 cases. The milk yield was ranging from one to two liters / day. Majority of the affected were dull and depressed and 5 animals had salivation. Dung was scanty and pasty in four cases and in two it was pellety.

The mean temperature, pulse and respiratory rates and rumen motility of affected animals were $100.61 \pm 0.19^{\circ}\text{F}$, $56.0 \pm 2.47 / \text{min}$ $21.66 \pm 1.6 / \text{min}$ and $1.33 \pm 0.21 / 5 \text{ min}$ respectively (Table 7).

The mean values of pH, SAT, MBRT, gas production time, total protozoal count, rumen ammonia nitrogen, TVFA of rumen liquor in affected were 8.03 ± 0.11 ; 20.5 ± 1.4 ; 17.16 ± 1.4 ; 7.38 ± 0.29 ; $1.83 \pm$

0.06, 32.89 ± 1.73 and 55.16 ± 1.85 respectively. Rumen fluid examination (Table 8) revealed that the colour was yellowish brown with distinct ammoniacal odour in 3 and it was slightly ammoniacal in 3 samples. Protozoal motility was absent in one sample and it was sluggish in 4 and moderate in one. Iodophilic activity was only + in 5 and absent in one sample.

The mean haematological values of Hb (g%), PCV (%), TEC ($\times 10^6/\mu\text{l}$) and TLC ($\times 10^3/\mu\text{l}$) in buffaloes with alkaline indigestion were 11.6 ± 0.20 , 44 ± 7.8 , 5.5 ± 1.33 and 9.1 ± 0.88 respectively. The values ranged from 10.9 to 12.2 (Hb), 41 to 47 (PCV), 4.9 to 5.8 (TEC) and 8.8 to 9.4 (WBC) respectively. The mean values of neutrophils, lymphocytes, eosinophils, monocytes and basophils were $46.16 \pm 0.5\%$, $48.3 \pm 0.19\%$, $3.5 \pm 0.21\%$, $1.6 \pm 0.9\%$ and $0.16 \pm 0.14\%$ respectively. These values are shown in Table No. 9.

Estimation of serum biochemical parameters revealed the mean values of calcium, phosphorus, magnesium, glucose, BUN, total protein, A/G ratio as 7.71 ± 0.25 mg%, 3.50 ± 0.16 mg%, 2.36 ± 0.30

mg%, 64.38 ± 2.37 mg%, 6.22 ± 0.36 mg%, 28.12 ± 2.94 and 0.78 ± 0.05 , respectively. These values are shown in Table No. 10.

4.3.2 Acid indigestion

Examination of clinical cases revealed anorexia in all the animals. Tympany was observed in 3 of the cases. Reduced milk yield, absence of rumination and decreased rumen motility were seen in 5 buffaloes. In 4 animals, diarrhoea was observed. All the animals were dull and depressed and salivation was found in 2 cases.

The mean temperature, pulse and respiratory rates were 101.05 ± 0.15 °F, 59.5 ± 1.3 / min, 28.5 ± 0.67 / min and the mean rumen motility was 0.67 ± 0.27 / 5 min. (Table No. 11)

Examination of rumen fluid samples revealed that all the samples were greyish in colour with putrid odour in 3 samples and semi aromatic odour in others. Protozoan motility was absent in 2 samples and sluggish in the rest. Iodophilic activity was nil in 2 samples

and only + in others (Table No. 12). The mean values of pH, SAT (min), MBRT (min), gas production time (ml/hr), total protozoal count ($\times 10^5$), rumen ammonia nitrogen (mg%), TVFA (meq/L) in the rumen fluid were 6.37 ± 0.10 , 25.33 ± 1.4 , 18.66 ± 0.7 , 7.01 ± 0.13 , 1.03 ± 0.06 , 9.51 ± 0.67 and 100.83 ± 3.52 respectively.

The mean values of Hb, PCV, RBC and WBC in affected buffaloes were 11.4 ± 0.19 g/dl, $44.5 \pm 0.77\%$, 5.4 ± 0.17 ($\times 10^6/\mu\text{l}$) and 9.25 ± 0.08 ($\times 10^3/\mu\text{l}$) with values ranging from 10.8 to 12.1 (Hb), 42 to 47, 4.9 to 6.1, 8.9 to 9.5 respectively. In these animals the mean values of neutrophils, lymphocytes, eosinophils, monocytes and basophils were $47.33 \pm 0.61\%$, $47.5 \pm 0.46\%$, $3.16 \pm 0.18\%$, $1.5 \pm 0.20\%$ and $0.16 \pm 0.14\%$ respectively. These values are depicted in Table No. 13.

The mean serum values of calcium, phosphorus, magnesium, glucose, BUN, total protein, A/G ratio were 10.53 ± 0.81 mg%, 4.15 ± 0.16 mg%, 2.89 ± 0.07 mg%, 62.91 ± 1.51 mg%, 31.17 ± 0.96 mg%, 9.01 ± 0.09 gm% and 0.83 ± 0.03 respectively (Table 14).

The mean clinical, haematological, rumen fluid and serum biochemical values of the buffaloes with fermentative dysfunctions in comparison with that of healthy buffaloes are depicted in Table Nos. 15 to 18.

4.4 Post parturient indigestion

Buffaloes with indigestion in the post parturient stage had scanty dung with a pasty consistency. Reduced rumen motility, decreased milk production, cough and lacrimation were the other notable signs. The affected buffaloes were dull and depressed.

The mean temperature, pulse, respiration, in affected animals were 101.53 ± 0.5 °F, 66.0 ± 3.5 / min, 30.5 ± 1.8 / min. Rumen motility was 3.8 ± 0.3 / 5 mts. These mean values are shown in Table No. 19.

The rumen fluid in these samples was dark brown in colour and ammonical odour could be noted in 4 samples. The protozoa were showing moderate motility in 5 samples and only in

one it was vigorous. The iodophilic activity was + in 2 and ++ in other samples.

The mean pH, SAT, MBRT, gas production time, total protozoal count, rumen ammonia nitrogen, TVFA in rumen fluid samples were 7.46 ± 0.13 , 14.16 ± 1.16 , 8.83 ± 0.74 , 9.0 ± 0.22 , 0.98 ± 0.04 , 19.74 ± 3.51 and 71.5 ± 2.9 respectively (Table No. 20).

In affected buffaloes the mean calcium, phosphorus, magnesium, glucose, protein, A/G ratio, BUN, AST, ALT, total bilirubin, values were 8.46 ± 0.54 , 3.63 ± 0.19 , 2.56 ± 0.25 , 41.87 ± 2.7 , 5.89 ± 0.24 , 0.91 ± 0.05 , 18.95 ± 1.48 , 55.33 ± 2.1 , 9.6 ± 1.17 and 0.528 ± 0.07 , respectively. These values are shown in Table No. 21.

Therapy

Results of the therapeutic trial conducted on the 3 groups of buffaloes are presented below.

Group I

In this group, 6 buffaloes that had simple indigestion were treated with Suruchi.

Prior to therapy the mean values of temperature, pulse rate, respiratory rate and rumen motility were 100.45 ± 0.27 °F; 50 ± 1.18 /min 22.16 ± 1.0 /min and 1.5 ± 0.22 / 5 min respectively and corresponding values after therapy were 100.46 ± 0.223 °F, 52.3 ± 1.1 / min, 22.3 ± 0.8 / min and 2.6 ± 0.21 / 5 mins. respectively. (Table No. 22)

Studies on rumen liquor samples in the buffaloes of this group revealed that protozoan motility, concentration and iodophilic activity were + to ++ before therapy and ++ to +++ after therapy. The mean values of pH, SAT, MBRT, gas production time, total protozoal count, rumen ammonia nitrogen, TVFA before treatment were 7.021 ± 0.06 , 12.83 ± 0.75 , 10.5 ± 0.56 , 1.09 ± 0.07 , 9.58 ± 0.3 , 18.89 ± 2.7 and 80.16

± 8.4 respectively and after treatment the values were 6.97 ± 0.01 , 8.16 ± 0.3 , 5.16 ± 0.7 , 2.62 ± 0.15 , 13.5 ± 0.42 , 18.08 ± 1.45 and 86.8 ± 8.14 respectively. (Table No. 23)

The mean values of biochemical parameters before treatment were 6.56 ± 0.38 mg% (Ca), 3.73 ± 0.2 mg% (P), 2.42 ± 0.22 mg% (Mg) 58.55 ± 3.49 mg % (glucose), 17.62 ± 0.8 mg% (BUN) $7.23 \pm 3.12\%$ (proteins) and 0.52 ± 0.07 (AG Ratio). The corresponding values after therapy were 7.96 ± 0.28 , 3.7 ± 0.18 , 2.59 ± 0.15 , 54.02 ± 1.5 , 10.36 ± 0.54 , 7.8 ± 0.16 and 0.796 ± 0.04 respectively. (Table No. 24)

Group II

6 buffaloes with simple indigestion in this group were treated with gastric care.

The mean values of temperature, pulse, respiration and rumen motility values before and after treatments were 100.51 ± 0.3 and

100.45 ± 0.09 F, 54.16 ± 1.6 and 52.16 ± 1.58 / min, 22.83 ± 1.01 and 24.5 ± 1.09 and 1.33 ± 0.021 and 2.66 ± 0.21 respectively (Table 25).

Examination of rumen liquor revealed that protozoan motility, iodophilic activity and protozoan concentration were + to ++ before therapy and ++ to +++ after treatment. In the rumen fluid, pH (6.96 ± 0.03 and 7.02 ± 0.03), SAT (15 ± 0.44 and 8 ± 0.36), MBRT (10.16 ± 0.6 and 5.83 ± 0.6), TPC (1.06 ± 0.1 and 2.915 ± 0.28), gas production time (9.5 ± 0.28 and 14.26 ± 1.19), rumen ammonia nitrogen (18.3 ± 1.19 and 10.18 ± 0.9) and TVFA (65.5 ± 3.2 and 82.3 ± 2.3) were the values estimated before and after therapy respectively (Table No. 26).

The mean values of biochemical parameters in this group before and after treatment were Calcium (8.05 ± 0.51 mg% and 8.73 ± 0.76 mg%), phosphorus (3.25 ± 0.36 mg% and 3.6 ± 0.18 mg%), magnesium (2.27 ± 0.25 mg% and 2.84 ± 0.25 mg%), glucose (61.41 ± 2.14 mg% and 58.26 ± 0.98 mg%), BUN (15.43 ± 0.83 mg% and 11.4 ± 0.61 mg%) total protein (6.04 ± 0.32 gm% and 6.88 ± 0.27 gm%) and A:G ratio, (0.765 ± 0.07 and 0.896 ± 0.06) respectively. (Table No. 27)

Group III

In this group, 6 buffaloes with simple indigestion were subjected for treatment with yeasacc bolus and ovine rumen liquor.

The mean values of temperature, pulse, respiratory rate and rumen motility were 100.25 ± 0.32 , 50.83 ± 6.7 , 20.66 ± 0.05 and 1.16 ± 0.03 before treatment and the values were 100.51 ± 0.15 , 52.66 ± 4.9 , 20.67 ± 0.09 and 3.33 ± 0.19 after treatment respectively (Table 28).

Among rumen liquor parameters protozoan motility, iodophilic activity and protozoan concentration were + to ++ before treatment and, ++ to +++ activity was noted after treatment pH (6.96 ± 0.04 and 6.99 ± 0.056), SAT (12.16 ± 0.61 and 8.0 ± 0.21), MBRT (9.33 ± 0.8 and 4.33 ± 0.6), TPC (1.06 ± 0.04 and 3.25 ± 0.12), GPT (8.66 ± 0.45 and 13.06 ± 0.62), RAN (16.26 ± 1.26 and 9.7 ± 0.91) and TVFA (67.66 ± 4.6 and 73.76 ± 2.9) were the other values estimated before and after treatment respectively. (Table No.29)

The mean biochemical values were calcium (8.05 ± 0.57 mg% and 8.73 ± 0.77 mg%), phosphorus (3.26 ± 0.36 mg% and 3.67 ± 0.19 mg%), magnesium (2.27 ± 0.28 mg% and 2.85 ± 0.32 mg%), glucose, (64.41 ± 2.14 mg% and 58.27 ± 0.48 mg%), BUN (15.14 ± 0.84 mg% and 13.65 ± 0.96 mg%), total proteins (6.05 ± 0.33 gm% and 6.88 ± 0.28 gm%) and A/G ratio (0.77 ± 0.08 and 0.90 ± 0.07) in sera samples of these animals before and after therapy respectively. (Table No. 30).

CHAPTER - V

DISCUSSION

Diseases among dairy animals are responsible for heavy economic loss in production there by rendering the enterprise, unprofitable. Rumen dysfunctions or the disorders of the ruminant for stomach, which are a group of complex multiple factorial derangements of functions form the major compartment of the losses. It can be said that inspite of the enormous amount of the resources spent on the scours and much biochemical intricacies explored, the incidence of rumen dysfunctions does not appear to have declined.

As detailed studies on incidence and other aspects of these disorders have not been undertaken earlier in these parts of Andhra Pradesh, investigation on the incidence of indigestion in buffaloes in and around Tirupati was undertaken for the first time in the present study. Perusal of records of 3 Veterinary Hospitals indicated that the per cent incidence of digestive disorders in buffaloes was found to be

35.46 per cent out of the total cases presented for the treatment. Epidemiological studies on rumen dysfunction / indigestion showed that digestive disorders that had the higher incidence (80.2%) belonged to the group of indigestion on the basis of hospital data analysis of 2 years clinical data at Madras (Balasubramanian and Gananpathy, 1965). Kumar *et al.* (2001) reported 24.3% of alimentary tract disorders in Madhura (Uttar Pradesh) during the period of 1994-96. In the present study, the per cent incidence of simple indigestion was found to be the highest (82.31) followed by acid indigestion (0.56%), alkaline indigestion (11.61%) impaction (4.41%) and tympany (1.09%). The inter-alia percentages of incidence in rumen dysfunctions were reported to be variable in different studies. Prasad (1971) also reported higher incidence of simple indigestion (26.82%) followed by acid (17.07%) and alkaline (15.85%) indigestions. Joshi (1980) reported 70.9%, 16.4% and 12.7% incidence of indigestion, impaction and tympany respectively. Kumar and Joshi (1988) stated that simple indigestion was the commonest condition followed by alkaline indigestion and acid indigestion in cattle and buffaloes. Further, during the year 2001, he observed that anorexia syndrome comprised of highest incidence. The incidence of simple indigestion was found to be

71.5%, followed by acid indigestion (21.2%) and alkaline indigestion (6.5%) in buffaloes.

With regards to the seasonal incidence, in summer, incidence of digestive disorders was more (47.19%) followed by rainy season (35.94%) and in winter season (35.60%). Prasad (1979) observed that rumen dysfunctions were (43.1%) more prevalent during summer due to roughage feeding, shortage of water and stress of high temperature with low humidity. Kumar *et al.* (2001) stated that summer season was more prone for this clinical maladies followed by rainy season and winter. Seasonal variation was highly significant in buffaloes (Kumar *et al.*, 2000) which may be explained on its more susceptibility to seasonal changes and difference in digestive physiology.

In the present study, clinical, haematological and serum biochemical parameters were investigated and rumen liquor was evaluated in 6 buffaloes considered as healthy and control group. In

these animals, the mean body temperature, heart rate, and respiratory rate were found to be similar to normal standard values as described by Rosenberger (1979), Misra (1992), Radostits *et al.* (1994) and several other workers. The general physical condition was fair in all and frequency of ruminal contractions was in normal range.

The pH of rumen fluid was ranging from 6.87 to 7.20 (mean 7.00 ± 0.52) which is similar to the values reported by Joshi and Misra (1975), Choudhri *et al.* (1981), Srinivasan (1983), Mohan *et al.* (1992) and Pradhan (1995).

Rumen protozoan concentration, motility and iodophilic activity were normal and comparable with the observations of Misra *et al.* (1972), Rosenberger (1979), Sivaji (1990), Jounary (1991) and Pradhan (1995).

The mean rumen protozoal count was recorded as $3.45 \pm 0.20 \times 10^5$ /ml of rumen liquor. Similar values were reported by Purser and

Moir (1966), Misra (1972), Chinnaiah (1992) and Nangia and Rita Sharma (1994).

The mean value of methylene blue reduction time was 5.33 ± 0.49 minutes which was in agreement with that of Rosenberger (1979), Thirunarayanan (1985), Chinnaiah (1992), Misra (1991) and Mohan *et al.* (1992).

The mean sedimentation activity of rumen fluid in healthy buffaloes was recorded as 7.5 ± 0.34 minutes, which was in concurrence with the average values of 12.8 minutes (Misra *et al.*, 1992), 10.5 ± 1.33 minutes (Sivaji, 1990) 12.6 ± 0.24 minutes (Pradhan, 1995). Sedimentation activity time depends upon the ingredients in the ration and time of feeding which may account for the variation in the observations (Rosenberger, 1979).

The average rumen ammonia nitrogen concentration was 12.52 ± 1.3 mg%. The value obtained by Swenson (1977) was 5.25 mg% and

Alikutty (1981), reported the concentrations as 13.21 ± 1.01 mg% in healthy buffaloes.

The average gas production time value of healthy animals was 13.41 ± 0.54 m/hour. Similar values were recorded by Singh *et al.* (1999).

In the present study, the mean total volatile fatty acid content of rumen fluid in healthy buffaloes was 86 ± 3.14 meq/L which was in agreement with that of Singh *et al.* (1997) and Sharma *et al.* (2000).

The mean serum calcium levels observed in healthy animals was 10.58 ± 0.54 mg/% which is in agreement with the findings of Kehar and Murthy (1945), Crook Shank and Singh (1955), Singh *et al.* (1972), Rao *et al.*, (1981) and Gupta *et al.*, (1995).

The mean serum inorganic phosphorus levels of healthy animals were 4.80 ± 0.37 mg%. Singh *et al.* (1972), Samad (1978) and Shrinkande *et al.* (1999) also recorded similar values.

The mean serum magnesium values in healthy buffaloes were 2.45 ± 0.13 mg% which is similar to the findings of Payne *et al.* (1974), Subbaraju (1989) and Shrikhande *et al.* (1999).

The mean glucose values of healthy buffaloes was 48.70 ± 1.26 and similar observations were made by Baumgartner and Skilicky (1979), Benjamin (1981); Gupta *et al.* (1995) Haloi *et al.* (1997).

The mean blood urea nitrogen value was found to be 10.35 ± 0.54 mg% as also reported by Benjamin (2003).

The mean serum total protein values and A/G ratio of healthy animals were 8.06 ± 0.53 and 1.01 ± 0.1 which are in agreement with the findings of Mahanta *et al.* (1997). In the present study, 6 buffaloes with alkaline indigestion and 6 with acid indigestions were selected for

clinical, haematological, biochemical investigation and study of rumen fluid parameters, to find out the extent of alterations in the above as compared with that of healthy control.

The average serum AST value in control group was 43.6 ± 2.34 IU/ml. These observations are in close proximity with earlier observations of Kaneko and Corenlius (1970).

The mean serum ALT value in healthy buffaloes was 9.6 ± 1.17 IU/ml which is in agreement with those reported by Singh *et al.* (1972), while Benjamin (1981) reported normal values as 4-11 IU/ml.

The mean serum bilirubin value of healthy animals was 0.12 ± 0.19 mg% which is similar to the previous findings of 0.13 ± 0.31 mg% reported by Baumgartner and Skalicky (1979) and Benjamin (1981).

Perusal of hospital records revealed 11.16% incidence of alkaline indigestion in buffaloes during the period from January 2002 to June 2003.

In some parts of the country animals with mild to moderate milk yield (8 kg milk) are solely maintained on barseem and additional quantity of concentrates are fed to those yielding more. Many a times, the concentrates are being partly replaced by protein extenders like urea. Abrupt change of ration to high plane of protein associated with excess fermentation or putrefaction give rise to alkaline indigestion (Hoflund,1967). Ingestion of protein rich diets (Anison and Lewis, 1959, Dirksen, 1987), decomposed / putrified feed and fodder (Hoflund, 1967), drinking of contaminated and sewage water (Nagarajan and Rajamani, 1973) exclusive feeding of paddy straw (Misra and Tripathy, 1963) and urea feeding in high doses (Davidovich *et al.*, 1977 and Dave, 1980) were found to be the causative factors for alkaline indigestion.

In the present study, all of the above factors might be contributing towards the genesis of this condition. In many cases, history regarding the nutritional regimen revealed exclusive feeding of paddy straw which might have contributed to alkaline indigestion in the present study.

Ingestion of poorly digestible roughage causes microfloral inactivity and reduction of microbial fermentation, while the continuous ingestion of

saliva leads to an increase in the pH of rumen fluid. Because of low rate of fermentation, enough acid is not produced to neutralize the alkaline pH of saliva. In addition, the absorption of VFAs through the rumen epithelium proceeds with the generation of bicarbonate in the rumen fluid. Fermentation of roughage leads to production of acetate and its absorption is associated with greater generation of bicarbonate in rumen fluid. Although the fermentation is low, the VFA absorption contributes to the rumen alkalinity.

Fermentation of high protein diet causes a rise in the level of ammonia leading to alkalosis. Over feeding of NPN sources and

accidental ingestion of some common fertilizers containing ammonium salts cause more dramatic elevation of ammonia concentration with rumen fluid pH above 7.5.

Alkaline indigestion due to high doses of urea was reported by Davidovich *et al.* (1977), Choudhuri *et al.* (1981), Alikutty (1981), Desai and Dave (1987) Ahuja *et al.* (1989), Randhawa *et al.* (1991), Singh and Thakur (1974), Randhawa and Singh (1982) and others.

In the present study, in clinical cases of alkaline indigestion, among the various symptoms observed, the most common and consistent symptoms were anorexia, atony of rumen and decreased ruminal motility which are similar to the findings of the earlier investigators (Misra and Tripathy, 1963; Nagarajan and Rajaman, 1973; Sethuraman and Rathor, 1979; Alikutty, 1981; Choudhuri *et al.*, 1981 Blood and Radostitis, 1989.

Various factors such as absorption of toxic amides and amines (Hoflund, 1967), variations in rumen pH and increase in histamine level have been reported to cause ruminal atony and anorexia. Ruminal motility could be suppressed by abnormal increase or decrease in rumen pH (Hungate, 1966).

Decreased milk yield, dullness and putrid odour could be the consequential symptoms of hypomotility of rumen and increased pH.

Scanty and pasty dung was observed in the present study, similar to the observations of Choudhuri (1981). The dung was hard and pellety (Misra and Tripathy, 1963) and loose (Dirksen, 1987) in affected animals.

There was no significant difference between the mean values of temperature, and respiratory rate in diseased animals as compared with healthy animals but pulse rate was significantly higher.

The mean pH value of the rumen liquor in buffaloes with alkaline indigestion was 8.03 ± 0.11 in contrast with that of healthy buffaloes (7.03 ± 0.52). The rumen fluid has good amount of buffers but the buffering capacity on the alkaline side is comparatively poorer as against acid side (Rao *et al.*, 1983). When there is excess production of ammonia as a result of fermentation, excess of saliva flowing into the rumen, the pH slowly increases upto a level of 7.5 after which buffering capacity still diminishes and such cases are classified under alkaline indigestion (Hoflund, 1967).

The pH varied from 8.0 to 8.9 as reported by Chouduri *et al.* (1981), Misra and Tripathy, (1963), Misra and Singh (1974) in buffaloes with alkaline indigestion.

The colour, consistency and odour of the rumen liquor in the healthy control group was yellowish brown, viscous and aromatic respectively, while in alkaline indigestion cases the rumen fluid was dark brownish in colour and had ammonical odour. These changes may be attributed to the putrefactive changes in the rumen, increased

multiplication of saprophytic bacteria and increased production of ammonia.

The fermented feeds, which are undergoing spoilage, contaminated feed and water when ingested introduce certain microflora viz., coliform and proteus spp. They allow the development of putrefactive decomposition. Similar observations were earlier reported by Misra and Tripathy (1963), Dash *et al.* (1972), Misra and Singh (1974), Sethuraman and Rathore (1979) and Dirksen (1987).

The protozoan concentration and motility in buffaloes with alkaline indigestion ranged from +/- to ++ and the motility was sluggish. The activity of the protozoa depends upon the availability of the required nutrients in the rumen liquor and also optimal pH. Abnormal fermentation, increased pH and also accumulation of toxic amines lead to death of protozoa and motility will be affected. Earlier investigators also observed similar findings (Misra and Tripathy, 1963; Hoflund, 1967; Prasad *et al.*, 1972; Choudhuri, 1986; Choudhuri *et al.*, (1980) Dirksen and Coleman (1988).

There was significant rise in sedimentation activity of the rumen liquor in diseased animals as the mean value was 20.5 ± 1.41 as compared to 7.5 ± 0.34 minutes in healthy control group. The longer period as observed in this study indicate gross inactivity of the essential flora while there could be abnormal activity of undesirable microbes. In alkaline indigestion increased SAT activity ranging from 30 to 51.20 minutes has been reported (Misra *et al.*, 1972; Prasad 1976 and Alikutty, 1981).

Similar to SAT, there was also significant increase in methylene blue reduction time in alkaline indigestion. The mean value was 17.16 ± 1.40 as compared to 5.33 ± 0.49 in healthy control group. The increase in the MBRT in the present study might be due to inactivation or death of ruminal flora and fauna (Nagarajan, 1985), as a result of abrupt changes in rumen pH (Hoflund, 1967). Similar findings were also reported earlier by Thirunarayanan *et al.*, (1985).

There was significant decrease in total protozoan count in cases of alkaline indigestion as the mean value was $1.83 \pm 0.06 \times 10^5$ /ml.

Similar results were reported by Randhawa *et al.*, (1991). These alterations in rumen liquor suggested that there was reduced activity of rumen microbes which reflected fore stomach indigestion.

There was a significant decrease in gas production time. The mean value in alkaline indigestion was significantly decreased to 7.38 ± 0.29 ml/hour as compared to 13.41 ± 0.54 ml/hour of healthy control animals. Corresponding values were reported by Randhawa *et al.* (1991) and Ahuja *et al.* (1989). These changes are due to the destruction of normal microflora and the absence of cellulolytic bacteria due to production of ammonia nitrogen in toxic concentrations in rumen liquor (Ahuza *et al.*, 1989).

Biochemical analysis of rumen liquor for ammonia nitrogen revealed significant increase in the values in alkaline indigestion. The mean value was significantly higher (32.89 ± 1.73 mg%) as compared to in healthy control animals (12.52 ± 1.32). Similar high RAN values were also reported in buffaloes with alkaline indigestion by Joshi and

Misra (1975). Sethuraman and Rathore (1974), Venkateswarlu *et al.* (1998) and Anuja *et al.* (1989).

There was significant decrease in total volatile fatty acids concentration in alkaline indigestion. The mean value was 55.16 ± 1.8 meq/lit as compared to healthy control group (86 ± 3.14 meq/lit). Similar values (56.30 ± 2.41 meq/lit) were reported in alkaline indigestion by Sethuraman and Rathore (1979) and Singh *et al.* (2003). This is due to reduced number of species of rumen microbes that govern the microbial flora of rumen activity and its pH Ahuja *et al.* (1989).

There was significant increase in the mean values of haemoglobin, PCV and WBC in buffaloes with alkaline indigestion. However, there was no significant difference as compared to healthy group. No alterations could be observed in other parameters. The increase in the values of Hb and PCV might be due to increased haemoconcentration (Huber, 1971) and also due to release of erythrocytes from spleen due to stress. Jain (1986) stated that

increase in TLC with immature neutrophils, lymphopenia, eosinopenia and monocytopenia are the result of release of corticosteroids due to stress induced by digestive disorders.

In the present study, estimation of certain serum constituents of buffaloes with alkaline indigestion revealed significant decrease in the mean values of calcium and phosphorus with no significant difference in values of magnesium as compared to control values. The mean values of calcium and phosphorus in alkaline indigestion were 7.71 ± 0.25 mg% and 3.50 ± 0.16 mg% as compared to 10.58 ± 0.54 mg% and 4.80 ± 0.37 mg% respectively in healthy control buffaloes. This reduction might be due to decreased supply from intestine as a result of disturbance in absorption of minerals from gut because of defective ionization (Choudhuri *et al.*, 1980). Similar findings were observed by Gupta *et al.* (1995). However no significant variation in calcium and phosphorus values was noted by Joshi and Misra (1975).

In the affected buffaloes biochemical analysis of blood revealed significant increase in the glucose level. The mean value was 64.38 ± 2.37 mg% as compared to 48.70 ± 1.26 mg% in healthy control

buffaloes. Increased blood glucose levels of similar (or) higher range were reported by Sethuraman and Rathore (1979), Alikutty (1981), Randhawa and Singh (1982). Desai and Dave (1987), Venkateswarlu *et al.* (1998) and Singh *et al.* (2003). Hyperglycemia associated with alkaline indigestion might be due to decrease in glucose utilisation by tissues, impairment of TCA cycle, to a lesser extent due to glycogenolysis in the liver, due to release of epinephrine and due to ammonia toxicity (Davidovich *et al.*, 1977; Alikutty, 1981).

Significant increase in BUN values was observed in cases of alkaline indigestion. The mean value was 28.12 ± 2.94 mg% as compared to 10.35 ± 0.54 mg% in healthy animals. Similar reports were observed by earlier investigations (Sethuraman and Rathor, 1979; Choudhuri *et al.*, 1981; Alikutty, 1981; Radhawa and Singh, 1982, Singh *et al.*, 2003 and Venkateswarlu *et al.* 1998). This could be attributed to maximum activity of urea cycle and formation of urea in an effort to deal with the excess ammonia carried to the liver through portal circulation.

There was significant decrease in total protein values in affected buffaloes. The mean value was 6.22 ± 0.36 g/dl as compared to 8.06 ± 0.5 g/dl % in healthy animals.

In the present study, the incidence of acid indigestion in buffaloes was found to be 0.56%, upon scrutiny of the hospital records from January 2002 to June 2003.

By definition, acidosis is a decrease in the alkali (base excess) in the body fluids relative to the acid (H^+ ion) content. Hence although diagnosis requires blood pH to fall below 7.35, other features such as fall in ruminal pH, clinical signs such as anorexia, variable feed intake, diarrhoea and lethargy are same diagnostic indicators of acidosis in feed lot animals (Owens *et al.*, 1998). Acute rumen acidosis is the most dramatic of the forms of ruminal microbial fermentation disorder. It received most research attention and events in pathogenesis are more clearly defined than those of other fermentative disorders.

The etiology of ruminal and systemic acidosis has been described in excellent reviews of Hungate (1966), Dunlop (1972), Huber (1976).

Development of acidosis is a complex interaction involving diet, ruminal microorganisms and the animal. The development of stable microflora upon transition from a forage to a concentrate diet is not immediate. Introduction of highly fermentable starch into rumen stimulates the growth of most ruminal bacteria, thereby increasing production of volatile fatty acids if the transition from a forage to cereal grain diet is too abrupt or if the particle size of concentrate ration is too small, microbial population becomes unstable, leading to production of lactic acid and causing acidosis (Mc Alister *et al.*, 1996).

In the present investigation, there was history of sudden ingestion of rice in the cooked form, feeding of excess grain, or root crops (sugar beets and potatoes) in affected animals. Nauriyal and Baxi (1978) stated that certain managemental problems that result in access of animals to such readily fermentable carbohydrate feeds in the pure form or in formulations lead to various forms of acute or chronic illness.

Buffaloes in the present study, that had acid indigestion exhibited symptoms such as inappetence, decrease in milk yield, absence of rumination, salivation and diarrhoea with variable severity. Similar signs were recorded by Dirksen (1965), Dunlop (1972) and several other workers.

Garry (1990) stated that severity of rumen acidosis and disease signs are quite variable depending upon the amount and type of carbohydrate rich feed consumed and the degree of prior rumen microbial adaptation to the carbohydrate substrate and the disease can range from a mild form of indigestion to an overwhelming toxæmia.

The body temperature was not altered in the affected buffaloes. Dirksen (1970) observed that temperature became normal or subnormal in acid indigestion. In some buffaloes at the present study pulse was wiry and dyspnoea was evident.

Rumen motility decreased in all the cases of acid indigestion. Huber (1976) stated that three mechanisms such as 1) involvement of hydrogen ion receptors elsewhere in the gastrointestinal tract 2) central inhibition by absorbed acid and 3) inhibition by absorbed amines or toxins are responsible for rumen stasis following the acidification of rumen ingesta. According to Garry (1990) high concentrations of undisassociated volatile fatty acids excite sensory epithelial receptors that reflexly inhibit rumen motility. Niederman *et al.* (1990) observed that high concentrations of VFA, tyramine and histamine inhibit rumen motility at low pH. Lactic acid at the level of duodenum may also influence ruminal motility through negative feed back inhibition. Higher levels of butyrate and presence of toxic amines such as histamine, tryptamine and tyramine in higher concentrations are responsible for inhibiting rumen motility (Singh *et al.* 2003)

In affected buffaloes, the mean rumen pH value was 6.37 ± 0.10 , which was significantly different from that of control (7.03 ± 0.52). This reduction in pH has been reported to be due to abnormal fermentation of simple carbohydrates by the acidogenic aerobic

microbes (Dirksen, 1970). Rapid fermentation of CHO by amylolytic bacteria in the paunch (Hungate, 1966) along with increase lactic acid brings about decrease in rumen pH. With acute ingestion of highly fermentable feed stuffs there is insufficient time for microbial adaptation resulting in abnormal fermentation with a shift in relative production of VFA towards more propionate and less acetate. The organic acids-formic, valeric and succinic acids increase and their accumulation lead to decrease in pH (Nidermanm *et al.*, 1990). Low pH due to excess lactic acid, lactates and butyric acid is a common feature of grain overfed cattle and sheep (Misra, 1967). The pH in acid indigestion varies from 5.5 to 6.5 in mild, 4.5 to 5.5 in moderate and 4 to 4.5 in severe cases. In subacute acidosis the pH was ranging from 5.0 to 5.5 (Goad *et al.*, 1998), whereas in acute lactic acidosis it ranges from 3.9 to 4.5 (Dunlop, 1972). Lower pH values of similar range were also recorded by Sinha *et al.* (1985), Vijaya Kumar *et al.* (1989). Singh *et al.* (2003) and several other workers. The rumen fluid in the affected animals was some what watery and milky grey in colour with pungent sour smell as observed by several workers.

Buffaloes with acid indigestion had increased values of SAT (25.33 ± 1.14) and MBRT (18.66 ± 0.71) when compared to that of healthy group (7.5 ± 0.34 and 5.33 ± 0.48 respectively). These findings were indicative of reduced cellulolytic activity due to development of rumen acidosis. Similar observations were noticed by Dirksen (1965) and Narendra *et al.* (1990).

There was significant decrease in the gas production time (7.01 ± 0.13 ml/hour) in cases of acid indigestion as compared to that of control group (13.41 ± 0.54 ml/hour). It might be due to less fermentation activity resulting from lowered pH.

There was significant reduction in total protozoan count in affected buffaloes in contrast with that of healthy group. The growth, multiplication and motility of the protozoa in the rumen liquor is dependent upon hydrogen ion concentration, which provides an optimal environment. A marked decrease in rumen pH thus led to a decrease in the motility and number of protozoa. Lysis of rumen protozoa occurs, when the rumen pH falls below 5.5.

There was no significant difference between the mean values of rumen ammonia nitrogen in buffaloes with acid indigestion and control healthy group indicating no effect of altered pH on this biochemical constituent.

Total volatile fatty acid content in affected buffaloes showed significant increase (100.83 ± 3.52 meq/L) as compared to that of healthy control. Literature on the effect of ruminal lactic acidosis on the correlation of pH and TVFA is intriguing. The conflicting reports on the increase or decrease in TVFA appears to depend on the stage of the disease when the animal is presented for treatment (Sinha *et al.*, 1985). The increase in TVFA's could be explained as a result of rapid fermentation with the increased production of these acids along with lactic acid (Briggs, *et al.*, 1957) Increase in TVFA in acidosis was recorded by Randhawa *et al.* (1981).

There was significant increase in hemoglobin in case of acid indigestion, when compared to the control group. The mean value in this group was $11.4 \pm 0.199\%$. Similar significant increase was also noted in PCV of this group as the acid mean value was found to be 44.5 ± 0.77 .

Leucocyte count was also found to be increased in this group but TEC was not altered significantly. In case of differential leucocytic count there was no significant difference in the values between indigestion group and control group.

The changes could be due to haemoconcentration effect of increased osmolarity of rumen contents (Broberg, 1956) causing withdrawal of fluid from intravascular compartment (Huber, 1971).

Estimation of serum calcium and magnesium in buffaloes with acid indigestion revealed values within the normal range. Similar findings were observed by Bide *et al.* (1973).

There was significant rise in levels of inorganic phosphorus in affected buffaloes when compared to the control group. Similar observations were made by Bide *et al.* (1973) and Jagos (1978) in both cross bred cattle and buffaloes. Increase in inorganic phosphorus without change in Ca level could be attributed to disturbed carbohydrate metabolism. (Nauriyal and Baxi, 1981). Choudhuri *et al.* (1980) stated that the purpose of increase in pH might be due to increase in buffering action and to maintain the acid base balance of blood.

Glucose levels were found to be significantly increased (62.91 ± 1.51 mg%) in cases of acid indigestion cases when compared to healthy group. Similar observations in acid indigestion were reported by Bide *et al.* (1973). With moderate acidosis, hyperglycemia has been reported by Dirksen (1965). This could be due to decreased glucose utilization in peripheral body tissues coupled with hepatic glycolysis under the effect of hyperactive adrenal medulla in acidosis (Naurial and Baxi, 1981). A significant rise in blood glucose concentration might

be due to increase in glycogenolysis or gluconeogenesis or due to decreased utilization as a consequence of decreased level of circulating IRI. The depletion of liver glycogen may be due to hyperactivity of adrenal medulla to cause increased glycogenolysis, thus contributing towards hyperglycemia (Randhawa *et al.*, 1980 and 1981).

The mean blood urea nitrogen (BUN) value was significantly increased (31.17 ± 0.96 mg%) in affected buffaloes. The rise BUN was probably due to decreased renal function and hepatic degeneration under acidosis state (Sandha, 1980). Increase in BUN might be due to myocardial insufficiency, renal degeneration and subsequently decreased urea clearance by kidneys (Randhawa *et al.*, 1981). Similar observations were reported by Naurial and Baxi (1981) and Singh *et al.* (2003).

There was no significant change in total protein and albumin - globulin ration in acid indigestion cases, when compared to control group. Similar observations have been made by Sandha (1980) and

Naurial and Baxi (1981). However Mullen and Bell (1967) recorded changed albumin : globulin ratio in barley feed calves.

In the modern commercialized farming every effort is being made to attain maximal milk production by providing moderate to minimum input. This imposes severe stress on the metabolic homeostasis of the high yielding animals making them vulnerable to metabolic disorders during post parturient period.

In veterinary clinical practice, indigestion is one of the most commonly encountered medical problem and post parturient indigestion has got special place in veterinary medicine as the condition may result in sub optimal production, poor health, low fertility, and prolonged calving intervals.

In the present study six buffaloes with indigestion in the post parturient state were investigated. These buffaloes exhibited partial to complete loss of appetite followed by decreased rumen motility. This

finding might be due to decrease in liver function and reduced vitamin B₁₂ synthesis. Similar findings were reported by Kadrekar and Murhkibhavi (1971), Hedao *et al.* (1982), Mahanta *et al.* (1988), Venkateswarlu (1990), Pillai (1992).

Decreased milk yield and passing of scanty and pasty faeces are the other signs, which might be resulting from typical inadequate secretion of bile salts, combined with lactation stress and negative energy imbalance. Similar observations have been described by Blood and Radostitis (1989), Mahanta *et al.* (1988) and Pillai (1992).

There was no significant difference in the mean values of temperature, pulse and respiratory rates between healthy animals and post-parturient indigestion cases and the values were comparable with the control values which indicate that post parturient indigestion with hepatic dysfunction has little or no effect on the vital parameters.

The rumen liquor in affected buffaloes was thin and had ammonical odour. Similar observations have been reported by Dash *et al.* (1972), Misra and Tripaty (1963), Misra and Singh (1974), Rajasekharan and Venkata swamy (1981), Pillai *et al.* (1995) and Mahanta *et al.* (1997).

The mean pH was 7.46 ± 0.13 and similar values were reported by Jones (1965), Hoflund (1967), Rajasekharan and Venkataswamy (1981) and Pillai *et al.*, (1995).

The protozoan motility in buffaloes with PPI cases ranged from ++ to +++. The activity of protozoa depends upon the availability of the required nutrients in the rumen liquor and optimal pH. Abnormal fermentation and accumulation of toxic amines may lead to death of protozoa and motility will be effected.

There was significant rise in mean values of SAT (14.16 ± 1.16) & MBRT (8.83 ± 0.74) when compared to control values. The longer period as observed in this study indicate gross inactivity of the

essential flora, while abnormal activity ranging from 30 to 51.20 min. has been reported (Misra *et al.*, 1972; Prasad 1976 and Alikutty (1981), Nagarajan (1985).

There was significant decrease in total protozoal count (0.98 ± 0.04) in cases of PPI. Similar values were reported by Randhawa (1981). These alterations in rumen liquor suggest that there was reduced activity of rumen microbes which reflected for stomach indigestion. There was also decrease in gas production time (9.0 ± 0.22) when compared to healthy buffaloes.

The rumen ammonia nitrogen was significantly raised (19.74 ± 3.51 mg%) when compared to healthy control group. Similar reports were observed by Joshi and Misra (1975) and Venkatesawarlu *et al.* (1998).

The mean concentration of TVFA was decreased (71.5 ± 29 meq/L) and it was reflected by the higher pH and low microbial count.

This is in agreement with the findings of Phillipson (1942) and Dirksen (1970), who observed inverse relationship between pH and TVFA concentration in the rumen liquor in early stages of rumen acidosis. Similar observations were recorded by Rajasekaran and Venkataswami (1981). The concentration of rumen ammonia nitrogen was increased (19.74 ± 3.51 mg%) compared to the normal healthy buffaloes which might be due to digestive disturbance following parturition.

The mean serum calcium values of all the animals were significantly lowered (8.46 ± 0.54 mg%) than the control value which might be due to either excretion in colostrums and milk or mobilization of calcium from skeleton or decreased supply from intestine as a result of disruption in absorption of minerals from gut because of defective ionisation (Choudhuri *et al.*, 1980). Similar observations were recorded by Prasad *et al.* (1977), Blood and Rodostits (1989) Gupta *et al.* (1995).

The mean serum inorganic phosphorus levels were slightly decreased (3.63 ± 0.19) and low serum phosphorus levels in PPI

affected animals might be associated with release of high contents of phosphorus in colostrums and milk at the onset of lactation (Payne, 1974) or probably due to its waste from digestive tract (Radostits, 1994). Similar values were recorded by Prasad *et al.* (1972) and Gupta *et al.* (1995).

The mean serum magnesium level of the PPI group was slightly lowered (2.56 ± 0.25) than the control values. A short period of starvation (24-48 hours) in lactating animals is capable of causing a fall in serum magnesium levels. (Radostits *et al.*, 1994). Subba Raja (1989) and Prameela (1999) also made similar observations.

The mean serum glucose values were lower (48.7 ± 2.7 mg%) than the control values. Pandey and Parai (1989) noted decreasing trend of serum glucose levels for almost one month after calving. Rajora *et al.* (1994) observed significantly lowered glucose levels in post-parturient cows. Gupta *et al.* (1995) estimated blood glucose in 34 cows and 59 buffaloes with post-parturient anorexia and found significantly lowered serum glucose values. Haloi *et al.* (1997) studied PPI in 27 cows and observed decreased serum glucose values.

Low glucose values in PPI are directly correlated with the appetite and absorption of nutrients from gut and rumen metabolism.

There was significant increase in the values of AST (55.33 ± 2.1 IU) in PPI. Hedao *et al.* (1982) observed elevated AST levels in buffaloes suffering from indigestion and Mahanta *et al.* (1988) reported increase in AST levels in PPI buffaloes with hepatic dysfunction. Similar values were reported by Pillai (1992); Haloi *et al.* (1997) and Prameela (1999). The increased levels of AST values were due to hypocalcemia which lead to the outward diffusion of intracellular enzymes into tissue fluids and circulation (Radostits *et al.* 1994) following increased wear and tear of tissues as a result of disturbed digestive system and metabolic activities of the animal (Ramesh Kumari, 1995).

There was slight increase (9.6 ± 1.17 IU) in ALT values in PPI buffaloes. Schafer and Wener (1974) reported that the change in

glutamic pyruvic transaminase activity in recently calved ketotic animals were too slight to have diagnostic significance. Hedao *et al.* (1982) reported elevated ALT levels in all types of indigestion. Pillai *et al.* (1992) Mahanta *et al.* (1997) also recorded similar findings.

There was increase in total bilirubin (0.528 ± 0.07) values in case of PPI when compared to the healthy buffaloes. The increased bilirubin levels in post-parturient animals and stated that it might be due to low to medium degree of liver damage. Baumgartner and Skalicky (1979) and also recorded high serum total bilirubin concentrations in post-parturient animals which indicated a degree of liver damage.

The mean values of total protein (5.89 ± 0.24) and A/G ratio (0.91 ± 0.05) of PPI cases were decreased significantly. This could be due to damage of hepatic cells as also reported by Sethuraman and Varma (1979) in buffaloes and Mahanta *et al.* (1997).

The above findings indicate that existence of slight hepatic inactivity in buffaloes with indigestion in post parturient state.

Simple indigestion, a mild form of rumen dysfunction characterised by anorexia, off feed, dull ness, with variable pH is one of the most common ailments of ruminants. It is the sequel of an abrupt change in the ration. Such feed changes present rumen microflora with nutrient substrates, to which they are not metabolically adopted, or adopted only in lesser quantities or that contain inhibitory substances or produce inhibitory substances upon fermentation. Generally this disease is relatively mild and self limiting. Mild acidosis or alkalosis may develop depending upon the nature of causative feed and its resultant fermentative degradation. Signs of microfloral inactivity are noted. In some of the affected, hypogalactia is a significant feature and to avoid economic loss due to suppressed milk production, radical treatment in all clinical cases is indicated.

Therapy for cases of indigestion using conventional drugs is costlier, whereas indigenous (herbal) drugs are cheap, safe and have no side effects (Singh *et al.* 1991 and 1992). Keeping above aspects in view, in the present study, 3 groups of buffaloes each comprising of 6 animals with simple indigestion were subjected for treatment with Suruchi powder and Rumenotorics (group I), gastricare bolus and rumentorics for group II and yeasacc bolus, ovine rumen liquour and rumenotorics for group III and the therapeutic response was studied.

The major clinical signs in the affected animals were anorexia, absence of rumination decreased rumen motility and reduced milk yield in lactating animals. Decrease in rumen motility is a feature of all cases of primary indigestion except in few cases where there is diarrhea. Higher percentage of propionate and butyrate probably lower rumen motility. Suppressed milk production as either hypogalactia or agalactia seen in indigestion might be due to presence of higher circulating biogenic amines indicative of nutritional stress. These amines cause release of catecholamines from their mobile pool, causing neutralization of let down hormone oxytocin, and through suppressing activity of other hormones such as prolactin, thyroxine and somatotropin decreased milk yield results.

All the animals had normal temperature, pulse and respiratory rates as that of healthy animals and the physical condition was found to be poor to fair before therapy.

Clinical examination after therapy revealed that appetite increased, rumination was restored, and milk yield enhanced and

rumen motility became normal in all treated animals. Dullness was not evident and physical condition in few also started to improve. The above findings indicate the efficacy of herbal drugs in bringing about optimum clinical improvement.

Evaluation of Rumen fluid in buffaloes with indigestion showed that the pH was ranging from 6.96 ± 0.03 to 7.021 ± 0.061 . Garry (1996) stated that in simple indigestion, the changes in pH were mild and tend towards acidosis or alkalosis. The protozoan motility was sluggish to moderate. Their concentration in microscopic field was less and the count was low in these animals prior to therapy. These changes might be due to adverse effects on ecology of rumen micro organisms and poor fermentation rate. The sedimentation activity time was increased, MBRT was prolonged, iodophilic activity was less and gas production time was low. Increased sedimentation time indicates decreased microbial activity (Garry, 1996) and suppressed microbial fermentation (Nicholas and Penn, 1958 and Misra and Tripathy, 1963). Increased MBRT and slow gas production time also

indicated decreased microbial fermentation in rumen due to inactive microflora and decreased microbial activity (Garry, 1990).

The protein content was low and rumen ammonia nitrogen content was more. The total volatile fatty acid content was lower in two groups. Singh *et al* (1997) recorded low TVFA in all cases of primary indigestion, because of low fermentation activity, and decrease in number and species of rumen microflora and fauna which is due to alternation in rumen pH, wherein some resistant species of microbes evolve and thrive.

After the completion of therapy, rumen fluid, samples when subjected for analysis revealed that pH was normal in all samples. The protozoan motility became vigorous, their concentration per field was optimum and count was normal. Sedimentation activity time and methylene blue reduction time were reduced and iodophilic activity was improved Gas production increased, protein content was enhanced rumen ammonia nitrogen content was reduced and TVFA production increased. All these changes indicate the therapeutic

efficacy of the drugs used in the present clinical trial in improving the rumen microbial activity.

In the present study, the mean serum biochemical values such as calcium, phosphorus, magnesium, blood glucose, blood urea nitrogen, total protein and albumin globulin ratio of all the animals in the clinical trial were not significantly altered from that of normal values before and after therapy. The blood glucose content was higher in buffaloes prior to therapy. Ramesh Kumari *et al* (1995) stated that because of glycogenolysis that is bound to occur in indigestion, glucose is oxidised to meet out the energy requirement of animals with low VFA production. Singh *et al* (1996) stated that significantly high blood glucose levels in primary indigestion are due to stress, which leads to release of corticosteroids, catecholamines and thereby glycogenolysis. If the animal has to survive and thrive for its energy requirement, it has to depend upon glucose oxidation. Buffaloes prior to therapy revealed higher BUN content. Ramesh Kumari *et al.* (1995) observed significantly higher Blood urea levels in all clinical cases of indigestion,

due to failure of urea recycling process and its neutralization by rumen microbes.

After therapy blood glucose level and BUN content were less indicating improved digestion due to the effect of treatment.

The results of the clinical trial in the present study indicated that both of the drugs employed viz., Suruchi. (each 5 gm bolus containing chitraka 1 gm, pippali 100 mg, sunti 100 mg, mareecha 100 mg, hingu 175 mg, ajavana 375 mg, shankha bhasme 750 mg) and gastricare (Guduchi 0-7.5 mg, Shunti - 0.60 mg , Haritaki 0.54 mg, Lasuna - 0.48 mg, Jiraka - 0.36 mg, Vidanga - 0.15 mg, Maricha - 0.12 mg) were found to be effective in eliciting a favorable response in buffaloes with indigestion. The efficacy of herbal drugs in treating digestive disorders was proved by the studies of many previous workers. Pal *et al* (1994) obtained significant increase in total protozoan count and motility, increase in TVFA, GFT, decrease in SAT within 72 hours after treatment of clinical cases of simple indigestion with "Ruchamax". In cattle with rumen dysfunctions, "Himalayan

batisa strong" proved to be beneficial in restoration of rumen function (Simmi Manjula *et al*, 1995).

Joshi and Mahesh Kumar (1995) used an ayurvedic preparation, "Kaptone batisa", which was found to be effective in the treatment of indigestion. Singh *et al* (1996) observed that the use of "pachoplus" and "Ruchamax" as appetite stimulants and digestive tonics gave good results in indigestion.

"Rumbion" a herbal orectic preparation was able to maintain rumen pH, reduce MBRT and increase TVFA in water buffaloes suffering from spontaneous primary and secondary anorexia (Kumar and Joshi, 1997).

Significant improvement in appetite, body condition and rise in milk production was obtained by Reenia Mukherjee (1998) in a clinical trial using "Himalayan batisa" in digestive disorders of buffaloes. Clinical cases of indigestion were treated with "Herbostrong" by Jagadish *et al* (1997) and in treated animals appetite regained,

rumination and rumen motility returned to normal with improvement in the quality of rumen liquor. Amruth Kumar and Suryanarayana (2001) found that "Ruchamax" was proved to be effective in alleviating indigestion. Pane *et al* (2000) found that gastricare and Liv.52 improved protozean motility and count, iodophilic activity, MBRT, SAT and TVFA in rumen liquor when used in goats with simple indigestion.

In the present clinical trial, though there was improvement in treated buffaloes of all the groups, the therapeutic response was comparatively more in animals of group III treated with yeasacc and ovine rumen liquor which responded in a more favourable manner.

The results of the study indicated that there was improvement in appetite, rumen motility, rumination in all the six animals of this group, whereas improvement could be observed only in some of animals of the group I and group II. Similarly there was increased ruminal microbial activity in all animals of group III after treatment which was not a feature in other groups (Table 31). In group III animals, all the animals after treatment showed improvement in

serum calcium with reduction in blood glucose and BUN, whereas in other groups similar response was not evident all treated animals.

Ovine rumen fluid and administration was carried out for group III buffaloes of the present study.

The efficacy of cud transplantation was well documented. Choudhari *et al* (1981) observed that compared to other methods of treatment, use of cud transplantation brought about early restoration of floral activity, which was reflected by improvement in appetite, rumination, rumen motility.

Srinivasan (1983) performed rumen fluid transplantation in twenty animals suffering from various digestive disorders and noticed a better improvement in clinical picture of animals. Rumen liquor transplantation is economical in treating animals with ruminal dysfunctions.

Garry (1990) stated that transfaunation should be repeatedly performed whenever the viability or activity of micro flora is in doubt and the benefits of reinoculating the rumen from a sick animal with normal forestomach micro flora should not be underestimated.

Thirunarayanan *et al* (1985) noticed clinical recovery in animals with primary indigestion, within 2 to 6 days of cud transplantation.

Radostits *et al.* (1994) opined that rumen liquor transplantation is essential in treating digestive dysfunctions of rumen .

Heterologous transplantation of rumen liquor was also found to be effective in treating rumen dysfunction. Malleswara rao (1996) treated various digestive disorders such as simple indigestion, acid and alkaline indigestion by administering sheep rumen liquor and found that heterologous or homologous rumen liquor transplantation can achieve the reestablishment of rumen ecosystem with complete clinical recovery.

The favourable response noted in the animals of this group might be attributed to presence of "yeasacc" in the regimen which is a probiotic compound consisting of live yeast cells of proprietary strain of *Saccharomyces cerevisiae*¹⁰²⁶ 25 billion (25x 10⁹) cells per bolus.

Probiotics which are bacterial cultures are beneficial in reestablishing a normal rumen micro environment. These compounds may act by stimulation of appetite fibre digesting bacteria, non specific immuno-stimulation and production of digestive enzymes and B vitamins that aid indigestion and provide necessary nutrients (Niederman *et al*, 1990).

CHAPTER - VI

SUMMARY

Digestive dysfunctions stand as a great menace to bovine health and production. It would be imperative to assess the magnitude of prevalence of these condition, to detect these disorders at the earliest by employing clinical biochemical examination and rumen liquor evaluation and to institute instant improved treatment to prevent the economic loss.

The present study was carried out to assess the incidence of different types of rumen dysfunctions in and around Tirupati and to elucidate various alterations in fermentative disorders and post-parturient indigestion. Evaluation of the therapeutic efficacy of herbal drugs and ovine rumen liquor in clinical cases of simple indigestion based on improvement in clinical symptoms, physical and microbial changes of rumen liquor and biochemical alterations in blood was also one of the objective of the study.

Out of a total of 26514 cases, presented to the various veterinary clinics in and around of Tirupati with different ailments. The incidence bovine indigestion was found to be 35.46%. Out of these the incidence of simple indigestion, acid indigestion, alkaline indigestion, impaction, tympany, were observed as 82.31%, 0.56%, 11.61%, 4.41% and 1.09% respectively. With regards to seasonal occurrence in winter, summer and rainy seasons the per cent incidence of indigestion were 35.6%, 47.19% and 35.94% respectively.

In the present study six healthy buffaloes which served as healthy control group, and six cases each of acid and alkaline indigestion were selected and subjected to detailed clinical examination, rumen liquor evaluation, haematological and biochemical analysis. These findings of the fermentative disorders were compared with that healthy control group to assess the extent of alterations in the diagnostic point of view.

The clinical cases belonging to alkaline and acid indigestion showed anorexia, decrease in milk yield, rumen hypomotility. The mean temperature, pulse, respiration rate and ruminal motility in the buffaloes with alkaline indigestion were 100.61 ± 0.19 °F, 56 ± 2.47 /min, 21.66 ± 1.6 / min and 1.33 ± 0.21 / min respectively and in acid indigestion, 101.05 ± 0.15 , 59.5 ± 1.3 / min, 28.5 ± 0.67 / min and 0.67 ± 0.27 / 5 min respectively. Except rumen motility, there was no much significant difference in above parameters. In rumen liquor evaluation, significant changes were observed in physical characters of rumen fluid, motility, iodophilic activity. SAT, MBRT, total protozoal count, rumen ammonia nitrogen and TVFA.

In case of haematology, significant changes were noted in haemoglobin, PCV and WBC values. The mean values of Hb, PCV and WBC in case alkaline indigestion were 11.6 ± 0.20 , 44 ± 7.8 and 9.1 ± 0.88 and in acid indigestion these values were 11.4 ± 0.19 , 44.5 ± 0.77 and 9.25 ± 0.08 respectively.

Biochemical analysis, revealed that the glucose and blood urea nitrogen were significantly altered in the fermentative disorders, when compared to the healthy control buffaloes.

In the present study 6 buffaloes with indigestion in post parturient state were selected and subjected for detailed evaluation of clinical, rumen liquor and bio-chemical values. There was no significant difference in case of temperature, pulse and respiration rate. But in case of rumen motility there was significant decrease of rumen motility in the post - parturient buffaloes with indigestion, when compared to healthy control group.

In the rumen liquor evaluation, it was found that the protozoan motility, iodophilic activity, total protozoan count were significantly decreased in the cases of PPI, when compared to healthy control group. There was significant increase in the values of SAT, MBRT and rumen ammonia nitrogen. Among the biochemical parameters, AST, ALT and total bilirubin values were significantly increased when

compared to healthy control group, which indicates the liver dysfunction in the PPI cases.

For therapeutic evaluation, 18 buffaloes, which were suffering from simple indigestion were selected and divided into 3 groups of 6 animals each. 6 buffaloes of healthy condition were served as a control group.

All the six buffaloes of group I were treated with Suruchi powder 10 G daily for 3 to 4 days along with rumentorics. Group 2 buffaloes were given gastricare bolus twice daily orally for 3 to 4 days, along with rumenotrics.

In the present clinical trial, there was improvement in all the parameters studied in buffaloes, treated with different herbal products. However, therapeutic response was comparatively more favourable in animals of Group III, treated with yeasacc and ovine rumen liquor, with notable response in all and more favourable animals subjected for treatment. The results of the study indicated,

that there was improvement in appetite, rumen motility, rumination in all six animals of this group where as improvement could be observed only in some of the animals of Group I and II. The favourable response noted in the III group might be attributed to presence of yeasacc, which is a pro-biotic compound and ovine rumen liquor which was contributing for the reestablishment of normal rumen micro environment and there by increasing the digestive efficiency in treated animals.

LITERATURE CITED

Ahjuja A K, Randhawa S S and Rathor S S 1989 Effect of acute ruminal alkalosis on microbial and biochemical changes in rumen liquor of buffalo calves. Indian Journal of Veterinary Medicine 9: 86-91.

Akhtar M L, Anjum A D 1997 Haematological and some biochemical values in indigestion in buffaloes. Buffalo Journal 13: 2, 187-193, 23 ref.

Alikutty K M 1981 Effect of alkaline indigestion on rumen liquor, blood and internal organs with particular reference to liver function in cattle and its therapy. Ph.D thesis Punjab Agricultural University, Ludhiana.

Amruth Kumar V V V and Suryanarayan C 2001 Clinico - biochemical and therapeutic efficacy of herbal preparations in experimentally induced simple indigestion on calves. ISVM XIX Annual Convention April 9-11, 2001. R.S. Pure, Jamu Page no. 22.

Annison E F and Lewis D 1959 Metabolism in rumen, pp. 184.
Mathew and Company London.

Ashok Kumar, Joshi B P 1993 Observations on therapeutic efficacy of
Bovirom bolus in bovine indigestion. Indian Veterinary Journal
70: 1 65-68, 9.

Balasubramanian R and Ganapathy M S 1965 A clinico - pathological
studies of indigestion. Indian Veterinary Journal 42: 89.

Barnett A J G and Reid R L 1957 Studies on the production of volatile
fatty acids from grasses by rumen liquor in an artificial rumen.
Journal of Agricultural Science 48: 315-321.

Basak D N, Sarkar S and Chakrabarti A 1993 A note on haematological
changes in experimentally induced acid indigestion in goats.
Indian Journal of Veterinary Medicine. 13, 1, 32.

Baumgartner W and Skalicky M 1979 Working values for laboratory,
diagnosis in cattle I - enzymes and metabolites in serum or
whole blood. Zentral Blattfur Veterinary Medizin 26A: 221-230
Veterinary Bulletin 419, 1980.

Benjamin M M 1981 Outline of veterinary clinical pathology, 3rd edition Iowa State University Press, USA.

Bide R W, Dorward W J and Tumdeson M E 1973 Canadian Journal of American Science 53(4): 697.

Blood D C and Radostitis O M 1989 Veterinary Medicine a text book of the diseases of cattle, sheep, pigs, goats and horses. 7th edition. The English language blood society, Bailliere, Tindall, London.

Blood D C and Henderson J A 1968 Veterinary Medicine 3rd edition Bailliere, Tindall and Cassell, London.

Briggs P K , Hogan J P and Reid R L 1957 The effect of volatile fatty acids, lactic acid and ammonia in rumen pH in sheep. Australian Journal of Agricultural Research 8: 674-693.

Broberg G C 1956 Vamforskanming Som Primar Sjukdomsorsak Nord Vet. Med. 8: 935.

Cakala S, Albrycht A and Bienierk K 1975 Bacterial change in the rumen fluid of cattle in experimental acidosis produced with the use of Saccharose. Veterinary Bulletin 45: 787.

Caroline N, Niederman V M D, Craig D Thatcher and Bimbo Welker
1990 Nutritional factors in bovine gastrointestinal disease.
Veterinary Clinics of North America. Food animal Practice 2,.

Chinnaiah R 1992 Therapeutic studies on alkaline indigestion in cattle
and buffaloes. M.V.Sc. Thesis Andhra Pradesh Agricultural
University, Hyderabad.

Choudhuri P C, Prasad B and Misra S K 1981 A note on the use of
rumen liquor on the treatment of chronic alkaline indigestion in
cows. Indian Journal of Animal Science 51: 356-357.

Choudhuri P C 1986 Acid and alkaline indigestion in bovine. Journal of
Maharashtra Veterinary Association 1: 1-10.

Choudhuri P C, Prasad B and Misra S K 1981 Indian Journal of Animal
Sciences. 512: 356.

Choudhuri P C, Randhava S S and Misra S K 1980 Effect of lactic
acidosis in electrolyte changes in blood and rumen liquor in
buffalo calves. Zbl. Vet. Med. A, 27, 358-363.

Conway E J 1957 Micro diffusion analysis and volumetric error, 4th ed.
Mosby Lockwood and Son, London.

Crookshank H R and Singh F H 1955 Serum values in wheat pasture poisoning cases. Journal of Animal Science 14; 964-969.

Dash P K, Misra S K and Mohanty G P 1972 Effect on acute indigestion on the rumen protozoal population and blood pictures of Indian cattle. Indian Veterinary Journal 9: 672.

Dave M R 1980 Studies on alkaline indigestion and its therapy in buffaloes. Ph.D. Thesis. Punjab Agricultural University, Ludhiana.

Davidovich A, Bartley E E, Bechtle R M and Dayton A D 1977 Ammonia toxicity in cattle III. Absorption of ammonia gas from the rumen and passage of urea and ammonia from the rumen to duodenum. Journal of Animal Science 45: 551-558.

de Alonso A N, Amelot F R A and Alvarez C M 1969 Progressive destruction of the ruminal flora and fauna by modifying the internal environment and the effects of this on cattle. *Revta vett Venez* 25: 265-305.

Desai P V and Dave M r 1987 Clinicopathological study of ruminal dysfunctions and strategy for ensuring effecting health cover for the exotic and crossbred animals. National Symposium 6th Annual Convention at the Indian Society for Veterinary Medicine 47.

Dirkesn G 1970 Acidosis in physiology of digestion and metabolism in ruminants edited by A T Phillipson pp.612-26 Oriel Press, New Castle Upon Tyne, United Kingdom.

Dirksen G 1965 Rumen acidosis in cattle. *Veterinary Medicine Rev.* Leverkusen 98-125.

Dirksen G 1987 Indigestions in cattle. 6th international meeting of the faculty of veterinary science. La Plata, Argentina, Schnetztor, Verlag pp. 42-55.

Dunlop R H 1972 Pathogenesis of ruminant lacticacidosis *Advances in Veterinary Science Comparative Medicine* 16: 259-302.

Fairbank B W and Krider J L 1944 factors involved in the synthesis of vitamins in the ruminant. North American Veterinarian 25; 22-25.

Gaikwad R V, Jagadish S and Bhelenao D P 1993 Studies on primary indigestion in milch buffaloes. Indian Veterinary Journal 70: 1076-1049.

Garry 1990 Diagnosing and treating indigestion caused by fermentative disorders. Symposium on bovine digestive diseases, Veterinary Medicine.

Garry 1996 Managing fore stomach problems caused by motor disease symposium on bovine digestive diseases IX. p. 651.

Goad D W, Good C L and Nagaraja T G 1998 Ruminal microbial and fermentative changes associated with experimentally induced subacute acidosis in steers. Journal of Animal Science 76: 234-241.

Gupta G C, Pachauri S P and Rajora V S 1995 Studies on post - parturient anorexia syndrome in bovine. Indian Journal of Veterinary Medicine 15: 67-70.

Haloi S K, Mahanta P N and Roychoudhury R K 1997 Clinico - biochemical and therapeutic studies of post -parturient indigestion in diary cows. Indian Journal of Veterinary Medicine 17(1&2): 28-30.

Hedao S G, Nisal M B and Purohit B L 1982 Indigestion in the buffaloes (haematological, biochemical clinical and therapeutic study) Pasudhan Issue 66 September - February 1982.

Hoflund S 1967 Animal diseases associated with the use of deteriorated feeding stuffs under sweedish conditions. Veterinary Bulletin 37: 710-717.

Huber T L 1971 Effect of acute indigestion on compartmental water volumes and osmolarity in sheep. American Journal of Veterinary Research 32: 887.

Huber T L 1976 Journal of American Science 43: p.902.

Hungate R E 1966 Rumen and its microbes. Academic Press, New York, London.

Jagdish S Abdul Samed Bhalerao D P and Pethe S G 1997 Report on the efficacy of herbostrong powder ISVM XV Convention Feb. 20-22, 1997 Bangalore, p.37.

Jagos B, Dvovak R Ilke J and Juradjdev J 1978 Veterinary Bulletin 44, 343.

Jain N C 1986 Schalm's veterinary Haematology 4th edition, Lea and Febiger, Philadelphia.

Jani R G, Prajapati B R and Dave M R 1995 Haematological and biochemical changes in normal fertile and infertile Surti buffaloes. Indian Journal of Animal Science 65(5): 536-539.

Jones L Meyer 1965 Text book of veterinary pharmacology and therapeutics. Iowa state University Press, USA, p. 85.

Joshi B P 1969 Grain engorgement in bovines. A case of acid indigestion in bullock. Indian Veterinary Journal 46: 343-345.

Joshi H C and Mahesh Kumar 1995 Comparative efficacy of pachoplux and bovirax in indigestion in bovines. The ISVM XIII Annual Conventional and National Symposium 7-9 April HPKV, Palampur.

Joshi B P and Misra S S 1975 Epizootiological studies of bovine rumen dysfunctions with reference to the incidence. Indian Journal of Animal Science 44: 742-746.

Joshi B P 1970 Seasonal incidence of bovine indigestion in tropics. Indian Veterinary Journal 47: 1005-1007.

Joshi B P and Misra 1975 Clinical studies on changes in ruminal pH, TVFA and ammonia nitrogen in spontaneous rumen dysfunctions in Zebu buffaloes. Indian Veterinary Journal 52: 445-450.

Joshi H C and Mahesh Kumar 1995 Therapeutic efficacy of kaptone batisa against simple indigestion in bovines. The ISVM XIII Annual Convention and National Symposium on Current approach to the latent diseases of animal and birds 7-9 April 1995 HPKV, Palampur.

Joshi S V 1980 M.V.Sc Thesis Chandra Sekhar azad of Agriculture and Technology, Kanpur.

Jounary J P 1991 Defauntation of the rumen. Rumen microbial metabolism and ruminants digestion (ed by Jaunay J P) pp. 239-261.

Kadvekar L K and Murkibhar G R 1981 Modern clinical concepts of aetiology and classification of anorexia in diary bovines, its treatment with Vitamin B complex and live extract. Indian Journal of Animal Sciences 41: 15-17.

Kaneko J J and Cornelius C E 1970 Clinical biochemistry of domestic animals volume I 2nd edition, Academic Press, New York.

Kehar N D and Murthy V V S 1945 Blood changes in cattle fed on a protein deficient diet. Indian Journal of Veterinary Science 15: 183-186.

Krishnamurthy M, Rajan T S S, Venkataraman R and Nagarajan V S 1985 Incidence and diagnosis of various disorders of ruminant. Paper presented at All India Conference on "Current Aspects of the various disorders of ruminants stomach. Compedium, Madras Veterinary College.

Kumar A and Joshi B P 1988 A comprehensive study of herbal rumenotrics in buiatrics as alternate therapy. II pan common wealth veterinary conference. Compendium. February, 1998 Bangalore, p. 319.

Kumar A, Sharma S D and Joshi B P 2000 Seasonal distribution of clinical morbidities among bovine in semi arid area. Indian Veterinary Journal 24: 293.

Kumar A, Sharma S D and Joshi B P 2001 Incidence of common alimentary tract disorders in bovine in Mathura district. Indian Veterinary Journal. 79: 220.

Leonard L Slyter 1976 Influence of acidosis on rumen function. Journal of Animal Science 43, 4.

M C Allister T A, Popp J D and Cheng K J 1996 Controlling digestive disturbances in feed lot cattle. Proceedings of the 1996 Canadian Society of Animal Science Annual Meeting held in lethbridge, Alberta on July 7-11.

Mahanta P N, Misra S K and Naurial D C 1988 Biochemical indicators of live injury and its therapy in post - parturient dyspepsia in buffaloes. Indian Journal of Veterinary Medicine 8: 36-37.

Malleswara Rao 1996 Therapeutic use of ovine rumen liquor for ruminal dysfunctions in bovine. Acharya N.G.Ranga Agricultural University, Rajendra Nagar, Hyderabad.

Manjula S, Prasad B, Singh R and Thakur S 1995 Efficiency of HB strong in rumen dysfunction in cattle. Indian Journal of Indigenous medicines 16: 2: 145-146.

Mishra S K 1991 Therapeutic efficacy of rumbion - a herbal rumentoric drug in cases of simple indigestion in ruminants. 10th convention Indian Society of Veterinary Medicine, Bombay, 85.

Misra S K 1992 Therapeutic efficacy of rumbion a herbal rumenotonic drug in cases of simple indigestion in ruminants. Indian Journal of Indigenous Medicines. 8: 2, 2-11.

Misra S K and Singh U 1974 Studies on the clinico - pathologic and therapeutic aspects of indigestion in cattle. Indian Veterinary Journal 51: 698-704.

Misra S K and Tripathy R C 1963 Studies on the rumen liquor from cattle feed exclusively on paddy straw. Indian Veterinary Journal 40: 496-499.

Misra S K, Dash P K and Mohanty G P 1972 The protozoan fauna of the rumen and reticulum of Indian cattle. Indian Veterinary Journal 49: 464-469.

Misra S K, Dash P K and Mohanty C P 1972 The protozoa fauna of the rumen and reticulum of Indian cattle. Indian Veterinary Journal 49: 463.

Mohan P R, Nambi A P, Gnanaprakasam V and Rasan T S S 1992 Rumen liquor changes in digestive disorders in sheep. Indian Veterinary Journal 69(10): 919-921.

Monroe C F and Perkins A E 1939 A study of the pH values of the ingesta of the bovine rumen. Journal of dairy science 22: 983-991.

Mullen C F and Perkins A E 1939 A study of the pH values of the ingesta of the bovine rumen. Journal of Dairy Science 22: 983-991.

Mullen P A and Bell F 1967 Proceedings 1vth Int. Meet World Association, Buiatrics.

Mullen PA 1976 Veterinary Research 98: 439.

Nagarajan V V 1985 Clinical application of rumen fluid examination in the diagnosis of various digestive disorders of the ruminants. All India Conference on various digestive disorders of ruminants stomach. 8th and 9th January, Tamil Nadu Agricultural University, Madras.

Nagarajan V V and Rajamani S 1973 Alkalne indigestion and rumen putrefaction in a cow. Indian Veterinary Journal 50: 1147-1151.

Nangia O P and Rita Sharma 1994 Influence niacin supplementation of rumen fermentation and microbial protein synthesis in buffaloes. Indian Veterinary Journal 71(10): 978-982.

Narendra R M, Tripathy S B and Das P K 1990 A note on treatment of ruminant acidosis in calves. Indian Journal of Veterinary Medicine 1: 74-75.

Naurial D C and Baxi K K 1978 Biomedical profile of crossbred cattle and buffaloes in experimentally induced lactic acidosis. Journal of Research, Punjab Agricultural University, Ludhiana 15: 433-438.

Nauriyal D C and Baxi K K 1981 Biomedical profile of cross - bred cattle and buffaloes in experimentally induced ruminal lactic acidosis III. Intra - ruminal crushed barley grain administration. Indian Veterinary Journal of Medicine 1: 51-57.

Nicholus R E and Penn Katherinee 1958 Simple methods for the detection of unfavourable changes in rumen ingesta. Journal of American Veterinary Medical Association 133: 275-277.

Niederman N, Cragi D Thatcher and Bimbo Walker 1990 Nutritional factor in bovine gastrointestinal disease. Veterinary clinics of North America. Food Animal Practice. vol. 6 no. 2.

Owens F N, Secrist D S, Hill W J and Gill D R 1998 Acidosis in cattle. Journal of Animal Science 76: 275-286.

Pal B, Prasad B, Sharma S K and Wadhwa D R 1994 Efficacy of a herbal formulation in simple rumen indigestion in calves.

Pal B, Prasad B, Sharma S K and Wadhwa D R Efficacy of AV / SDS / 12- A herbal product in experimental simple indigestion in calves ISVM XII Annual Convention and National Symposium Feb. 4-6th 1994. Madras, p. no. 26.

Pandey N N and Parai T P 1989 Physiological changes in the metabolic profile of cows at calving. Indian Journal of Veterinary Medicine 9: 27.

Pane T, Maliekal and Alex P C 2000 Efficacy of gastricare and Liv52 in simple indigestion in goats, National Symposium on strategies for containment and control of economically important diseases of livestock and XVIII and Annual Convocation of the ISVM p.40.

Payne J M, Rowland G T, Monston R, Dews S M and Paker K A 1974 A statistical appraisal of the results of the metabolic profile tests on 191 herds in the BVA / ADA joint exercise in animal husbandry and productivity. British Veterinary Journal 56(4): 325.

Phillipson A T 1942 The fluctuation of pH and organic acids in the rumen of the sheep. Journal of Experimental Biology 19: 186-98.

Pillai K G 1992 Status of hepatic function in post - parturient indigestion in bovine. M.V.Sc., Thesis, Acharya N.G. Ranga Agricultural University, Hyderabad.

Pillai K G, Choudhuri P C and Syam Sundar N 1995 Clinical, biochemical and therapeutic aspects of post - parturient indigestion in buffaloes. Indian Veterinary Journal 72: 605-607.

Pillai K G, Choudhuri P C and Sundar N S 1995 Clinical biochemical and therapeutic aspects of post - parturient indigestion in buffaloes. Indian Veterinary Journal 72: 6, 605-607; 6 ref.

Pradhan N R 1995 Therapeutic efficacy of herbosal A herbal digestive tonic for ruminants. Indian Veterinary Journal 72(2): 195-197.

Prameela E 1999 Therapeutic studies on post -parturient indigestion in cross - bred cows. M.V.Sc. thesis ANGRAU, Hyderabad.

Prasad J 1971 M.V.Sc. Thesis. Agra University, Agra.

Prasad J 1976 Some biochemical studies on bloat. Indian veterinary Journal 53: 124-127.

Prasad J 1977 Studies on correlation between ruminal pH, TVFA, and ammonia nitrogen in clinical and experimental indigestions in cattle and buffaloes. Indian Veterinary Journal. 54: 922-923.

Prasad J 1979 Study on the reticulo-ruminal movements and rumen pH in clinical indigestion in cattle and buffaloes. Indian Veterinary Journal 56: 476-477.

Prasad J, Ahluwalia S S and Joshi B P 1972 Clinico-biochemical studies in indigestion in Indian cattle and buffaloes. Indian Journal of Animal Science 42: 911-914.

Prasad J, Ahluwalia S S and Joshi B P 1973 A note on clinico-biochemical studies in indigestion in cattle and buffaloes. Indian Journal of Animal Science 43: 245-248.

Purser D B and Moir R J 1996 Dietary effects upon concentrations of protozoa in the rumen. Journal of Animal Science 25: 668-674.

Radostits O M, Blood D C and Gay C C 1994 Veterinary Medicine (8th edition) English Language Book Society, Bailliere Tindall, London.

Rajasaekharan J and Venkataswami V 1981 Physico-chemical properties of rumen liquor in post parturient indigestion of *Bubalis bubalis*. Indian Veterinary Journal 58: 490-492.

Rajasekharan J and Venkataswami V 1981 Physicochemical properties of rumen liquor in post parturient indigestion of *Bubalis bubalis*. Indian Veterinary Journal 58: 490-492.

Rajora V S and Pachauri 1994 Blood profiles in preparturient and post-parturient cows and in milk fever cases. Indian Journal of Animal Sciences 64(1): 31-34.

Ramaswamy G 1972 Studies on the rumen liquor and haemogram in rumen acidosis in goats. M.V.Sc., Thesis, Tamil Nadu Agricultural University, Madras.

Ramesh Kumari Akbar M A, Singh N and Sangwan M L 1995 Status of certain blood metabolites, hormones, biogenic amines and their impact on production in healthy and indigestion cases of lactating murrah buffaloes. Indian Journal of Animal Nutrition 12(3): 147-150.

Randhawa C S, Randhawa S S and Gupta P P 1991 Histopathological studies in buffaloes calves fed with paddy straw. Indian Journal of Animal Sciences 61(5): 482-487.

Randhawa C S, Randhawa S S, Naurial D C 1992 Experimental therapeutic trial in paddy straw induced alkaline indigestion in buffalo calves. Indian Journal of Animal Sciences 62(3): 256.

Randhawa S S and Singh V B 1982 Clinico-biochemical and histopathological studies on accidental urea toxicity in a cross bred cattle. Indian Journal of Veterinary Medicine 2: 55-58.

Randhawa S S, Setia M S and Misra S K 1980 Effect of experimental ruminal acidosis on blood glucose and plasma insulin concentration in buffalo calves. *Current Science* 49, 2, 82-83.

Randhawa S S, Singh K B and Misra S K 1981 Some studies on biochemical changes in peracute lactic acidosis in crossbred calves. *Indian Journal of Animal Health* XX, 1.

Rao D S T, Reddy J S and Choudhuri P C 1983 Clinico-biochemical and therapeutic studies on alkaline indigestion in bovine in and around Tirupati. National Symposium on emerging diseases. GBPUAT, Pantnagar, 7th - 9th July 1983.

Reena Mukherjee 1998 Treatment trial of Himalayan Batissa in digestive disorders of cattle. ISVM. XVI Convention of ISVM and National Symposium on Health care practices for livestock productivity in 21st century. 1998 Nagpur.

Rosenberger G 1979 Clinical examination of cattle verlag paul Parey, Hamburg and W B Saunders Company, Philadelphia, pp. 200-251.

Samad A Anantwar L G and Rajguru D N 1984 Studies on post parturient hypoagalactia syndrome stimulating ketosis in buffaloes II clinical signs and biochemistry souvenir, National Symposium on Animal Health vis-à-vis rural economy and 3rd annual convention of the ISVM, 30.

Samad A, Rahman A and Ali K 1978 A note on certain blood chemicals and haematological values of repeat breeding heifers caused by granular vulvo vaginitis. Indian Journal of Animal Science 48: 620-22.

Sandha H S 1980 Effect of ruminal acidosis on function of kidney and pancreas and therapy. M.V.Sc. Dissertation. Punjab Agricultural University, Ludhiana.

Sapori K K and Prasad B 1986 Physico-chemical and microbial changes in rumen liquor of calves engorged with wheat straw. Indian Journal of Veterinary Medicine 6, 2, 82-86.

Schafer M and Wener P 1974 Suitability of determining serum glutamic oxalo acetic transaminase and glutamic pyruvate transaminase for detection of metabolic liver damage in an

organised. Prophylaxis scheme on dairy farms. J Monatschefe für veterinar Medizin 29: 601-606 and Veterinary bulletin 1254.

Sethuraman V and Rathor S S 1979 Clinical studies and therapy of experimental rumen acute acid and alkaline indigestion in bovines. Indian Veterinary Journal 56: 23-26.

Sethuraman V 1968 Studies on ruminal liquor in case of indigestion in cattle. M.V.Sc. thesis, Tamil Nadu Agricultural University, Madras.

Sethuraman V 1976 Studies on bovine ruminal indigestion in natural and experimental cases and their therapy. Ph.D Punjab Agricultural University, Ludhiana.

Sharma I J, Rakesh Kumar S K, Malviya 2000 Comparative profile of blood and rumen fluid organic components of buffaloes and cattle. Indian Journal of Dairy Science 53: 6.

Shrikhande K B, Sapre V A, Joshi M V 1999 Some biochemical aspects of experimental acid indigestion in bullock. PKV Research Journal 15: 2, 154-156.

Simmi Manjula B, Prasad R J, Singh and Thakur S 1995 A note on the efficacy of H B strong in rumen dysfunction. The ISVM XIII Annual Convention and National Symposium on Current Approach to the latent diseases of Animal & Bird 1995 7-9 April HPKV Palampur 176062.

Singh A P, Joshi H C and Singh R 1972 Studies on certain blood constituents in cattle and buffaloes. Indian Veterinary Journal 49: 473-477.

Singh B P and Thakur D K 1974 Urea poisoning in heifer. Indian Veterinary Journal 51: 229-230.

Singh N, Akbar M A and Kumari R 1997 Effect of tranquilizers on biogenic amines, VIA and milk production in clinical cases of primary indigestion in buffaloes. 590-593.

Singh N, Akbar M A Kumari R 1992 Indian Veterinary Medical Journal 16: 189.

Singh N, Ramesh Kumari M A Akbar and Rekha Singh 2003 changes in metabolites and biogenic amines in clinical cases of primary indigestion of lactating murrah buffaloes. Indian Veterinary Journal 8: 515-518.

Singh N, Ramesh Kumari Akbar M A 1999 Clinical efficacy of herbal and other drugs in primary indigestion cases of lactating murrah buffaloes. Indian Journal of Dairy Science 52: 5.

Sinha V K, Misra S K and Choudhuri P C 1985 Clinico-therapeutic management of experimental ruminal acidosis in buffalo calves. Indian Journal of veterinary Medicine. 5, 1, 59.

Sivaji K 1990 Therapeutic use of cattle rumen liquor in ruminal dysfunctions of buffaloes. M.V.Sc. Thesis APAU, Hyderabad.

Snedecor G W and Cochran W G 1980 Statistical methods, 7th edn. The Iowa State University Press Ames, Iowa USA.

Srinivasan S R 1983 Study on transfaunation in the buiatric practice. M.V.Sc. Thesis, Tamil Nadu Agricultural University, Madras.

Stocker H, Lutz H and Rusch P 1999 Clinical haematological and biochemical findings in milk fed calves with chronic indigestion. *veterinary Record* 145: 11, 307-311, 35 ref.

Subbaraja S 1989 Studies on metabolic profile tests in crossbred cattle with particular reference to ketosis. M.V.Sc. Thesis Andhra Pradesh Agricultural University, Hyderabad.

Swenson M J 1977 Dukes physiology of domestic animals (9th edition). Comstock Publishing Associates, Ithaca and London.

Thirunaryanan R, Gnanprakasam V and Nagarajan V V 1985 Effect of rumen fluid transplantation in buiatrics practice and study of rumen microflora. *Cheiron* 14: 224-227.

Venkateswarlu M, Choudhuri P C, Reddy J S 1998 Biochemical changes in rumen liquor and blood in clinical cases of alkaline indigestion in buffaloes. *Indian Veterinary Journal* 75: 5 438-440.

Venkateswarlu S 1990 Studies on alkaline indigestion in bovine M.V.Sc. Thesis Andhra Pradesh Agricultural University, Hyderabad.

Vihan V S, Joshi B P and Rai P 1973 Observations on changes in pH and lactic acid in rumen fluid and lactic acid in bovine indigestion. Indian Veterinary Journal 50: 1178-1181.

Vijaya Kumar K 1985 Study on the relationship between V F A concentration in ruminal contents and blood glucose in primary indigestion in ruminants. M.V.Sc., thesis Tamil Nadu Agricultural University, Madras.

Vijaya Kumar K, Srinivasan S R and Gnanapraksham V 1989 A note on VFA concentration in ruminal contents and blood glucose in primary indigestion. Indian Journal of Veterinary Medicine 125-126.

Zust J, Pestevsek U and Vengust A 2000 Impact of lactic acid fermentation of carbohydrates in the large intestine on the pathogenesis of acute lactic acidosis in cattle. Deutsche - Tierärztliche - Wochenschrift 107: 9, 359-363 29 ref.

Table 22 : Clinical observations in buffaloes before and after therapy (Group I)

Sl.No.	Animal No. / Case No.	Temperature (°F)		Pulse (/ min)		Respiration (/ min)		Rumen motility (/ 5 min)	
		BT	AT	BT	AT	BT	AT	BT	AT
1	M ₉	100.2	100.8	54	56	22	19	2	3
2	M ₂	100.4	101.2	52	55	20	21	1	2
3	6284	100.2	100.2	49	51	26	25	1	3
4	869	101.1	100.6	51	51	22	23	1	3
5	872	99.8	100.4	46	52	24	24	2	2
6	8373	99.6	100.6	48	49	19	22	2	3
	Mean	100.45	100.46	50	52.3	22.16	22.3	1.5	2.6
	±	±	±	±	±	±	±	±	±
	SE	0.27	0.22	1.18	1.1	1.04	0.8	0.22	0.21

Table 23 : Rumen liquor evaluation in buffaloes before and therapy (Group I)

Sl. No.	Animal No. / Case No.	pH		Protozoan motility		Iodophilic activity		Protozoal count		SAT (min)		MBRT (min)		Total protozoan count (1x10 ⁵)		Gas production time (ml/hr)	
		BT	AT	BT	AT	BT	AT	BT	AT	BT	AT	BT	AT	BT	AT	BT	AT
1	M ₉	7.2	7.01	++	+++	++	+++	++	+++	14	8	12	7	1.12	2.4	10	1
2	M ₂	7.2	6.97	++	+++	++	+++	++	++	12	9	11	4	0.89	2.1	10	1
3	6284	6.9	7.0	+	++	++	+++	++	+++	12	8	9	6	1.2	3.1	9	1
4	869	7.0	6.98	++	+++	+	++	++	+++	16	8	12	7	1.01	2.9	10.5	1
5	872	6.86	6.94	++	+++	++	+++	++	+++	11	7	9	4	0.96	2.78	9.5	1
6	8373	6.97	6.96	+	+++	+	+++	++	+++	12	9	10	3	1.36	2.46	8.5	1
	Mean	7.021	6.97							12.83	8.16	10.5	5.16	1.09	2.62	9.58	13
	±	±	±							±	±	±	±	±	±	±	±
	SE	0.06	0.01							0.75	0.30	0.056	0.7	0.07	0.15	0.3	0.4

Table 24 : Serum Biochemical values in buffaloes of Group I - with Suruchi therapy (Group I)

Sl. No.	Animal No. / Case No.	Calcium (mg%)		Phosphorus (mg%)		Magnesium (mg%)		Glucose (mg%)		BUN (nmg%)		Total proteins (g/dl)		A/G ratio	
		BT	AT	BT	AT	BT	AT	BT	AT	BT	AT	BT	AT	BT	AT
1	M ₉	8.3	8.91	3.6	3.71	1.96	2.12	68.4	54.2	15.9	12.8	7.64	7.81	0.7	0.97
2	M ₂	6.98	7.82	4.1	3.92	2.21	2.4	59.2	51.0	15.42	10.9	7.2	7.4	0.3	0.85
3	6284	7.1	7.96	34.2	3.68	3.26	2.9	59.8	56.2	17.6	15.1	7.81	7.3	0.47	0.65
4	869	7.24	7.28	2.93	2.84	1.79	2.23	64.1	58.9	18.9	14.6	8.12	8.4	0.75	0.82
5	872	8.96	8.64	4.24	4.5	2.62	3.01	56.4	55.16	16.8	12.8	6.21	7.8	0.51	0.69
6	8373	6.4	7.16	4.12	3.86	2.69	2.91	4.34	48.7	21.1	19.4	6.42	8.1	0.42	0.8
	Mean ± SE	6.56 ± 0.0	7.96 ± 0.0	3.73 ± 0.0	3.7 ± 0.18	2.42 ± 0.0	2.59 ± 0.0	58.55 ± 3.4	54.02 ± 1.5	17.62 ± 0.8	10.36 ± 0.5	7.23 ± 0.03	7.8 ± 0.0	0.525 ± 0.0	0.796 ± 0.0

		38	28	2		22	15	9			4	12	16	7	4
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Table 25 : Clinical observations in buffaloes with simple indigestion (Group 2)

Sl. No.	Animal No. / Case No.	Temperature (°F)		Pulse (/min)		Respiration (/ min)		Rumen motility (/ 5 min)	
		BT	AT	BT	AT	BT	AT	BT	AT
1	896 (5 days)	99.8	100.2	59	56	26	24	1	3
2	913 (4 days)	100.2	100.6	48	54	23	28	1	3
3	919 (4 ays)	101.6	100.5	52	49	24	20	2	2
4	986 (4 days)	100.8	100.2	54	53	19	24	1	2
5	1031 (4 days)	101.0	100.8	54	46	21	26	1	3
6	865	99.7	100.4	58	55	24	25	2	3
	Mean	100.5	100.45	54.16	52.16	22.83	24.5	1.33	2.66
	±	±	±	±	±	±	±	±	±
	SE	0.3	0.09	1.6	1.58	1.01	1.09	0.021	0.21

Table 26 : Rumen liquor evaluation in buffaloes with simple indigestion (Group II)

Sl. No.	Animal No. / Case No.	pH		Protozoan motility		Iodopilic activity		Protozoal count		SAT (min)		MBRT (min)		Total protozoan count (1x10 ⁵)		Gas production time (ml/hr)	
		BT	AT	BT	AT	BT	AT	BT	AT	BT	AT	BT	AT	BT	AT	BT	AT
1	896 (5 days)	6.86	6.92	++	+++	++	++++	++	+++	17	9	10	6	0.86	2.34	8.5	12
2	913 (4 days)	6.92	6.98	+	+++	++	+++	++	+++	14	7	11	5	0.79	3.32	9	12
3	919 (4 ays)	7.0	7.08	+	++	++	+++	++	++	15	7	11	5	1.02	2.89	9.5	12
4	986 (4 days)	7.12	6.98	++	++	+	+++	+	+++	15	8	9	4	0.99	3.12	9.5	12
5	1031 (4 days)	6.98	7.06	+	++	++	++	+	+++	14	9	8	7	1.31	1.96	10	12
6	865	6.8	6.94	+	+++	+	++	++	+++	15	8	12	8	1.43	3.86	10.5	14
	Mean	6.96	7.02							15	8	10.16	5.83	1.06	2.915	9.5	14
	±	±	±							±	±	±	±	±	±	±	±
	SE	0.03	0.03							0.44	0.36	0.6	0.6	0.1	0.28	0.28	1.1

Table 27 : Biochemical findings in buffaloes with simple indigestion

Sl. No.	Animal No. / Case No.	Calcium (mg%)		Phosphorus (mg%)		Magnesium (mg%)		Glucose (mg%)		BUN (nmg%)		Total proteins (g/dl)		A/G ratio	
		BT	AT	BT	AT	BT	AT	BT	AT	BT	AT	BT	AT	BT	AT
1	896 (5 days)	7.94	8.21	2.96	3.5	2.32	2.4	59.6	58.4	12.86	12.4	6.21	7.2	0.72	0.89
2	913 (4 days)	6.43	6.96	3.45	3.7	1.69	2.24	67.0	55.6	13.89	11.6	5.6	6.4	1.07	0.93
3	919 (4 days)	10.46	11.9	4.8	4.5	2.21	2.5	68.26	58.0	18.3	15.4	4.9	5.8	0.47	1.0
4	986 (4 days)	8.4	8.5	2.6	3.1	3.6	3.56	55.4	56.2	16.76	14.8	5.8	6.9	0.81	0.64
5	1031 (4 days)	6.97	7.02	3.46	3.6	1.92	2.29	61.2	62.4	16.4	16.8	6.6	7.6	0.78	0.80
6	865	8.1	9.8	2.26	3.6	1.89	4.1	57.0	59.0	14.4	10.9	7.17	7.4	0.74	1.12

	Me	8.0	8.	3.	3.6	2.	2.	61.	58.	15.	11	6.	6.	0.7	0.8
	an	5	73	25	6	27	84	41	26	43	.4	04	88	65	96
	±	±	±	±	±	±	±	±	±	±	±	±	±	±	±
	SE	0.5	0.	0.	0.1	0.	0.	2.1	0.9	0.8	0.	0.	0.	0.0	0.0
		1	76	36	8	25	25	4	8	3	61	32	27	7	6

Table 28 : Clinical Observations In Buffaloes With Simple Indigestion (Group III)

Sl. No.	Animal No. / Case No.	Temperature (°F)		Pulse (/min)		Respiration (/min)		Rumen motility (/ 5 min)	
		BT	AT	BT	AT	BT	AT	BT	AT
1	686	100.4	100.8	58	58	18	19	1	4
2	699	100.0	100.6	46	49	24	22	1	3
3	736	99.8	100.4	48	52	21	20	2	3
4	771	101.2	100.8	52	54	19	22	1	2
5	804	99.4	99.9	53	51	20	21	1	3
6	826	100.7	100.6	48	52	22	20	1	3
Mean		100.25	100.51	50.83	52.66	20.66	20.67	1.16	3.33
±		±	±	±	±	±	±	±	±
SE		0.32	0.15	6.7	4.9	0.05	0.09	0.03	0.19

Table 29 : Rumen - liquor evaluation in buffaloes with simple indigestion (Group III)

Sl. No.	Animal No. / Case No.	pH		Protozoan motility		Iodophilic activity		Protozoal count		SAT (min)		MBRT (min)		Total protozoan count (1x10 ⁵)		Gas production time (ml/hr)		Rumen ammonia nitrogen (mg%)		TVFA (meq/L)	
		B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A
1	686	6.97	7.01	+	+	+	+	+	+	12	8	10	4	1.02	2.8	8	13	15.6	9.8	63	71
2	699	6.84	6.96	+	+	+	+	+	+	14	7	8	4	0.96	3.1	9	12.5	16.2	10.2	70	74
3	736	6.79	6.98	+	+	+	+	+	+	11	8	9	4	0.87	2.6	8.5	14	16.3	9.4	59	68
4	771	7.12	6.98	+	+	+	+	+	+	12	8	8	3	1.25	3.8	10	12.5	18.2	8.4	72	73
5	804	6.96	7.03	+	+	+	+	+	+	13	9	9	6	1.48	3.6	8.5	13.5	14.9	9.6	68	72
6	826	7.09	6.98	+	+	+	+	+	+	11	8	2	5	0.79	3.58	8	13	10.4	10.8	74	81
Mean		6.96 ±	6.99 ±							12.16	8.0 ±	9.33	4.33	1.06	3.25	8.66	13.06	16.26	9.7 ±	67.66	73.76

±		0.	0.						±	0.	±	±	±	±	±	±	±	0.	±	±
SE		04	05						0.	2	0.	0.	0.	0.	0.	0.	1.	9	4.	2.
		1	6						61	1	8	6	4	2	5	26	1	6	9	

Table 30 : Biochemical findings in buffaloes in simple indigestion (Group III)

Sl · No.	Animal No. / Case No.	Calcium (mg%)		Phosphorus (mg%)		Magnesium (mg%)		Glucose (mg%)		BUN (nmg%)		Total proteins (g/dl)		A/G ratio	
		BT	AT	BT	AT	BT	AT	BT	AT	BT	AT	BT	AT	BT	AT
1	686	6.84	7.65	3.1	3.4	1.86	2.32	63.26	51.3	11.4	10.3	6.86	6.98	0.73	0.81
2	699	7.4	7.52	2.86	3.12	2.13	2.46	66.8	55.6	13.6	9.3	6.2	7.16	0.87	0.904
3	736	9.3	9.62	2.72	2.96	2.22	2.52	62.7	58.4	10.86	11.2	5.8	6.4	0.45	0.56
4	771	6.9	7.3	3.67	3.82	1.93	2.6	69.3	61.31	16.2	12.8	5.6	5.8	0.69	0.81
5	804	7.87	8.16	3.25	3.30	2.43	2.51	53.8	51.21	14.3	13.8	6.2	6.3	0.27	0.71
6	826	10.28	10.86	3.91	3.78	2.6	72.87	66.8	45.42	13.6	10.2	7.6	7.45	0.74	0.79
	Mean	8.05	8.73	3.26	3.67	2.27	2.85	64.41	58.27	15.14	13.65	6.05	6.88	0.77	0.90
	±	±	±	±	±	±	±	±	±	±	±	±	±	±	±
	SE	0.57	0.77	0.36	0.19	0.28	0.32	2.14	0.48	0.84	0.96	0.33	0.28	0.08	0.07

Table 31 : Comparative therapeutic response - clinical observation

Group	Clinical parameters - comparison				
	appetite	milk yield	rumination	condition	rumen motility
Group I	++	+	++	++	++
Group II	++	++	++	+++	++
Group III	+++	+++	++	+++	+++

Group	Rumen liquor evaluation						
	PM	IA	PC	SAT	MBRT	TPC	TVFA
Group I	++	++	++	++	+	+	++
Group II	++	++	+++	++	+	++	++
Group III	+++	+++	+++	+++	++	+++	+++

Group	Biochemical findings			
	Calcium	Glucose	BUN	Total protein
Group I	+	++	++	++
Group II	++	++	+	+
Group III	+++	+++	+++	++

Table 1 : Incidence of rumen dysfunctions in buffaloes in and around Tirupati

(January 2002 - June 2003)

S. No.	Name of the centre	Total no. of cases treated	No. of buffaloes with digestive disorders		Simple indigestion		Alkaline indigestion		Acid indigestion	
			No	Per cent	No.	Per cent	No	Per cent	No.	Per cent
1.	Veterinary clinic M.R.Pally	9780	3523	36.02	287 2	81.52	424	(12.03%)	21	(0.59)
2.	Pudipatla	7943	2353	29.62	192 8	81.93	280	(11.89%)	14	(0.59)
3.	Tirupathi	8791	3528	40.13	294 1	83.36	388	(10.99%)	18	(0.51)
	Total	26514	9404	35.46	774 1	82.31	109 2	11.61%	53	0.56

Table 2 : Incidence of rumen dysfunctions in buffaloes in different seasons

	Total no. of cases treated	No. of cases treated for digestive disorders	Simple indigestion	Alkaline indigestion	Acid indigestion
Winter	2310	824 (35.6%)	667 (80.94%)	113 (13.71%)	2 (0.24%)
Summer	1820	859 (47.19%)	741 (86.26%)	85 (9.89%)	3 (0.34%)
Rainy season	2434	875 (35.94%)	728 (83.19%)	95 (10.85%)	11 (1.25%)

Total	6564	2558 (38.97%)	2136 (83.50%)	293 (11.45%)	16 (0.62%)
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Table 3: Clinical observations in healthy buffaloes (control group)

Sl.No.	Temperature (°F)	Pulse (/ min)	Respiratio (/ min)
1.	99.8	52	22
2.	100.4	47	25
3	98.9	52	20
4.	100.2	49	19
5.	100.7	53	18
6.	100.0	46	21
Mean ± SE	100 ± 0.25	49.83 ± 1.20	20.83 ± 1.

Table 4 : Rumen liquor evaluation in healthy buffaloes (control group)

No.	pH	Odour	Protozoan motility	Iodopilic activity	SAT (min)	MBRT (min)	Gas production time (ml/hr)	Total protozoan count (1x10 ⁵)	Rumen ammonia nitrogen (mg%)	(
.	6.9	Aromatic	+++	+++	8	6	13	3.8	8.6	
.	7.1	"	+++	+++	6	7	14.5	3.6	12.1	
.	6.87	"	++	+++	8	4	12.5	2.9	8.9	
.	6.94	"	+++	+++	8	6	15	2.8	14.5	
.	7.20	"	+++	++	7	5	11.5	4.1	16.4	
.	6.98	"	+++	+++	8	4	14	3.5	14.6	
an	7.00				7.5	5.33	13.41	3.45	12.52	
	±				±	±	±	±	±	
E	0.52				0.34	0.49	0.54	0.20	1.32	

Table 5 : Hematological values in healthy buffaloes (control group)

No.	Hb (g/dl)	PCV (%)	RBC (x 10 ⁶ /μl)	WBC (x 10 ³ /μl)	Differential Leucocytic Count%				
					Neutrophils (N)	Lymphocytes (L)	Eosinophils (E)	Monocytes (M)	Ba
.	10.21	34	5.6	9.3	46	48	5	1	
2	9.43	29	4.8	8.92	48	48	3	1	
.	12.6	38	6.23	9.01	44	49	4	2	
	10.01	29	4.63	8.06	46	51	2	1	
.	9.89	32	5.20	9.80	46	49	3	2	
.	11.3	34	5.53	8.03	44	52	3	1	
mean	10.8	32.7	5.33	8.85	45.66	51.16	3.33	1.3	
±	±	±	±	±	±	±	±	±	
E	0.14	0.88	0.22	0.26	0.56	0.09	0.18	0.22	

Table 6 : Biochemical findings in healthy buffaloes (control group)

Sl.No.	Calcium (mg%)	Phosphorus (mg%)	Magnesium (mg%)	Glucose (mg%)	BUN (nmg%)	Total protein (g/dl)	A:G ratio	(P)
1.	9.63	3.72	1.95	49.40	12.86	8.46	0.89	
2.	11.64	6.40	2.89	52.60	9.30	7.43	1.04	
3.	11.46	4.52	2.59	50.40	10.70	10.04	0.74	
4.	10.82	4.82	2.20	43.60	10.23	7.89	0.98	
5.	8.60	5.16	2.56	47.00	9.64	6.09	1.44	
6.	11.34	4.20	2.53	49.20	9.40	8.32	0.98	
S.E	10.58 ± 0.54	4.80 ± 0.37	2.45 ± 0.13	48.70 ± 1.26	10.35 ± 0.54	8.06 ± 0.53	1.01 ± 0.1	

Table 11 : Clinical observations in buffaloes with acid indigestion

Sl.No.	Temperature (°F)	Pulse rate (per min)	Respiratory (per min)
1	101	62	28
2.	100.6	58	26
3.	100.8	64	29
4.	101.4	56	31
5.	100.9	61	28
6.	101.6	56	29
Mean ± SE	101.05 ± 0.15	59.5 ± 1.3	28.5 ± 0.6

Table 12 : Pungent rumen liquor evaluation in buffaloes with acid indigestion

No.	pH	Odour	Protozoan motility	Iodophilic activity	SAT (min)	MBRT (min)	Gas production time (ml/hr)	Total protozoan count (1×10^5 ml)	Rumen ammonia nitrogen (mg%)	(
.	6.04	Putrid	0	0	26	18	6.5	0.98	8.6	
.	6.34	Sour	+/-	+	28	21	7.2	1.03	10.21	
.	6.12	Pungent	+	0	28	19	6.9	1.32	12.2	
.	6.67	Sour	+	+	23	18	7	0.99	10.1	
.	6.45	Putrid	0	+	26	20	7	0.86	8.2	
.	6.26	Sour	+	+	21	16	7.5	1.01	7.8	
an	6.37				25.33	18.66	7.01	1.03	9.51	:
	±				±	±	±	±	±	
E	0.1				1.14	0.71	0.13	0.06	0.67	

Table 13 : Hematological values in buffaloes with acid indigestion

No.	Hb (g/dl)	PCV (%)	RBC (x 10 ⁶ /μl)	WBC (x 10 ³ /μl)	Differential Leucocytic Count%				
					Neutrophils (N)	Lymphocytes (L)	Eosinophils (E)	Monocytes (M)	Ba
.	11.2	42	5.7	9.5	46	49	4	1	
2	10.8	44	4.9	9.1	49	47	2	2	
.	11.8	47	6.1	9.4	47	49	3	1	
.	11.6	44	4.9	8.9	46	46	4	1	
.	12.1	47	5.4	9.2	49	46	3	2	
.	10.9	43	5.4	9.4	47	48	3	2	
mean	11.4	44.5	5.4	9.25	47.33	47.5	3.16	1.5	
±	±	±	±	±	±	±	±	±	
E	0.19	0.77	0.17	0.08	0.61	0.46	0.18	0.20	

Table 14 : Biochemical findings in buffaloes with Acid indigestion

Sl.No.	Calcium (mg%)	Phosphorus (mg%)	Magnesium (mg%)	Glucose (mg%)	BUN mg(%)	Total Proteins (g/dl)	A:G
1.	8.69	4.9	2.8	62.1	34.2	9.31	0
2	10.04	4.3	2.1	64.3	29.6	8.87	0
3.	9.9	3.9	2.62	58.7	31.2	9.16	0
4.	11.24	3.8	1.93	63.4	28.6	8.64	0
5.	10.64	4.1	2.03	69.12	30.02	9.12	0.
6.	10.62	3.9	2.86	59.86	33.4	8.94	0
Mean	10.53	4.15	2.89	62.9	31.17	9.01	0
±	±	±	±	±	±	±	
SE	0.81	0.16	0.07	1.51	0.96	0.09	0

Table 7 : Clinical observations in buffaloes with alkaline indigestion

Sl.No.	Temperature (°F)	Pulse rate (/ min)	Respiratory rate (/ min)	Rumen mot (/ 5 min)
1.	101.2	52	22	2
2	100.8	64	18	1
3.	99.8	48	21	1
4.	100.6	62	29	1
5.	100.8	56	22	1
6.	100.5	54	18	1
Mean	100.61	56.0	21.66	1.33
±	±	±	±	±
SE	0.19	2.47	1.6	0.21

Table 8 : Rumen liquor evaluation in buffaloes with - Alkaline indigestion

No.	pH	Odour	Protozoan motility	Iodophilic activity	SAT (min)	MBRT (min)	Gas production time (ml/hr)	Total protozoan count (1 x 10 ⁵ ml)	Rumen ammonia nitrogen (mg%)	(
	8.2	Ammonical	+	+	18	14	8.5	1.62	34.6	
	7.9	Ammonical	+	+	20	16	7	1.89	29.8	
	8.4	Ammonical	0	+	26	19	7	2.01	38.24	
	7.6	Slightly ammonical	++	+	21	13	8	1.9	26.9	
	7.9	Slightly ammonical	+	-	16	19	85	1.86	31.6	
	8.2	Slightly ammonical	+	+	22	22	8	1.65	36.2	
an	8.03				20.5	17.16	7.38	1.83	32.89	
	±				±	±	±	±	±	
E	0.11				1.4	1.4	0.29	0.06	1.73	

Table 10 : Biochemical findings in buffaloes with Alkaline indigestion

No.	Calcium (mg%)	Phosphorus (mg%)	Magnesium (mg%)	Glucose (mg%)	Total protein (g/dl)	BUN (mg%)	A:G
1.	8.1	3.4	2.83	59.4	6.24	27.84	0
2.	7.8	3.42	2.32	66.4	5.43	33.4	0
3.	8.6	4.1	1.96	71.3	4.9	19.6	1
4.	7.56	3.7	3.6	63.2	7.21	392.	0
5.	6.89	3.45	1.9	56.4	6.8	22.4	0
6.	7.3	2.9	1.6	69.6	6.76	26.3	0
Mean	7.71	3.50	2.36	64.38	6.22	28.12	0
±	±	±	±	±	±	±	
SE	0.25	0.16	0.30	2.37	0.36	2.94	0

Table 9 : Haematological values in buffaloes with alkaline indigestion

Sl.No.	Hb (g/dl)	PCV (%)	RBC (x 10 ⁶ /μl)	WBC (x 10 ³ /μl)	Differential Leuco		
					Neutrophils (N)	Lymphocytes (L)	Eosin (E)
1	11.6	43	5.6	9.3	46	49	4
2	12.1	41	4.9	8.9	47	48	2
3	10.9	45	5.8	9.2	47	48	3
4	11.8	47	5.2	8.8	46	49	3
5	12.2	45	5.8	9.4	45	48	5
6	11.0	43	5.5	9.2	46	48	4
Mean	11.6	44	5.5	9.1	46.16	48.3	3
±	±	±	±	±	±	±	±
SE	0.20	7.8	1.33	0.88	0.5	0.19	0.

Table 15 : Clinical parameters - comparison

	Temperature (°F)	Pulse (/ min)	Respiration (/ min)	Rumen mot (/ 5 min)
Control	100 ± 0.25	49.83 ± 1.20	20.83 ± 1.01	7.5 ± 0.3
Acid	101.05 ± 0.15*	59.5 ± 1.36*	28.5 ± 0.678	0.67 ± 27
Alkaline	100.62 ± 0.19 ^{NS}	56 ± 2.47*	21.67 ± 1.65 ^{NS}	1.33 ± 0.2

* - Indicates significance at 5%

NS - Indicates No significance

Table 16 : Rumen fluid evaluation in fermentative disorders (mean values) in comparison with healthy control

	pH	SAT (min)	MBRT (min)	Total protozoan count (1x10⁵)	Gas production time (ml/hr)	Rumen ammonia nitrogen (mg%)	T (m
control	7.0 ± 0.52	7.5 ± 0.34	5.33 ± 0.49	3.45 ± 0.20	13.41 ± 0.54	12.52 ± 1.32	86
acid	6.37 ± 0.10*	25.33 ± 1.2*	18.67 ± 0.7*	1.03 ± 0.06*	7.01 ± 0.13*	9.51 ± 0.7 ^{NS}	100.8
alkaline	8.03 ± 0.12*	20.5 ± 1.41*	17.17 ± 1.40*	1.83 ± 0.07*	7.38 ± 0.29*	32.89 ± 1.73*	55.1

* - Indicates significance at 5%

NS - Indicates No significance

Table 17 : Mean haematological values in fermentative disorders in comparison with healthy control

Sl.No.	Group	Hb (g/dl)	PCV (%)	RBC ($\times 10^6/\mu\text{l}$)	WBC ($\times 10^3/\mu\text{l}$)	Differential Leuco		
						Neutrophils (N)	Lymphocytes (L)	Eosin (E)
1	Control	10.5 \pm 0.14	32.7 \pm 0.88	5.33 \pm 0.26	8.85 \pm 0.26	45.66 \pm 0.56	51.16 \pm 0.09	3.33 \pm 0.09
2	Acid	11.4* \pm 0.19	44.5* \pm 0.77	5.4 ^{NS} \pm 0.17	9.25* \pm 0.08	45.7 ^{NS} \pm 0.51	47.5 ^{NS} \pm 0.46	3.16 ^{NS} \pm 0.09
3	Alkaline	11.6* \pm 0.20	44* \pm 7.8	5.5 ^{NS} \pm 1.33	9.1* \pm 0.8	45.2 ^{NS} \pm 0.5	48.3 ^{NS} \pm 0.19	3.5 ^{NS} \pm 0.09

* - Indicates significance at 5%

NS - Indicates No significance

Table 18 : Mean serum biochemical findings in fermentative disorders in comparison with healthy control

	Calcium (mg%)	Phosphorus (mg%)	Magnesium (mg%)	Glucose (mg%)	BUN (mg%)	Total protein (g/dl)	A:
rol	10.58 ± 0.49	4.80 ± 0.37	2.45 ± 0.13	48.70 ± 1.26	10.35 ± 0.54	8.06 ± 0.53	1.0
d	10.53 ± 0.18*	4.15 ± 0.16 ^{NS}	2.89 ± 0.07*	62.91 ± 1.51*	31.17 ± 0.90*	9.10 ± 0.10 ^{NS}	0.83
ine	7.71 ± 0.25*	3.50 ± 0.16*	2.36 ± 0.30 ^{NS}	64.38 ± 2.37*	28.12 ± 2.94*	6.22 ± 0.36*	0.78

* - Indicates significance at 5%

NS - Indicates No significance

Table 19 : Clinical observations in buffaloes with post parturient indigestion

Sl.No	Temperature (°F)	Pulse (/ min)	Respiration (/ min)	Rumen motility (/ 5 min)
1	99.9	66	26	4
2	101.6	74	38	5
3	101.4	72	29	3
4	102.3	61	26	4
5	100.6	51	32	3
6	103.4	72	32	4
Mean ± SE	101.53 ± 0.50	66.0 ± 3.5	30.5 ± 1.8	3.8 ± 0.30

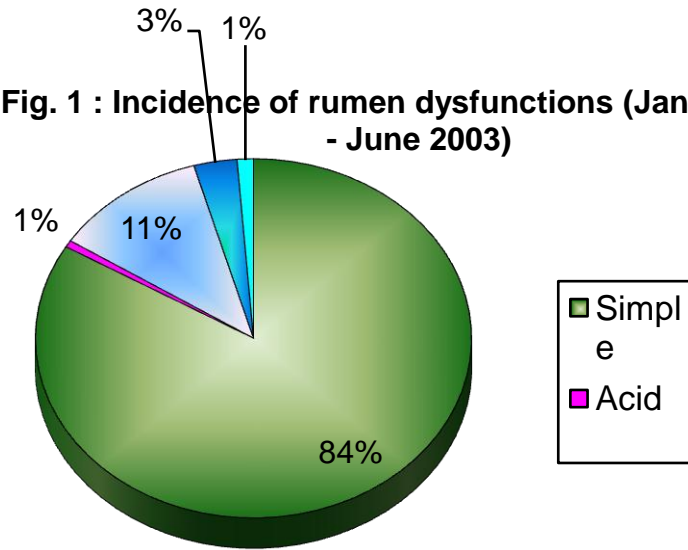
Table 20 : Rumen liquor evaluation in buffaloes with post partum indigestion

No.	pH	Odour	Protozoan motility	Iodophilic activity	SAT (min)	MBRT (min)	Gas production time (ml/hr)	Total protozoan count (1×10^5)	Rumen ammonia nitrogen (mg%)	(
	7.8	Ammonical	++	++	14	10	9	1.2	26.9	
	7.5	Ammonical	++	++	12	8	10	0.93	19.3	
	7.0	Aromatic	++	+	16	6	9	1.02	8.63	
	7.5	Aromatic	++	++	19	11	8.5	0.96	16.4	
	7.8	Amonical	+++	++	12	8	8.5	0.84	32.4	
	7.2	Slightly Ammonical	++	+	12	10	9	0.94	14.83	
an	7.46				14.16	8.83	9.0	0.98	19.74	
	±				±	±	±	±	±	
E	0.13				1.16	0.74	0.22	0.04	3.51	

Table 21 : Biochemical findings in buffaloes with - post partum indigestion

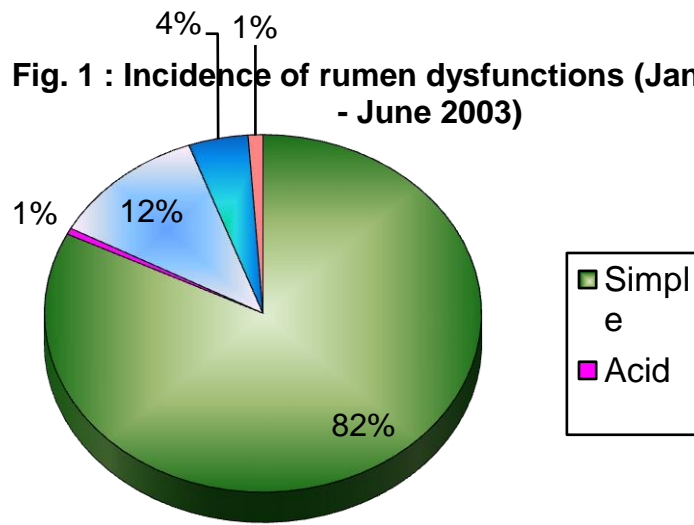
No.	Calcium (mg%)	Phosphorus (mg%)	Magnesium (mg%)	Glucose (mg%)	Total Proteins	A/G Ratio	BUN mg%	AST (U/L)	ALT (U/L)	B
.	9.6	4.3	23.1	52.12	6.83	0.881	14.8	52	9	
2	7.78	3.05	2.43	38.6	5.38	0.95	19.3	49	14	
.	9.2	32.7	1.95	32.8	4.26	0.97	16.42	61	8	
	10.1	3.47	2.1	41.6	7.12	0.8	22.1	56	9	
.	6.96	4.1	3.6	46.2	5.91	0.69	24.26	62	6	
.	7.16	3.6	3.0	39.39	5.89	1.13	16.82	52	12	
an E	8.46 ± 0.54	3.63 ± 0.19	2.56 ± 0.25	41.87 ± 2.7	5.89 ± 0.24	0.91 ± 0.05	18.95 ± 1.48	55.33 ± 2.1	9.6 ± 1.17	0

Fig. 1 : Incidence of rumen dysfunctions (January 2002 - June 2003)



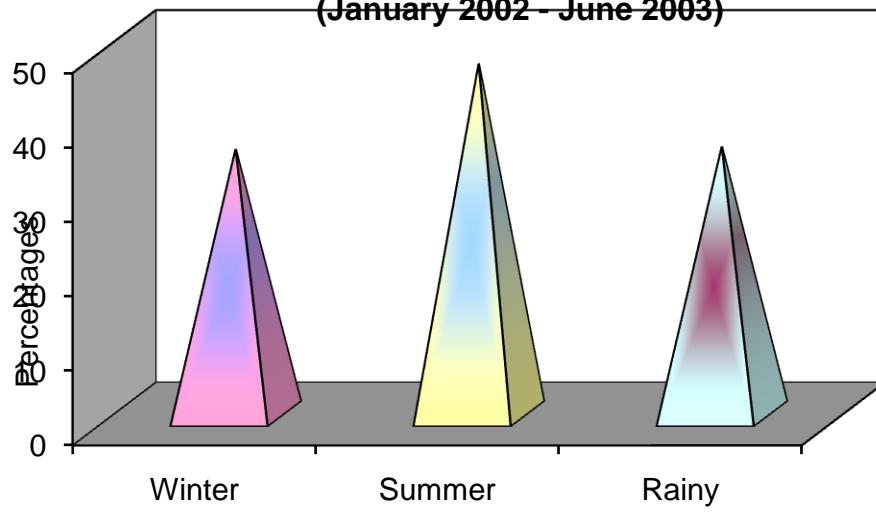
Simple	Acid	Alkaline	Impaction	Tympany
2136	16	293	82	31

Fig. 1 : Incidence of rumen dysfunctions (January 2002 - June 2003)



Simple	Acid	Alkaline	Impaction	Tympany
7741	53	1092	415	103

**Fig. 2 : Seasonal incidence of rumen dysfunctions
(January 2002 - June 2003)**



Winter	35.6
Summer	47.1
Rainy	35.94