STUDIES ON NON-SPECIFIC ANOREXIA IN CATTLE

By

P. G. BABY

ABSTRACT OF THE THESIS

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Kerala Agricultural University

Department of Clinical Medicine
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ABSTRACT

Non-specific anorexia as a peculiar clinical syndrome in cattle was observed for the last one and a half decades in Kerala. Sample survey on the incidence of this syndrome was conducted through the selected veterinary hospitals in the field and of the Kerala Agricultural University. During the period of 1978-1982, anorexia syndrome in cattle constituted 10.95 per cent of the total and 32.30 per cent of their digestive disorders. The incidence of the syndrome was also noted high during the months of November to April every year.

Ten apparently healthy cattle maintained under identical conditions of feeding and management at the University Livestock Farm, Mannuthy were selected at random and used as the control animals (Group I) for this study. Twenty selected clinical cases of non-specific anorexia presented at the University Veterinary Hospital, Mannuthy were divided into groups of ten each (Group II and Group III) and utilized for these investigations. Course of the disease was followed and samples of rumen liquor and blood were collected and analysed on the first, third and fifth days of their admission in the clinic. Inappetance, mucopurulent nasal discharge, dryness of the muzzle, followed by peeling of its epithelium, constipation or diarrhoea, weakness, emaciation and also marked reduction in milk yield in the lactating animals were the clinical manifestations noted in the affected animals. Their rectal temperature was normal, pulse weak and rapid, respiration

normal but sometimes laboured and visible mucous membranes were pale or became icteric in the later stages of the disease. Rate of rumen motility was reduced and feeble in strength with rumination remaining suspended.

Animals of group II were given conventional therapy comprising oral administration of alkaline stomachics. Animals of group III were given 25 per cent dextrose solution and vitamin B-complex with liver extract parenterally and stomachics orally on the first, third and fifth days of their admission in the clinic.

Rumen liquor of animals of groups II and III was light yellow, olive green or greenish in colour, aromatic/offensive in odour and thick/thin in consistency on the first day of observation. Protozoal motility was poor (+) to vigorous (+++) and sedimentation activity time was prolonged significantly on the first day. The mean pH of the rumen liquor of these animals was not significantly different from that of the healthy group. Increase in the ammonia nitrogen level and decrease in total volatile fatty acids concentration in the rumen liquor observed on the first day were significant. Blood glucose, total bilirubin, total protein, albumin and albumin/globulin ratio in the serum were changed significantly in animals with non-specific anorexia. Significant changes observed in the above parameters in group II animals were further enhanced on third and fifth days of observation. In group III animals, a decrease in the ammonia nitrogen level

and increase in the total volatile fatty acids concentration in the rumen liquor observed on the third and fifth day of admission in the clinic was statistically significant. Blood glucose, albumin and albumin-globulin ratio in the serum were also increased significantly in group III animals on fifth day.

Following modified line of therapy the animals of group III became normal within three to five days. Clinical improvement was indicated by increased appetite, revival of rumen motility and rumination and also increased milk yield in the lactating animals. Decrease in the ammonia nitrogen level and increase in the total volatile fatty acids concentration in the rumen liquor of group III animals were significant on fifth day of therapy. Increase in blood glucose, albumin, albumin-globulin ratio in the serum were also found to be statistically significant on the fifth day.

The changes in the blood glucose, total bilirubin, total protein, albumin and albumin-globulin ratio in the serum indicated hepatic insufficiency possibly responsible for the anorexia developed in the diseased animals. The modified line of therapy was found to be superior to conventional therapy for the clinical management of non-specific anorexia in cattle.

DECLARATION

I hereby declare that this thesis entitled "Studies on Non-specific Anorexia In Cattle" is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title of any other University or Society.

P.G. Baby

Mannuthy,
-4-1989.

CERTIFICATE

Certified that this thesis entitled "Studies on Non-specific Anorexia in Cattle" is a record of research work done independently by Sri. P.G. Baby under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to him.

Dr. K.M. Alikutty
(Chairman, Advisory Board)
Professor and Head,
Department of Clinical Medicine,
College of Veterinary & Animal Sciences,
Mannuthy.

Mannuthy,
29-4-1989.

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P.G. Baby

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

Introduction

INTRODUCTION

Digestive disorders constitute some of the major causes of anorexia in ruminants. Unlike other species, cattle are more prone to digestive disorders due to the great variability in the quality and the quantity of the feeds they consume. Adoption of improved agricultural practices and introduction of cross-breeding programme have brought about marked changes in the profile of primary rumen dysfunctions which Hoflund (1967) has described as "man-made diseases or diseases of civilization". Digestive disorders in bovine animals were mainly due to dietary abnormalities such as ingestion of undigestible roughages particularly of low protein content, mouldy, overheated and frosted feeds, excess concentrates and sudden change of feeds (Hoflund, 1967). Prolonged and heavy oral dosing of antibiotics and sulphonamides may also cause indigestion due to destruction of normal ruminal flora. Deficiency of minerals and vitamins produces diseases of the digestive system either directly or indirectly and badly affect their appetite.

Since the last one and a half decade , a peculiar anorectic syndrome in cattle was observed in Kerala. Though not recognised as a disease entity, anorexia causes considerable economic loss in dairy animals due to severe loss of production. The incidence of this condition in Kerala was seemingly highest during the year 1979-80 with larger number of cases noticed during the months of November to April and thereafter

the rate of incidence was gradually reduced. This syndrome was mostly seen in lactating, pregnant and growing cattle which were maintained on rations containing groundnut cake as the main ingredient of the concentrates. Though morbidity rate was found to be very high mortality was often low when treated properly. As the main clinical manifestations, affected animals had loss of appetite, dullness, dryness of the muzzle, reduced rate of rumination, emaciation and in the lactating animals reduction in milk-yield.

Indigestion was associated with liver damage due to toxins liberated from the rumen and reticulum (Kadvekar and Murkibhavi, 1971). Liver has a vital role in the maintenance of appetite and non-specific anorexia in cattle could be associated with its functional derangements. Parenteral administration of vitamin-B complex with liver extracts was suggested for effecting early recovery from indigestion in cattle (Misra and Singh, 1974). Field veterinarians have also communicated that administration of liver tonics were effective for treating cases of non-specific anorexia in cattle. However, various aspects of non-specific anorexia in cattle as reported from the field have not been clearly understood. Therefore, this study was taken up to investigate the alimentary derangements and functional status of the liver in animals affected with non-specific anorexia, the details of which could profitably be utilized to adopt effective therapeutic regimen for this condition in the field. Those investigations were aimed to:

1. collect data on the incidence,
2. record clinical observations in the affected animals,
3. evaluate the microbial and biochemical profile of the rumen,
4. evaluate the status of the liver function, and
5. compare the efficacy of different lines of therapy.

Review of literature

Digestive dysfunctions in cattle constituted about 40.0 per cent of all diseases treated every year at Wisconsin (Nichols, 1963). Higher incidence of digestive dysfunctions in cattle has also been reported from Cornell, where the incidence was more during October to April due to changes in the feed during the season (Udall, 1964). According to Balasubramaniam and Ganapathy (1965) indigestion formed 80% of the digestive disorders in bovine animals treated at the Madras Veterinary College Hospital during 1961-'62. Joshi (1970) reported that incidence of digescive dysfunctions in bovine animals was more common during summer season when roughages available to the animals were dry. It was also reported that indigestion constituted 75.70 to 81.51 per cent of the total of gastro-intestinal disorders in cattle treated at the Madras Veterinary College Hospital during 1960-64 (Verma and Ganapathy, 1973). Chakraborthy et al. (1974) observed very high incidence of indigestion in cattle in Assam during south-west monsoon season. Prasad et al. (1976a) reported that 65.0 per cent of anorexia in sheep and goat was due to digestive dysfunctions and among this 63.0 per cent was due to simple indigestion. Bindumadhav and Krishnamoorthy (1979) recorded high incidence of digestive disorders in large animals (36.60 per cent) at the Madras Veterinary College Hospital during 1971-'72. Prasad and Rekib (1979) also reported

a high incidence of rumen dysfunctions during the summer season. According to Thomas (1983) the incidence of digestive disorders in cattle was more during summer followed by winter and rainy seasons in Kerala. He opined that the shortage of good quality green fodder and ingestion of low grade, dry and coarse roughages, scarcity of good drinking water coupled with stress due to high environmental temperature were the probable causes for high incidence of rumen disorders in cattle during summer season.

2.2. Etiology

Digestive disorders in cattle were classified into primary type in which the digestive system was directly involved and secondary type associated with other diseases (Nichols, 1963). According to him the major causes of digestive dysfunctions in cattle were ingestion of excess quantities of feed, improper ratio of nutrients, infrequent and irregular feeding and watering, supply of feeds lacking physical consistency and poor environmental and managemental conditions. Based on the changes in the pH of the rumen liquor Hoflund (1967) classified ruminal disorders into simple indigestion, acid indigestion and alkaline indigestion. He reported that simple indigestion resulted from feeding damaged food materials or abrupt change in feeds, especially of inferior quality, while ingestion of excess quantity of easily fermentable carbohydrates resulted in acid indigestion. Etiology of alkaline indigestion was attributed to intake of spoiled silage and rumen putrefaction

due to intake of poor quality fodder and water. Joshi (1970) observed that ruminal dysfunctions in cattle as indigestion, impaction and tympany of the rumen were caused by dietetic irregularities. Sub-acute primary indigestion in cattle due to abrupt changes from good to poor quality straw was reported by Misra et al. (1972b). Sudden replacement of ricebran with decorticated salseed in the ration resulted in primary indigestion in large number of dairy cattle (Dash and Misra, 1972). Dunlop (1972) suggested that feeds rich in non-fibrous carbohydrates, carbohydrate precursors of lactic acid, toxic doses of feeds and constituents, psychological and environmental factors, accumulation of lactic acid in the gastrointestinal tract, microbial metabolism of lactate and changes in the pH in the forestomach as etiological factors of acid indigestion. Drinking contaminated water under unhygenic conditions resulted in the development of alkaline indigestion in cows (Nagarajan and Rajamani, 1973). Joshi and Misra (1977) classified rumen dysfunctions in cattle into simple indigestion, indigestion with impaction, indigestion with tympany and toxic indigestion. The authors considered simple indigestion as the mildest form of rumen dysfunction and designated it anorexia or ruminal atony. Acid indigestion in cattle was experimentally produced by feeding of excess quantity of grains (Svendson, 1974; Sethuraman and Rathor, 1979a; Nauriyal et al., 1978 and Randhawa et al., 1981). Ingestion of excess quantity of raw rice, sudden change over to excess feeding of boiled rice, jack fruits, etc. resulted in acid indigestion in cattle and goats (Aleyas and

Vijayan, 1981). Alikutty (1981) experimentally induced ruminal alkalosis in cattle by intraruminal administration of urea. Thomas (1983) observed that simple indigestion in cattle resulted from dietary abnormalities like abrupt changes in feeds and feeding schedule or variations in the water intake. Ruminal acidosis in goats was experimentally induced by by intraruminal administration of raw rice (Pillai, 1980).

Liver plays an important role in the maintenance of appetite and in anorexia there could be a derangement in its functioning (Davidson and Passmore, 1962). Marston et al. (1961) reported that in anorexia of sheep vitamin B_{12} level in the liver was lowered with a decrease in the appetite in the animals affected. Pienkowski (1970) observed that in acid indigestion in cattle toxic products absorbed from the gastrointestinal tract may cause functional disturbances of hepatic cells. Hepatic insufficiency was noticed in most of the cases of anorexia associated with simple, acid or alkaline indigestion, impaction and bloat in cattle and buffaloes (Prasad et al. 1972). In primary rumen impaction of zebu cattle and buffaloes hepatic insufficiency was reported by Prasad and Joshi (1975). Joshi and Misra (1976) opined that hepatic injury in spontaneous rumen dysfunctions in buffaloes was caused by damages to the liver cells from toxins liberated in the forestomach compartments. Dienick (1981) observed a derangement in the excretory and metabolic functions of the liver in experimental ruminal acidosis. Randhawa et al. (1981) recorded diffuse coagulation necrosis and microabscesses in the liver parenchyma in ruminal acidosis in buffalo calves. McSherry et al.

(1964) observed that in 387 out of 1279 sick cattle admitted to the clinic of Ontario which had hyperbilirubinomia, anorexia and ruminal stasis were found to be the most frequent clinical signs. Hyperbilirubinemia was due to failure of liver to remove unconjugated bilirubin from the serum because of hepatic insufficiency. Rajan et al. (1983) reported hepatic damage in non-specific anorexia in cattle. It was suggested that hepatic damage was caused by the aflatoxins present in the groundnut cake fed to the animals.

2.3. Clinical signs

Hoflund (1967) described the clinical signs as dehydration, hide-bound condition, sunken eyes and oliguria due to acute indigestion in cattle. According to Dash et al. (1972) and Misra and Singh (1974) the manifestations of acid indigestion in cattle were subnormal temperature, cold extremities, dry muzzle, dullness, dehydration, ataxia, dilated pupil, absence of rumen contractions, restlessness, water balloned rumen, abdominal pain, salivation, mild to acute tympany, recumbency and dyspnoea. In alkaline indigestion of cattle, high rumen pH (7.5 to 8.5), putrid fishy smell to breath, anxious painful look, regurgitation of rumen contents, depressed pulse and respiration and reduced rumen motility were reported. In alkaline indigestion in cattle Nagarajan and Rajamani (1973) observed congested mucous membranes, dryness of muzzle and putrid odour for the rumen contents. Joshi and Misra (1977) described simple indigestion as the mildest form of rumen

dysfunction, manifested by ruminal atony off-feed and dullness. pH of the rumen liquor was 5.6 to 7.4 and infusoria were normal in number and motility. Prasad (1979) reported that reticulo-ruminal motility was adversely affected in all types of indigestion in cattle and buffaloes irrespective of the disturbances in the pH of rumen liquor. Sethuraman and Rathor (1979a) described the manifestations of acid indigestion in cattle and buffaloes as anorexia, dullness, suspended rumen motility, accelerated pulse and respiration, arched back, discharge from the eyes and nostrils, diarrhoea, dehydration, muscle tremors, shifting lameness, jugular pulse, recumbency and coma. Experimental rumen alkalosis was manifested by anorexia, tympanitis, lacrimation, salivation, passage of semisolid dung, congested mucous membranes, alteration of pulse and respiratory rates, purulent discharge from the eyes and nostrils, grinding of teeth, groaning, arched back, offensive odour from the nostrils, straddling gait, muscle tremors, convulsions and polyuria. Alikutty (1981) reported hyperammonaemia, muscle tremors, ataxia, progressive tetany merging to convulsive episodes in experimental rumen alkalosis in cattle. Choudhuri et al. (1981) observed drop in milk yield, cessation of rumen motility, passage of scanty pasty dung, rough body coat and dryness of muzzle in chronic alkaline indigestion. In simple indigestion of cattle general depression and dullness, suspended rumination, normal or pasty and scanty dung and drop in milk yield were reported (Thomas, 1983). Blood et al. (1983) described the clinical signs in

simple indigestion as reduction in appetite, drop in milk yield, depression and dullness, ruminal atony, cessation of rumination and constipation with scanty firm dung. In acid indigestion they observed anorexia, abdominal pain, reduction or absence of rumen motility, subnormal body temperature, dehydration, shallow respiration and recumbency after 48 hours.

2.4. Diagnosis

Digestive dysfunctions in cattle were associated mainly with dietary irregularities and so history taking was considered useful for their diagnosis (Prasad and Rekib, 1979 and Dirksen, 1979). Diagnosis of diseases of the digestive system was facilitated by its physical examination (Boddie, 1962; Misra et al., 1972a and Dirksen, 1979). The normal rate of rumen motility was recorded as 1-2 per minute and its normal consistency was doughy (Boddie, 1962). Dirksen (1979) recorded the normal rate of rumen motility in cattle as 7 to 12 per 5 minutes and hypo-motility or atony was present in all disorders of the forestomach in cattle. Prasad (1979) classified the reticulo-ruminal motility as hypermotile (3 movements in 1 minute), normal (2 movements in 1 minute or 3 movements in 2 minutes), hypomotile (1 movement in 1 to 2 minutes) and atonic (no movements clinically perceptible). According to Blood et al. (1983) reticulo-ruminal motility in cattle could be 1-3 per minute and consistency was doughy.

2.4.1. Examination of rumen liquor.

Analysis of rumen fluid for its physical, biochemical and microbial characters was considered as a valuable aid in the diagnosis of diseases of digestive system in ruminants (Nichols and Penn, 1958; Jagos et al., 1977 and Blood et al., 1983).

2.4.1. Physical characters.

2.4.1.1. Odour.

Rumen liquor from healthy animals had an aromatic odour and this depended on the nature of rumen contents (Misra et al., 1972a; Misra and Singh, 1974; Alonso, 1979 and Dirksen, 1979). Abnormal odour of rumen liquor of cattle was reported to vary from faintly sour to putrid fishy in sub-acute primary indigestion, pungent in acid indigestion (Misra et al., 1972b) and putrid fishy in alkaline indigestion (Misra and Singh, 1974 and Sethuraman and Rathor, 1979b). In cattle with simple indigestion odour of the rumen liquor was faintly aromatic/ faintly sour (Thomas, 1983).

2.4.1.2. Colour.

Normal colour of the rumen liquor in cattle depends on the nature of the diet, time of feeding and stage of digestion (Alonso, 1979 and Dirksen, 1979) and it varies from yellowish brown (Misra et al., 1972a and Misra and Singh, 1974), grey and olive to brownish green and pure green (Dirksen, 1979), greenish brown (Alikutty, 1981) or greenish yellow (Thomas, 1983). Colour of rumen liquor in cattle was yellowish brown

in simple indigestion (Dash and Misra, 1972), yellow in acid indigestion and dark brown in alkaline indigestion (Misra and Singh, 1974). Thomas (1983) reported that abnormal colour of rumen liquor in simple indigestion in cattle was brownish yellow or brownish.

2.4.1.3. Consistency.

Normal consistency of rumen fluid of cattle was viscous or slightly viscous (Misra et al., 1972a and Dirksen, 1979) and thick with heavy concentration of disintegrated food particles (Thomas, 1983).

In alkaline indigestion of cattle the rumen liquor was watery in consistency (Hoflund, 1967; Misra and Singh, 1974 and Alikutty, 1981). In primary indigestion of cattle rumen liquor was thin and watery in acid indigestion (Dash et al., 1972 and Misra and Singh, 1974). According to Thomas (1983) consistency of the rumen liquor was thin/thick in simple indigestion of cattle.

2.4.1.4. Biochemical characters.

pH

Normal values of pH of the rumen liquor of cattle reported by the various workers were 6.7 to 6.9 (Misra et al., 1972a), 6.4 to 6.8 (Alonso, 1979), 5.5 to 7.0 (Dirksen, 1979), 6.81 $\pm$ 0.005 (Alikutty, 1981), 6.81 $\pm$ 0.44 (Thomas, 1983) and 6.5 to 7.0 (Blood et al., 1983). In simple indigestion of cattle ranges of pH of the rumen liquor were 6.0 to 7.0 (Hoflund,

1967), 6.7 to 6.9 (Misra et al., 1972b), 5.6 to 7.4 (Prasad et al., 1972), 7.0 ± 0.67 (Vihan et al., 1973) and 6.7 to 7.1 (Thomas, 1983). In bovine ruminal acidosis it was reported to be 4.0 to 5.5 (Hoflund, 1967), 3.8 to 4.5 (Dash et al., 1972), 4.0 to 4.5 (Misra and Singh, 1974). In alkaline indigestion of cattle the pH of the rumen liquor was increased and the values reported were 7.5 to 8.5 (Hoflund, 1967), 8.6 (Nagarajan and Rajamani, 1973), 8.0 ± 0.08 (Vihan et al., 1973), 7.2 to 9.5 (Misra and Singh, 1974), 8.0 to 8.9 (Choudhuri et al., 1981) and 8.26 ± 0.66 (Alikutty, 1981).

2.4.1.5. Total volatile fatty acids.

Concentration of total volatile fatty acids (TVFA) in rumen liquor of healthy cattle was reported to be 60-120 mEq/L (Phillipson, 1977), 87.8 ± 3.3 mEq/L (Joshi and Misra, 1976), 86 mEq/L (Prasad, 1977), 65 to 95 mEq/L (Dirksen, 1979), 84.3 mEq/L (Sankaranarayan and Venkatayan, 1980) and 90.69 ± 2.27 mEq/L (Alikutty, 1981).

Hoflund (1967) reported that the total volatile fatty acids concentration in the rumen liquor was lowered during digestive disorders in cattle. Prasad et al. (1973) observed an increase in the concentration of total volatile fatty acids in the rumen which ranged between 72.0 and 114.6 mEq/L during the early stages of acid indigestion. It came down after two hours due to decreased production of total volatile fatty acids at the low ruminal pH. In bovine animals the total volatile fatty acids level was found to be 82.89 ± 3.1 mEq/L in simple

indigestion, 149.2 ± 13.08 mEq/L in acid indigestion, 63.38 ± 6.4 mEq/L in alkaline indigestion, 87.7 ± 3.3 mEq/L in impaction of rumen and 76.9 ± 11.2 mEq/L in ruminal bloat (Prasad et al., 1972). In alkaline indigestion of cattle and buffaloes low total volatile fatty acids levels (63.38 ± 6.4 mEq/L) was recorded by Joshi and Misra (1975). Prasad (1977) noticed a negative correlation between the rumen pH and total volatile fatty acids and between TVFA and ammonia nitrogen of rumen liquor in primary anorexia of cattle and buffaloes.

2.4.1.6. Ammonia nitrogen (NH_3-N).

Ammonia nitrogen concentration of rumen liquor in healthy cattle was found to be 5.0 to 25.0 mg per cent (Phillipson, 1977), 8.0 to 11.3 mg per cent (Prasad, 1977), 25.30 ± 0.9 mg per cent (Sethuraman and Rathor, 1979b) 5.0 to 12.0 mg per cent (Dirksen, 1979), 13.0 to 19.0 mg per cent (Sankaranarayan and Venkatayan, 1980) and 13.21 ± 1.01 mg per cent (Alikutty, 1981).

Prasad (1977) reported variations in the concentration of ammonia nitrogen in the rumen liquor of cattle in different types of digestive disorders such as simple indigestion (12.2 ± 1.3 mg per cent), acid indigestion (6.56 ± 0.21 mg per cent), alkaline indigestion (23.01 ± 2.3 mg per cent), impaction of rumen (21.7 ± 2.3 mg per cent) and ruminal bloat (21.7 ± 2.3 mg per cent). Prasad et al. (1973) observed a decrease in the rumen ammonia nitrogen level in early stages of acid indigestion and an increase in alkaline indigestion in buffaloes.

2.4.1.7. Microbial characters.

Rumen protozoa

Rumen protozoa count was suggested as an aid for diagnosis of rumen dysfunctions (Hungate, 1966). Misra et al. (1972a) described the protozoal motility of rumen liquor of healthy cattle ranging from moderate (++) to vigorous (+++) with 10 to 30 protozoa per microscopic field. Dirksen (1979) suggested that the protozoa in the rumen liquor normally varied according to composition of the ration, feeding time and level of the rumen fluid from where the samples were collected.

Hoflund (1967) observed that alterations in the pH of rumen fluid was detrimental to the survival of rumen microbes. Dash et al. (1972) noticed the disappearance of protozoa when the pH of the rumen liquor was below 5.5 and very few survived between pH of 5.5 to 6.0. Misra et al. (1972b) reported that in primary indigestion of cattle the protozoal count and their motility were reduced without any changes in the pH of rumen liquor. In primary indigestion in cattle a low (+) to moderate (++) concentration of protozoa was reported by Dash and Misra (1972). Prasad et al. (1973) reported that the rumen protozoa died and disintegrated at low pH of 5.5 and at high pH of 8.5. Joshi and Misra (1977) noticed that in simple indigestion of cattle there was no change in the normal activity and number of rumen protozoa. Chaudhuri et al. (1981) observed that in alkaline indigestion in cattle at pH above 8.0 all rumen protozoa were dead. Thomas (1983) reported that the protozoal

motility in rumen liquor of healthy cattle varied from moderate (++) to vigorous (+++) and in simple indigestion it varied from low (+) to moderate (++).

2.4.1.8. Sedimentation activity time (SAT).

Nichols and Penn (1958) suggested that determination of sedimentation activity time (SAT) was helpful to assess the rumen microbial activity. According to Hoflund (1965) prolonged sedimentation activity time (SAT) indicated poor microbial activity. Misra et al. (1972a) reported that in cattle sedimentation activity time of rumen liquor varied from 8.0 to 18.0 minutes with an average value of 12.8 min. Prasad et al. (1973) observed quick sedimentation of particulate material of rumen fluid in both acid and alkaline indigestion in buffaloes. Quick sedimentation, unclear sediment and delay in floatation of particulate materials of rumen liquor indicated various degree of inactivity of rumen microbes (Prasad, 1976). Alikutty (1981) observed that in alkaline indigestion in cattle sedimentation activity time was 51.29 $\pm$ 4.22 minutes against 20.33 $\pm$ 2.77 minutes in the control animals. Normal sedimentation activity time of rumen liquor in cattle from western countries varied from 4.0 to 8.0 min. (Dirksen, 1981) and 3.0 to 9.0 min (Blood et al., 1983). Thomas (1983) recorded it as 14.65 $\pm$ 0.65 minutes in healthy cattle and 27 $\pm$ 3.27 minutes in cattle with simple indigestion.

2.4.2. Evaluation of liver function.

Doxey (1971) opined that screening tests of considerable

value for the diagnosis of functional disorders of liver in small animals have limited value in ruminants. Estimations of blood sugar, plasma protein, albumin, albumin/globulin ratio, serum chloesterol and serum bilirubin could be used for assessing the functional status of the liver (Medway et al., 1969 and Benjamin, 1985).

2.4.2.1. Total serum protein, albumin, albumin:globulin ratio (A:G ratio).

Normal plasma protein concentration of cattle was found to be 7.16 g per cent and albumin as 4.31 g per cent (Doxey, 1971). The corresponding values for serum protein and albumin reported by Rowlands et al. (1975), Ross and Halliday (1976), Tasker (1978) and Dirksen (1979) were 6.6-8.6 g per cent and 2.70-3.70 g per cent, 7.14-7.6 g per cent and 3.46-3.77 g per cent, 7.1 $\pm$ 0.59 g per cent and 3.0 $\pm$ 0.22 g per cent and 6.0-8.0 g per cent and 3.0-4.0 g per cent, respectively. Pillai (1980) reported serum protein level in cross-bred cattle in Kerala as 6.83 g per cent. According to Blood et al. (1983) the normal serum protein level in cattle was 5.7-8.1 g per cent and serum albumin 2.1-3.6 g per cent. Benjamin (1985) reported the normal level of total protein, albumin and albumin/globulin ratio in the serum were 6.74-7.46 g per cent, 3.03-3.08 g per cent and 0.84-0.94, respectively.

Prasad et al. (1972) reported that liver dysfunction indicated by high albumin/globulin ratio was a common complication in bovine indigestion. He recorded the total serum protein of 8.69 $\pm$ 0.81 g per cent and the serum albumin concentration of

4.14 ± 0.58 g per cent and the albumin/globulin ratio of 0.77 ± 0.05 in indigestion in cattle. Hepatic insufficiency in most cases of rumen dysfunctions in cattle and buffaloes was revealed by changes in the serum levels of protein, albumin and albumin/globulin ratio (Prasad et al., 1973; Prasad and Joshi, 1975; Sethuraman and Rathor, 1979; Bienick, 1981; and Barnouin et al., 1981).

2.4.2.2. Total serum cholesterol.

Though physiological variations occur under varying managemental conditions estimation of serum cholesterol level provided valuable information on the functional status of the liver (Pearson and Craig, 1980 and Clampitt, 1980). The normal values of serum cholesterol in cattle reported by various workers were 100 mg per cent (Doxey, 1971), 70 mg per cent (Dwivedi et al., 1972), 132-159 mg per cent (Ross and Halliday, 1976), 80-264 mg per cent (Tasker, 1978), 93-169 mg per cent (Baumgartnes and Skallcky, 1979), 126 to 204 mg per cent (Sinha et al., 1981), 87.95 ± 5.16 mg per cent (Alikutty, 1981), 97-155 mg per cent (Sharon et al., 1982), 39-177 mg per cent (Blood et al., 1983) and 80-120 mg per cent (Benjamin, 1985).

Harvey and Hoe (1971) advocated the estimation of total serum cholesterol in conjunction with enzymes estimation for evaluation of liver functions in sheep. Estimation of serum cholesterol for assessment of liver functions was recommended by various workers and its decreased level suggested hepatic insufficiency (Gupta et al., 1976; Mullen, 1976; Mattelib et al., 1976 and Benjamin, 1985).

2.4.2.3. Blood glucose.

Normal blood glucose level in cattle was reported to be 35-55 mg per cent (Kaneko and Cornelius, 1970), 40 mg per cent (Mullen, 1976), 43.7 mg per cent (Rowlands et al., 1977), 64 ± 18 mg per cent (Tasker, 1978), 60-80 mg per cent (Dirksen, 1979), 53 ± 0.60 mg per cent (Wiener and Russell, 1980), 51.6 mg per cent (Pillai, 1980), 41.29 ± 2.39 mg per cent (Alikutty, 1981) and 35-55 mg per cent (Blood et al., 1983 and Benjamin, 1985). In hepatitis due to aflatoxicosis in cattle the blood glucose level was reduced from 62.4 mg per cent to 56.8 mg per cent (Applebauren and Marth, 1983).

2.4.2.4. Total serum bilirubin.

Estimation of total and free bilirubin in the serum was found to be useful for the diagnosis of liver dysfunctions in animals (Clampitt, 1980 and Benjamin, 1985). Normal total serum bilirubin level in cattle reported by various authors were 0.24 ± 0.15 mg per cent (Doxey, 1971), 0.2 ± 0.07 mg per cent (Tasker, 1978), 0.05 to 0.4 mg per cent (Dirksen, 1979), 0.13-0.31 mg per cent (Baumgartner and Skalicky, 1980), 0.3-0.4 mg per cent (Sharon et al., 1982), 0-1.9 mg per cent (Blood et al., 1983) and 0.01-0.47 mg per cent (Benjamin, 1985)

Dwivedi et al. (1972) reported that due to fascioliasis in cattle and buffaloes serum bilirubin level increased to 0.75 mg per cent from the normal level of 0.08 mg per cent. Mattilib et al. (1976) observed elevated serum bilirubin level in hepatitis due to carbontetrachloride toxicity in goats. In

diffuse liver diseases of cattle total serum bilirubin increased to 0.697 mg per cent from the normal value of 0.301 mg per cent (Vasilev, 1979). In experimental ruminal acidosis increased level of serum bilirubin was observed by Bienick (1981). McSherry et al. (1984) observed hyperbilirubinemia in cattle with hepatic insufficiency. Berteni et al. (1986) opined that high bilirubin level in blood (above 0.4 mg per cent) and low serum albumin and cholesterol levels could be taken as indications of hepatic insufficiency in cows. Rajan et al. (1988) reported increased levels of serum bilirubin (0.53 mg per cent) in non- specific anorexia of cattle.

2.4.3. Treatment.

Stevens et al. (1958) recommended the use of potassium antimony tartrate or tartar emetic for restoring rumen motility in cattle. Hoflund (1967) suggested oral administration of one litre of brewers yeast or 0.5 kg of baker's yeast and parenteral use of B-complex vitamin and antihistamines as supportive therapy for grain engorgement in cattle. Gnanaprakasam (1970) reported that oral administration of antacids, fresh rumen liquor, antibiotics and parenteral administration of fluids and electrolytes, thiamine hydrochloride and antihistamines were effective for treatment of ruminal acidosis in goats. Slamina et.al., (1970) treated the ruminal acidosis of cattle with a proprietary preparation consisting of buffer salts,stimulants,sodium propionate and trace elements. He observed that within forty-eight hours of the treatment, ruminal pH, volatile fatty acids concentration, blood

alkali reserve, calcium, phosphorus and alkaline phosphatase in the blood returned to normal. Kadvekar and Murkibhavi (1977) recommended parenteral administration of vitamin-B-complex and liver extract at a dose rate of 1 ml each per 50 kg body weight as a course of three injections daily for anorexia in bovine animals. In indigestion due to change in feed from normal to salseed supplemented ration in cattle satisfactory response was obtained when treated with 'Himalayan Batisa' and treacle (Dash and Misra, 1972). Misra and Singh (1974) found that oral administration of 200 ml of 5% lactic acid effective for alkaline indigestion and magnesium carbonate or sodium bicarbonate at the rate of 225 g initially followed by 30 g for few days in acid indigestion for correcting the ruminal pH in cattle. Subsequent to the correction of ruminal pH, 'Himalayan Batisa' and 'Livogen' were administered. Prasad and Rekib (1975) treated rumen acidosis in cattle by administering sodium bicarbonate orally and intravenously (7.5%). After 3 hours of oral administration of sodium bicarbonate fresh rumen liquor was given. Pulvis Nuxvomica was also given orally as a rumenatoric for early restoration of rumen motility. Oral administration of 'Anorexon' tablets at the rate of 1 tablet twice daily followed by antacids for two to three days was found to be effective in the treatment of non-specific anorexia in bovine animals (Prasad et al., 1976b). Sethuraman and Rathor (1979a) recommended oral administration of sodium bicarbonate or magnesium carbonate and parenteral administration of Ringer's lactate, antihistamines, thiamine hydrochloride and

liver extracts in experimental acid indigestion in bovine animals. Fresh rumen liquor, penicillin and rumenatorics were also given orally to the above condition. For experimental alkaline indigestion they recommended oral administration of 5% acetic acid, streptomycin and rumen liquor and parenteral administration of Ringer's lactate, antihistamines and vitamin-B complex and liver extract. Aleyas and Vijayan (1981) treated cases of ruminal acidosis in cattle and goats using antacids along with tender coconut water and cud transplantation orally and 5 per cent dextrose saline and antihistamines parenterally. Alikutty (1981) observed clinical recovery in 67.70 per cent of experimental cases of alkaline indigestion in cattle treated with a therapeutic regimen consisting of partial evacuation of rumen contents followed by intraruminal administration of lactic acid, parenteral administration of 'Betnesol', 'Thiacal' and B-complex with liver extract and oral administration of cobalt sulphate and fresh rumen liquor. In addition molasses and rice gruel were given intraruminally as a supportive therapy. Thomas (1983) tried two lines of therapy for simple indigestion in cattle one of which comprised oral administration of bitter stomachics (Ammonium carbonate, pulvis zingiberis, pulvis chiretta and pulvis nuxvomica) and parenteral administration of 6 ml of liver extract with vitamin B complex for four consecutive days. In the other modified line of therapy oral administration of 'Anorexon' tablets at the dose rate of 2 tablets daily for 3 days and bitter stomachics and parenteral administration of 'calborol'

(calcium borogluconate) at the rate of 225 ml daily for 2 days were given. Modified line of therapy was found superior to conventional line of therapy for the management of simple indigestion in cattle. Blood et al. (1983) recommended oral administration of magnesium hydroxide (400 g/ 450 kg body weight) or 5 per cent acetic acid or vinegar (5-10 litres) depending on the pH of the rumen in case of simple indigestion in cattle. Reconstitution of the rumen flora by cud transplantation was also found to be highly effective. In ruminal acidosis oral administration of magnesium hydroxide (500 g/450 kg body weight) and parenteral administration of 1.3 per cent solution of sodium bicarbonate and fluids and electrolytes were suggested. Administration of antihistamines, corticosteroides, thiamine hydrochloride parenterally and antibiotics and brewer's yeast orally were recommended as ancillary treatment.

Materials and Methods

3. MATERIALS AND METHODS

Data on the incidence of non-specific anorexia were collected from records maintained at the University Veterinary Hospitals, Mannuthy and Trichur and from the field veterinary hospitals at Arimboor, Anthikadu and Pattikadu for a period of five years from 1978-1982.

Ten healthy adult cross-bred cattle maintained under identical feeding and managemental conditions at the University Livestock Farm, Mannuthy were selected at random and used as healthy control animals (Group I) for this study. These animals were fed compounded cattle feed and green fodder at the standard levels recommended and fresh clean water was provided ad libitum. Rumen liquor was collected using a suction pump following the method of Alenso (1979) for analysis. Samples of 5 millilitres of blood were collected by jugular puncture in clean, dry, glass vials with sodium fluoride added @ 10 mg per millilitre of blood as anticoagulant for estimation of blood glucose and samples of 20 millilitres of blood collected in clean, dry glass test-tubes without any anticoagulant for separation of the serum for estimating the other parameters. The samples were stored at 4°C till analyses were performed.

Based on the history and detailed clinical examination twenty animals with typical signs of non-specific anorexia presented at the Veterinary Hospital, Mannuthy were selected at random into groups of ten each (Group II and Group III) and utilized as the experimental animals for these investigations. Course of the illness was followed and the samples

of rumen liquor and blood were collected from both the groups for analysis as in the case of animals of the control group on day 1, 3 and 5.

Animals of group II were given conventional therapy comprising oral administration of stomachics as prescribed below:-

℞

Ammonium carbonate - 60 g

Pulvis nuxvomica - 30 g

Pulvis zingiberis

Pulvis gentian

Pulvis chiretta - aa 60 g

Mft Pulv IV Sig I BID ac elect.

Group III animals were treated by modified line of therapy comprising of administration of 500-1000 ml dextrose 25% solution intravenously, 5 ml of vitamin B complex with liver extract intramuscularly on alternate days for 5 days and stomachics orally as prescribed above, daily for 5 days.

Analysis of clinical materials

pH of rumen liquor was recorded immediately after collection using strips of wide ranged BDH *pH* paper. Physical characters of the rumen liquor and protozoal motility were assessed as per the method of Misra and Tripathy (1963). Sedimentation Activity Time (SAT) was determined soon after collection using a sample of fresh strained rumen liquor as per the method of Nichols and Penn (1950). Total volatile fatty acids (TVFA) and ammonia nitrogen (NH_3-N) levels in the

rumen liquor were estimated as per the method of Barnett and Reid (1957) and Conway (1957), respectively.

Estimation of blood glucose, total cholesterol and total bilirubin in the serum were made as per O-Toluidine method of Hultman (1959), Zak (1957) and Malloy and Evelyn (1937), respectively. Total protein and albumin in the serum were estimated as per the biuret method of Huerga et al. (1964) and Barthalomew and Deloney (1968) from which the serum albumin/ globulin ratio was also derived. Statistical analysis of the data was carried out as described by Snedecor and Cochran (1967).

4. RESULTS

Data on the incidence of anorexia syndrome in bovine animals showed its maximum prevalence during 1979-80 with the highest number of cases from November to April every year. Non-specific anorexia constituted 10.95 per cent of the total and 32.30 per cent of the digestive disorders in cattle during the period of 1978-82 (Tables 1 and 2).

Commencement of the disease was gradual and was indicated by inappetance, mucopurulent nasal discharge, dryness of the muzzle followed by peeling of its epithelium, constipation or diarrhoea, weakness, emaciation and also reduction in milk yield in lactating animals. As the disease progressed varying degree of anorexia prevailed. Temperature was normal, pulse weak and rapid, respiration was normal, but sometimes laboured and the visible mucous membranes were pale and became icteric in the later stages of the disease. Rate of rumen motility was reduced and feeble in strength with rumination remaining suspended.

In healthy cattle (group I) rumen liquor had greenish-yellow colour, aromatic odour and moderately thick consistency with vigorous (+++) protozoal motility. The mean values of pH, sedimentation activity time, ammonia nitrogen and total volatile fatty acids concentrations were 6.62 $\pm$ 0.104, 14.7 $\pm$ 0.539 minutes, 8.1 $\pm$ 0.39 mg per cent and 72.8 $\pm$ 2.31 mEq/L, respectively (Table 3). The mean values of blood glucose, total cholesterol, total bilirubin, total protein, albumin and

albumin/globulin ratio in the serum were 61.78 ± 0.69 mg per cent, 117.41 ± 7.35 mg per cent, 0.27 ± 0.2 mg per cent, 7.01 ± 0.15 g per cent, 3.46 ± 0.08 g per cent and 1.01 ± 0.03, respectively (Table 4).

Samples of rumen liquor of animals of group II were light yellow, olive green or greenish in colour, aromatic in odour and thick in consistency. Their protozoal motility was poor (+) to vigorous (+++). The mean values of pH, sedimentation activity time, ammonia nitrogen and total volatile fatty acids concentration were 6.69 ± 0.12, 17.4 ± 0.88 minutes, 11.4 ± 0.64 mg per cent and 56.60 ± 3.34 mEq/L respectively on the first day (Table 5). The mean values of blood glucose, total cholesterol, total bilirubin, total protein, albumin and albumin/globulin ratio in the serum were 46.37 ± 2.75 mg per cent, 116.49 ± 6.71 mg per cent, 0.40 ± 0.03 mg per cent, 6.53 ± 0.10 g per cent, 2.95 ± 0.09 g per cent and 0.82 ± 0.02, respectively (Table 6).

In group III animals on the first day of observation, the colour of the rumen liquor was found to vary from greenish, greenish-yellow or light yellow. It had slight offensive to aromatic odour, thin to thick consistency and poor (+) to vigorous (+++) protozoal motility. The mean values of pH, sedimentation activity time, ammonia nitrogen and total volatile fatty acids concentration in the rumen liquor were 6.87 ± 0.07, 17.9 ± 1.28 minutes, 12.8 ± 0.59 mg per cent and 55.5 ± 3.93 mEq/L, respectively (Table 7). The mean values of blood

glucose, total cholesterol, total bilirubin, total protein, albumin and albumin/globulin ratio in the serum were 40.69 ± 3.55 mg per cent, 95.45 ± 4.18 mg per cent, 0.26 ± 0.05 mg per cent, 6.67 ± 0.06 g per cent, 2.88 ± 0.03 g per cent and 0.76 ± 0.01, respectively (Table 8). Changes in sedimentation activity time, ammonia nitrogen level and volatile fatty acids concentration in the rumen liquor and blood glucose, total bilirubin, total protein, albumin and albumin/globulin ratio in the serum in diseased animals were found statistically significant ($P < 0.05$).

Animals treated with conventional therapy (group II) did not show any clinical improvement on the third day. Still they had depressed appetite , suspended rumination and feeble rumen motility with its rate one per two minutes. Animals treated with modified therapy (group III) showed improvement in feed intake on the third day of treatment. Their rumen motility became stronger and the rate was one per minute and rumination resumed. Slight increase in milk production was also noticed. The rumen liquor of group II animals on the third day was light yellow, olive green or greenish in colour, aromatic in odour and thick in consistency. Their protozoal motility was poor (+) to vigorous (+++). The mean values of pH, sedimentation activity time, ammonia nitrogen and total volatile fatty acids concentration were 6.76 ± 0.12, 18.7 ± 0.60 minutes, 12.3 ± 0.88 mg per cent and 51.5 ± 4.31 mEq/L, respectively (Table 5). The mean values of blood glucose, total cholesterol, total

bilirubin, total protein, albumin and albumin/globulin ratio in the serum were 45.71 ± 1.58 mg per cent, 118.14 ± 6.22 mg per cent, 0.39 ± 0.05 mg per cent, 6.59 ± 0.08 g per cent, 2.94 ± 0.11 g per cent and 0.84 ± 0.02, respectively (Table 6). In group III animals the rumen liquor was greenish, greenish yellow, olive green or light yellow in colour, aromatic to slight offensive in odour and thin to thick in consistency. Protozoal motility varied from poor (+) to vigorous (+++). The mean values of pH, sedimentation activity time, ammonia nitrogen level and total volatile fatty acids concentration were 6.96 ± 0.06, 15.5 ± 1.16 minutes, 10.8 ± 0.57 mg per cent and 66.3 ± 5.82 mEq/L, respectively (Table 7). The mean values of blood glucose, total cholesterol, total bilirubin, total protein, albumin and albumin/globulin ratio in the serum were 51.48 ± 2.21 mg per cent, 103.37 ± 4.62 mg per cent, 0.25 ± 0.02 mg per cent, 6.68 ± 0.10 g per cent, 3.10 ± 0.07 g per cent and 0.82 ± 0.03, respectively (Table 8). In the case of group II animals comparison of data between the first and third day of therapy showed no significant variation. In the case of animals of group III rumen liquor showed a significant decrease in the ammonia nitrogen level and significant increase in the total volatile fatty acids concentrations. The increase in the blood glucose level observed on the third day was found statistically significant ($P < 0.05$).

On the fifth day of observation the animals treated with conventional therapy still did not show any clinical improvement. Animals remained anorectic, rumination was suspended

and rumen motility was feeble in strength and the rate was one per minute. Milk production further reduced and animals became weak and emaciated. Animals treated with modified therapy have became clinically normal by the fifth day. Animals started feeding normal rations and milk production increased considerably. Samples of rumen liquor of group II animals on the fifth day had light yellow or greenish in colour, with an aromatic odour and thick consistency. Protozoal motility was poor (+) to vigorous (+++). The mean values of pH, sedimentation activity time, ammonia nitrogen and total volatile fatty acids concentration were 6.77 $\pm$ 0.88, 17.5 $\pm$ 0.67 minutes, 11.2 $\pm$ 0.51 mg per cent and 50.2 $\pm$ 3.13 mEq/L, respectively (Table 5). The mean value of blood glucose, total cholesterol, total bilirubin, total protein, albumin and albumin/globulin ratio in the serum were 45.66 $\pm$ 1.20 mg per cent, 106.85 $\pm$ 5.03 mg per cent, 0.36 $\pm$ 0.02 mg per cent, 6.5 $\pm$ 0.10 g per cent, 2.93 $\pm$ 0.10 g per cent and 0.80 $\pm$ 0.04, respectively (Table 6).

On the fifth day in group III animals the rumen liquor was greenish, greenish-yellow, olive green or light yellow in colour, aromatic in odour and thick in consistency. Their protozoal motility were vigorous (+++). The mean values of pH, sedimentation activity time, ammonia nitrogen and total volatile fatty acids concentration were 6.82 $\pm$ 0.11, 15.3 $\pm$ 0.87 minutes, 10.6 $\pm$ 0.79 mg per cent and 70.4 $\pm$ 5.47 mEq/L respectively (Table 7). The mean values of blood glucose, total cholesterol, total bilirubin, total protein, albumin

and albumin/globulin ratio in the serum were 54.43 ± 1.51 mg per cent, 109.03 ± 9.87 mg per cent, 0.25 ± 0.04 mg per cent, 6.54 ± 0.06 g per cent, 3.04 ± 0.05 g per cent and 0.87 ± 0.03, respectively (Table 8). In the case of group II animals comparison of data between the first, third and fifth days of therapy, no significant variations were observed. In group III animals, decrease in the ammonia nitrogen level and increase in the total volatile fatty acids concentration in the rumen liquor were statistically significant ($P<0.05$). The increase in the blood glucose level, albumin and albumin/globulin ratio in the serum observed on the fifth day was also found to be statistically significant ($P<0.05$).

On comparison the conventional therapy with modified therapy, it was found that there were significant changes in the sedimentation activity time and total volatile fatty acids concentrations in the rumen liquor and blood glucose level and serum bilirubin levels in group III animals given modified therapy (Table 11) ($P<0.05$).

On comparison of data between the fifth day of therapy, decrease in the sedimentation activity time and increase in the total volatile fatty acids concentration observed in the rumen liquor in the group III animals were found to be significant. Increase in blood glucose and decrease in the serum bilirubin observed in the same group of animals were also statistically significant (Table 11).

Table 1. Incidence of non-specific anorexia in cattle for the period from 1978-1982

Year	Total cases	Digestive disorders		Non-specific anorexia		Percentage of non-specific anorexia among digestive disorders
		Number	Percentage	Number	Percentage	
1978	18627	6525	35.02	829	9.81	12.7
1979	17606	6705	38.08	2925	16.61	43.62
1980	18574	6467	34.81	3118	16.78	48.21
1981	17828	5632	31.59	1478	8.29	26.24
1982	19814	6655	33.38	984	4.96	14.78
Total	94349	31984	33.89	10334	10.95	32.30

Table 2. Month-wise incidence of non-specific anorexia in cattle for the period 1978-1982

Month	1978	1979	1980	1981	1982	Total
January	182	353	424	208	116	1283
February	234	360	378	198	132	1302
March	278	393	363	214	129	1377
April	206	451	378	176	121	1332
May	128	299	212	76	50	765
June	42	72	170	70	48	402
July	10	42	128	48	46	274
August	7	62	116	42	38	265
September	54	70	78	38	30	270
October	140	168	169	72	41	590
November	240	265	310	158	109	1082
December	308	390	392	178	123	1391
Total	1829	2925	3118	1478	984	10334

Table 3. Evaluation of rumen liquor for physical, microbial and biochemical characters in healthy control cattle (Group I)

Sl. No.	Animal No.	Age (years)	Colour	Odour	Consistency	Protozoal motility	Sedimentation activity time (SAT) (minutes)	pH	Ammonia nitrogen (mg %)	Total volatile fatty acids (mEq/L)
1	1019	5	Greenish yelow	Aromatic	Thick	(+++)	17	7.0	8.0	70
2	813	4	"	"	"	"	15	7.0	9.0	80
3	795	6	"	"	"	"	17	6.5	8.0	65
4	545	6	"	"	"	"	12	6.5	8.0	70
5	689	4	"	"	"	"	13	6.5	8.0	65
6	640	6	"	"	"	"	15	7	9.0	62
7	433	7	"	"	"	"	16	6.7	9.0	82
8	219	6	"	"	"	"	14	6.7	8.0	78
9	716	5	"	"	"	"	13	6	9.0	80
10	343	4	"	"	"	"	15	6.3	8.0	76
Mean ± S.E.							14.7 ±0.539	6.62 ±0.104	8.1 ±0.38	72.8 ±2.31

Table 4. Biochemical values in blood of cattle control group (Group I)

Sl. No.	Animal No.	Blood glucose (mg %)	Total serum cholesterol (mg %)	Total serum bilirubin (mg %)	Total serum protein (g %)	Serum albumin (g %)	A/G ratio
1	1019	59.84	150.25	0.2	6.8	3.2	0.88
2	813	60.31	90.87	0.3	6.5	3.4	1.09
3	795	65.81	125.45	0.3	7.5	3.8	1.15
4	545	59.04	85.00	0.2	7.2	3.6	1.00
5	638	64.40	125.00	0.2	7.5	3.7	0.97
6	640	62.25	124.22	0.3	7.8	3.8	1.18
7	433	63.08	150.00	0.4	6.5	3.1	0.91
8	219	60.50	92.85	0.2	7.0	3.3	0.89
9	716	60.25	125.00	0.3	6.8	3.5	1.06
10	348	62.30	105.46	0.3	6.5	3.2	0.96
Mean ± S.E.		61.78 ±0.69	117.41 ±7.35	0.27 ±0.02	7.01 ±0.15	3.46 ±0.08	1.01 ±0.03

Table 5. Physical, microbial and biochemical characters of rumen liquor of cattle with non-specific anorexia given conventional therapy (Group II)

Parameters	Treatment days			t-value
	First	Third	Fifth	
Colour	Light yellow, olive green or greenish	Light yellow, olive green or greenish	Light yellow, olive green or greenish	—
Odour	Aromatic	Aromatic	Aromatic	
Consistency	Thick	Thick	Thick	
Protozoal motility	(+), (++) and (+++)	(+), (++) and (+++)	(+), (++) and (+++)	
SAT (minutes)	17.50 ± 0.88	13.70 ± 0.60	17.50 ± 0.67	NS
pH	6.69 ± 0.12	6.76 ± 0.12	6.77 ± 0.88	NS
NH_3-N (mg %)	11.40 ± 0.64	12.30 ± 0.80	11.20 ± 0.51	NS
TVFA (mEq/L)	56.60 ± 3.34	51.50 ± 4.31	50.20 ± 3.13	NS

Note: Clinical cases studied: Nos. D 4079, 4589, 5449, 5676, 5676, 3672, 3314, 3993, 4041, 4171, and 5563 of Veterinary College Hospital, Nonnuthy.

NS = Not significant

Table 6. Biochemical changes in blood in cattle with non-specific anorexia - conventional therapy group (Group II)

Parameters	First day	Third day	Fifth day	t-value
Blood glucose (mg %)	46.37 ± 2.75	45.71 ± 1.58	45.66 ± 1.20	NS
Total serum cholesterol (mg %)	116.49 ± 6.71	118.14 ± 6.22	106.85 ± 5.03	NS
Total serum bilirubin (mg %)	0.40 ± 0.03	0.39 ± 0.05	0.36 ± 0.02	NS
Total serum protein (g %)	6.53 ± 0.10	6.59 ± 0.08	6.5 ± 0.10	NS
Serum albumin (g %)	2.95 ± 0.09	2.94 ± 0.11	2.93 ± 0.10	NS
Albumin/globulin ratio	0.82 ± 0.02	0.84 ± 0.02	0.80 ± 0.04	NS

NS - Not significant

Table 7. Physical, microbial and biochemical characters of rumen liquor in cattle with non-specific anorexia - Modified therapy group (Group III)

Parameters	First day	Third day	Fifth day	t-value
Colour	Greenish, greenish yellow or light yellow	Greenish, greenish yellow, olive green or light yellow	Greenish, greenish yellow, olive green or light yellow	
Odour	Aromatic - slight offensive	Aromatic - slight offensive	Aromatic	
Consistency	Thin to thick	Thin to thick	Thick	
Protozoal motility	(+), (++), (+++)	(++, (++),(+++)	(+++)	
SAT (minutes)	17.90 ± 1.28	15.50 ± 1.16	15.30 ± 0.87	NS
pH	6.87 ± 0.07	6.96 ± 0.06	6.82 ± 0.11	NS
NH_3-N (mg %)	12.80 ± 0.59	10.80 ± 0.57	10.60 ± 0.79	3.585^a
TVFA (mEq/L)	55.50 ± 3.93	66.30 ± 5.82	70.40 ± 5.47	2.756^b 4.053^a 3.264^b

Note: Clinical cases studied: Nos. B 1858, 1871, 2341, 2560, 3499, 3641, 4019, 5222, 5452 and 6353 of Veterinary College Hospital, Mannuthy.

* Significant at $P < 0.05$

NS - Not significant

a - t values for comparing first and third day values

b - t values for comparing first and fifth day values

Table 8. Biochemical changes in blood in cattle with non-specific anorexia - Modified therapy group (Group III)

Parameters	First day	Third day	Fifth day	t-value
Blood glucose (mg %)	40.69 ± 3.55	51.48 ± 2.21	54.43 ± 1.51	4.375^{a*} 4.317^{b*}
Total serum cholesterol (mg %)	95.45 ± 4.18	103.37 ± 4.62	109.03 ± 9.87	NS
Total serum bilirubin (mg %)	0.26 ± 0.05	0.25 ± 0.02	0.25 ± 0.04	NS
Total serum protein (g %)	6.67 ± 0.06	6.68 ± 0.10	6.54 ± 0.06	NS
Serum albumin (g %)	2.88 ± 0.03	3.10 ± 0.07	3.04 ± 0.05	2.32^{b}
Albumin/globulin ratio	0.76 ± 0.01	0.82 ± 0.03	0.87 ± 0.03	4.44^{b}

* Significant at $P < 0.05$

NS - Not significant

a - t values for comparing first and third day values

b - t values for comparing first and fifth day values

Table 9. Physical, microbial and biochemical changes in rumen liquor - comparison between group 1 (control) and group II (anorexia group) before treatment

Parameters	Healthy cattle (Mean ± S.E.)	Non-specific anorexia (Mean ± S.E.)	t-value
Colour	Greenish yellow	Light yellow, greenish yellow	-
Odour	Aromatic	Aromatic	-
Consistency	Thick	Thick	-
Protozoal motility	(+++)	(+++)-(++)	-
Sedimentation activity time (SAT) (minutes)	14.70 ± 0.539	17.40 ± 0.88	2.61*
pH	6.62 ± 0.104	6.69 ± 0.12	0.44
Ammonia nitrogen (mg %)	8.10 ± 0.38	11.40 ± 0.64	4.45*
Total volatile fatty acids (TVFA) (mEq/L)	72.80 ± 2.31	56.60 ± 3.34	3.98*

* Significant at $P<0.05$

Table 10. Biochemical changes in blood - comparison between control and anorexia groups

Parameters	Healthy cattle (Mean ± S.E.)	Non-specific anorexia (Mean ± S.E)	t-value
Blood glucose (mg %)	61.78 ± 0.69	46.37 ± 2.75	5.43*
Total serum cholesterol (mg %)	117.41 ± 7.35	116.49 ± 6.71	0.093
Total serum bilirubin (mg %)	0.27 ± 0.02	0.40 ± 0.03	3.28*
Total serum protein (g %)	7.01 ± 0.15	6.53 ± 0.10	2.66*
Serum albumin (g %)	3.46 ± 0.08	2.95 ± 0.19	4.21*
Albumin/globulin ratio	1.01 ± 0.03	0.82 ± 0.02	4.55*

* Significant at $P < 0.05$

Table 11. Comparative efficacy of conventional and modified line of therapy for non-specific anorexia in cattle

Parameters	Conventional therapy (Group II) (Mean ± S.E.)	Modified therapy (Group III) (Mean ± S.E.)	t-value
Rumen liquor			
Colour	Light yellow and greenish	Greenish, greenish yellow, olive green and light yellow	-
Odour	Aromatic	Aromatic	-
Consistency	Thick	Thick	-
Protozoal motility	(+), (++), (+++)	(+++)	-
Sedimentation activity time (SAT) (minutes)	17.87 ± 0.71	16.23 ± 1.10	1.190
pH	6.74 ± 0.10	6.86 ± 0.88	0.257
Ammonia nitrogen (mg %)	11.63 ± 0.67	11.4 ± 0.65	0.498
Total volatile fatty acids (mEq/L)	52.77 ± 3.59	63.4 ± 5.07	2.803*
Blood			
Blood glucose (mg %)	45.91 ± 1.84	49.06 ± 2.42	3.697*
Total serum cholesterol (mg %)	116.16 ± 5.98	102.61 ± 6.22	0.226
Total serum bilirubin (mg %)	0.38 ± 0.03	0.25 ± 0.03	2.737*
Total serum protein (g %)	6.54 ± 0.09	6.63 ± 0.01	0.239
Serum albumin (g %)	3.0 ± 0.1	2.97 ± 0.05	0.990
Albumin/globulin ratio	0.81 ± 0.02	0.81 ± 0.02	1.691

* Significant at $P<0.05$

Note: Comparison made based on the last (5th) day of treatment

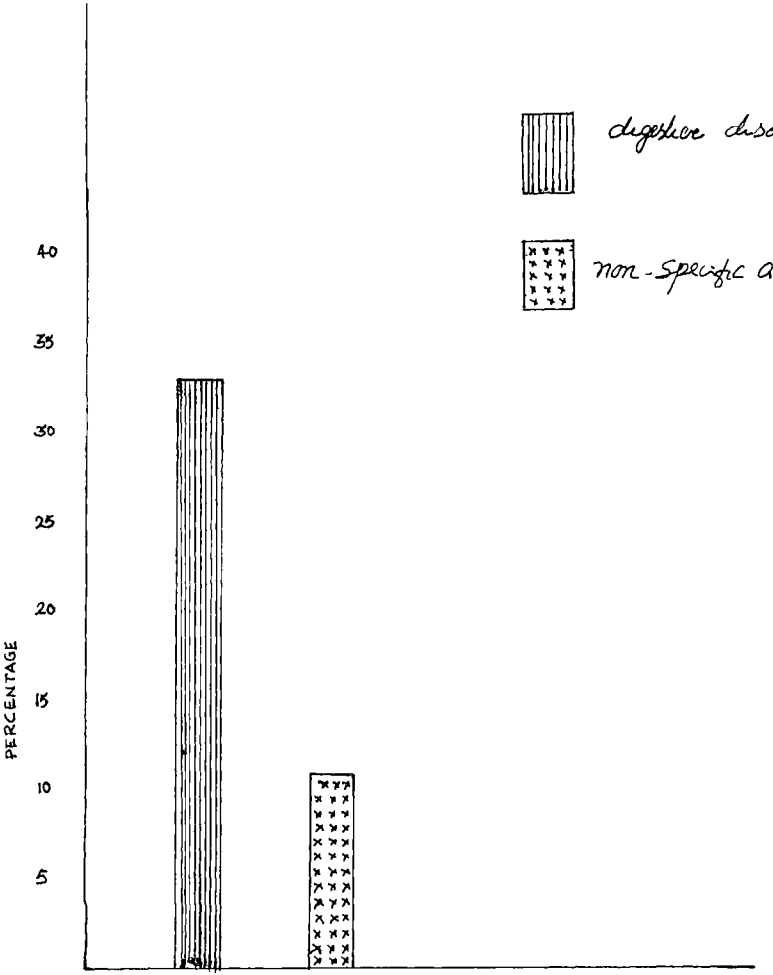

Fig 1 Percentage of incidence of digestive disorders and non-specific anorexia in cattle

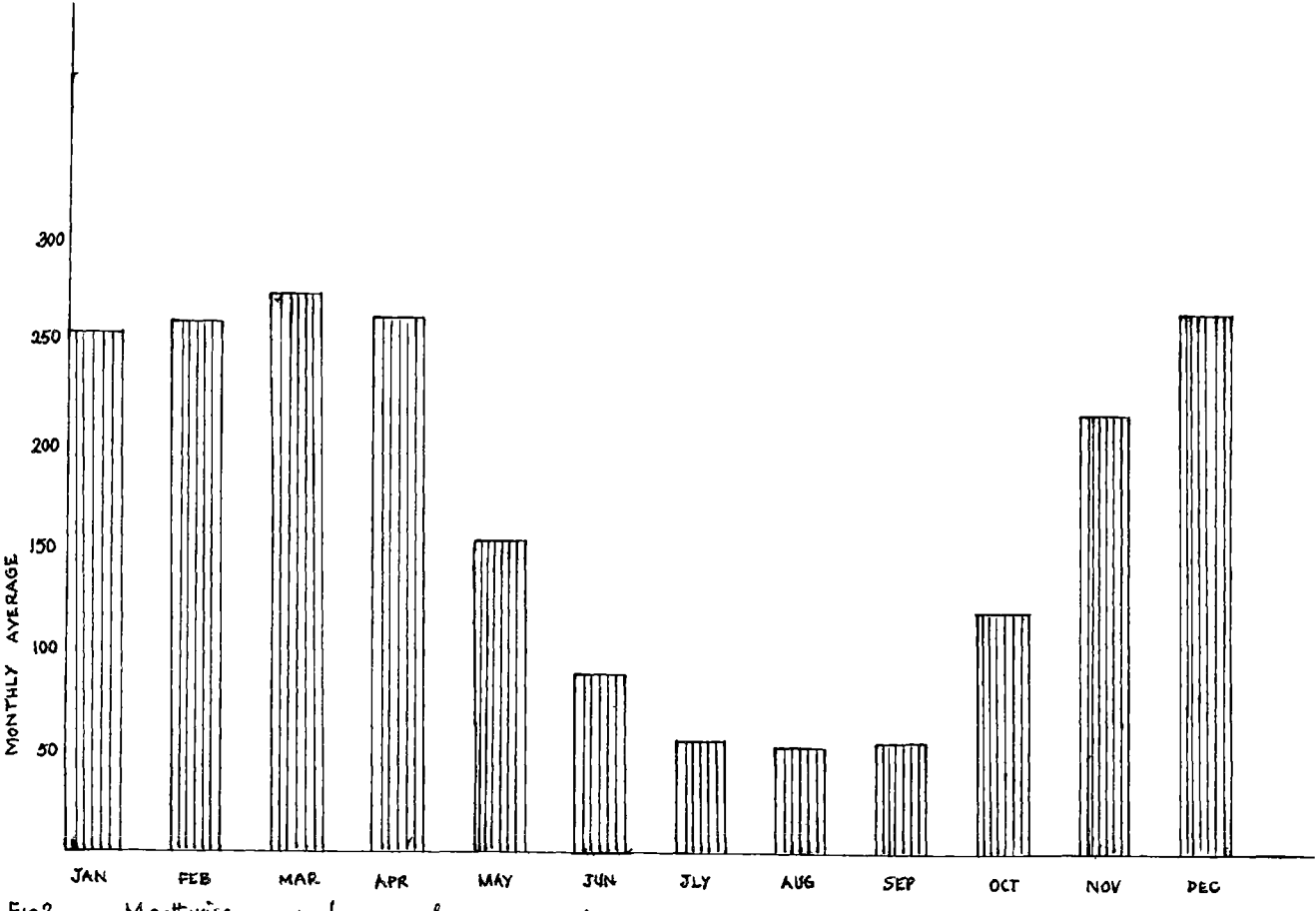

Fig2 Monthwise incidence of non-specific anorexia in cattle

group II
group III
80
70
60
50
TVFA (m Eq/L)
TVFA

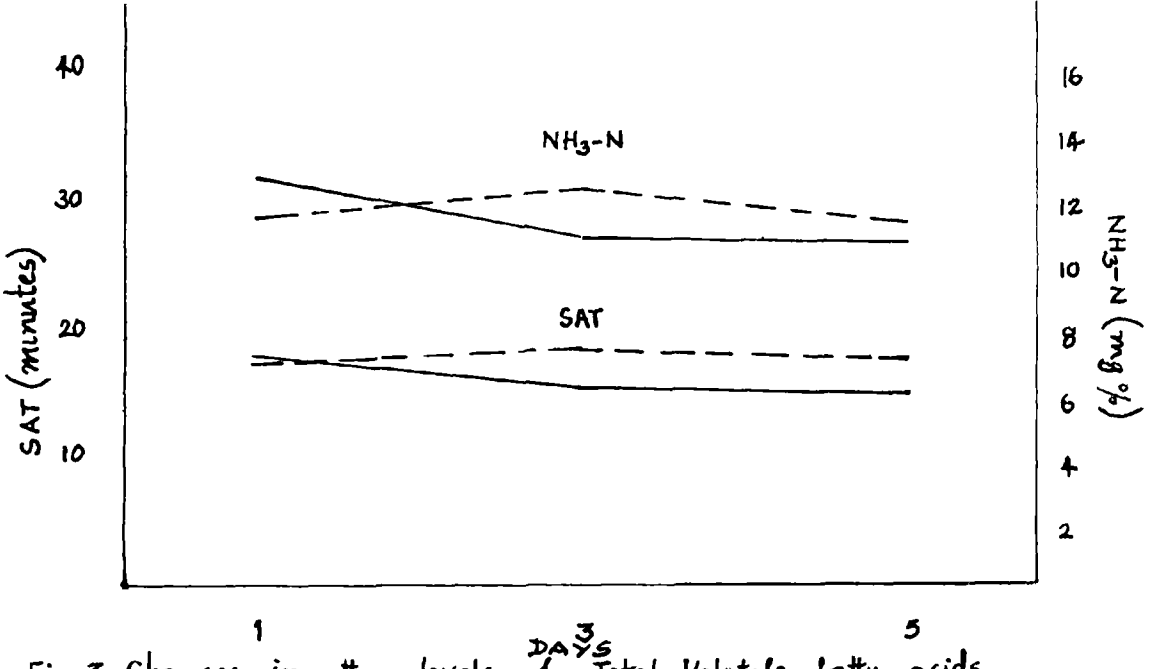

Fig.3 Changes in the levels of Total Volatile fatty acids, ammonia nitrogen and sedimentation activity time in rumen liquor of animals group II and group III

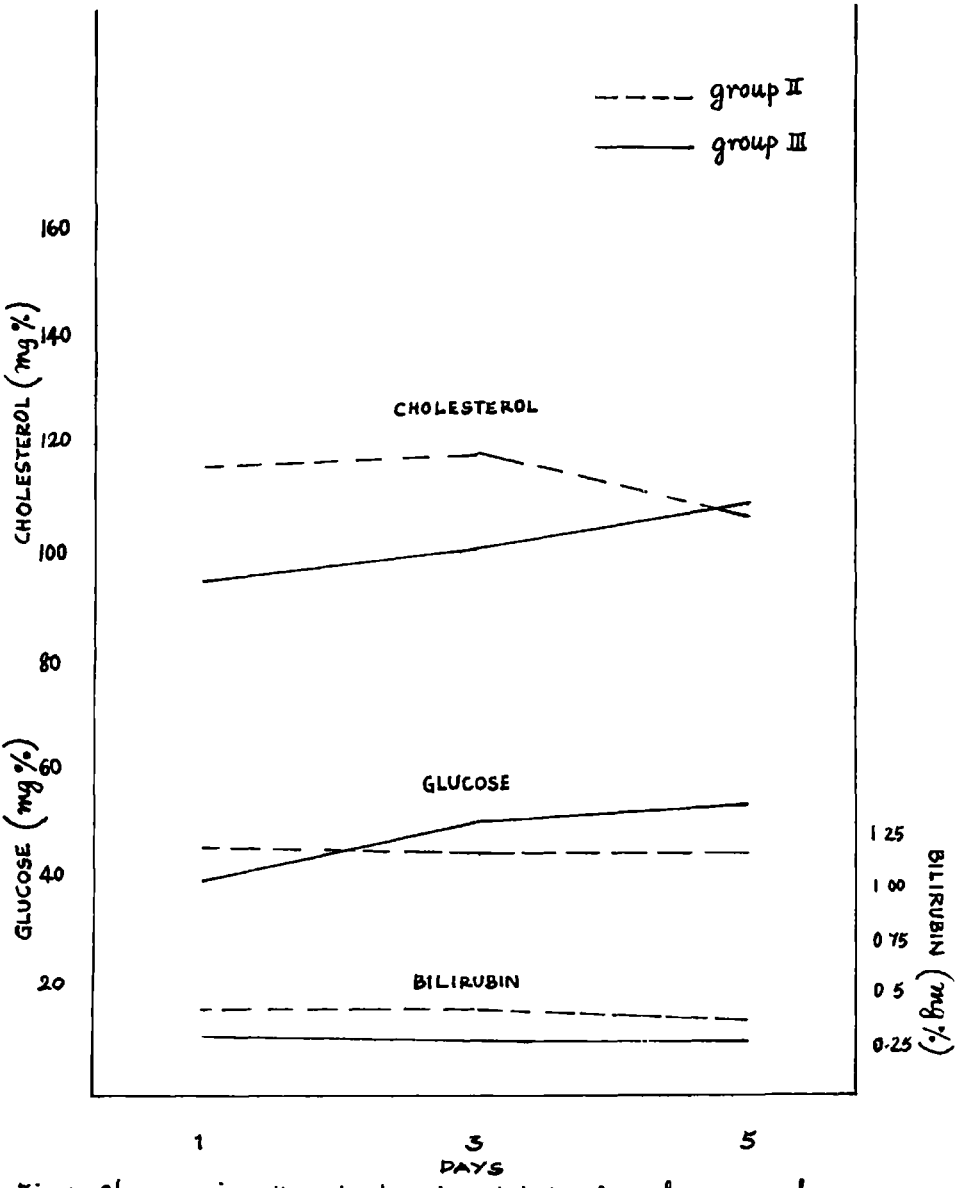

Fig 4 Changes in the levels of Cholesterol, glucose and bilirubin in blood in animals of group II and group III

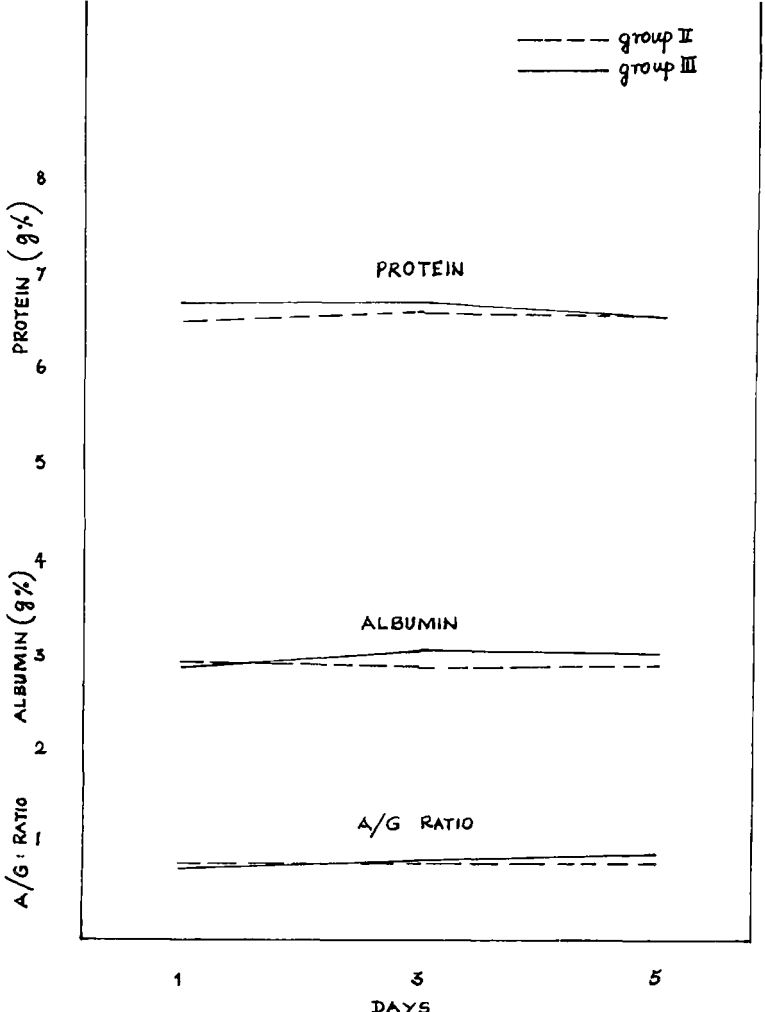

Fig 5 Changes in the levels of total protein, albumin and albumin/globulin ratio in the serum in animals of group II and group III

Discussion

5. DISCUSSION

Data on the incidence showed that 33.89 per cent of the total diseases in cattle were digestive disorders (Table 1 and Fig. 1) which was in fair agreement with the figures of 40 per cent and 36.60 per cent reported by Nichols (1963) and Bindumadhav and Krishnamoorthy (1979), respectively. Incidence of non-specific anorexia in cattle formed 10.95 per cent of the total and 32.30 per cent of their digestive disorders during the period of five years from 1978-1982. Season has apparently influenced the incidence of non-specific anorexia in cattle as observed under the present investigation in that larger number of animals were affected during the months from November to April every year (Table 2 and Fig. 2). This was similar to the trend of incidence of the digestive disorders in cattle as previously reported by Udall (1964), Joshi (1970), Prasad and Rekib (1979) and Thomas (1983). Shortage of green fodder and ingestion of dry coarse roughages during this period were probably the predisposing factors for the higher incidence of this syndrome during the months of November to April. Bovine animals maintained on high levels of groundnut cake had higher rates of incidence of this syndrome which has been corroborated by the findings of Rajan et al. (1988). Concentrate ration containing Inferior quality of groundnut cake could be a potent source for fungal toxins and those toxins could lead to hepatic damage in the affected animals.

5.1. Clinical signs

Animals with non-specific anorexia in the present study had clinical signs comparable to those of the digestive disorders in cattle reported by the previous workers (Joshi and Misra, 1977; Prasad, 1977; Thomas, 1983; Blood et al., 1983 and Rajan et al., 1988). Inappetence, reduced rumen motility and suspended rumination observed in the present study were in agreement with the earlier observations in ruminal indigestion in cross-bred cattle in Kerala (Thomas, 1983). Rajan et al. (1988) suggested that the clinical signs observed in the non-specific anorexia syndrome in cattle could be a reflection of the pathological changes in the liver.

5.2. Rumen liquor

5.2.1. Physical characters.

Colour of the rumen liquor in healthy animals (group I) in the present study was greenish yellow (Table 3). Colour of the rumen liquor being dependent on the nature of the feed, time after feeding and stage of digestion (Alonso, 1979 and Dirksen, 1979) and the greenish yellow colour observed in the case of healthy animals could be associated with the green fodder given to them ad libitum. Odour of the rumen liquor in healthy control cattle was aromatic similar to that reported by Misra et al. (1972a), Misra and Singh (1974), Alonso (1979) and Thomas (1983). The aromatic odour of the rumen liquor was imparted by the volatile fatty acids and protein digestion in the rumen (Alonso, 1979). Moderately

thick consistency of rumen liquor in the present study was in agreement with the findings of Misra et al. (1972a), Dirksen (1979) and Thomas (1983).

In the case of group II and group III animals the rumen liquor was light-yellow, greenish-yellow, olive green and greenish (Tables 5 and 7) which were in fair agreement with those described as the colour of normal rumen liquor in cattle (Misra et al., 1972a; Dirksen, 1979 and Alonso, 1979) and this could be due to the type of fodder given to the animals before the onset of the disease, while light yellow was the colour in animals fed straw, green, olive green and greenish-yellow was in animals fed green fodder. Odour of the rumen liquor in diseased animals was aromatic in all but in one case it was offensive. This could be due to rumen putrefaction and decreased production of total volatile fatty acids. The offensive odour of the rumen liquor became aromatic on the fifth day in animals given modified therapy.

5.2.2. Protozoal motility

Vigorous (+++) protozoal motility in the rumen liquor of healthy control animals observed in the present study agrees with the observations of Misra et al. (1972a) and Thomas (1983). The number of protozoa in the rumen liquor sample varied according to the composition of ration, time of collection after feeding and the level of rumen contents from where the sample was collected (Dirksen, 1979).

In the present study the protozoal motility of the rumen liquor of diseased animals was poor (+) to vigorous (+++) (Tables 5 and 7) which was similar to the observations made in digestive disorders of cattle by Dash and Misra (1972) and Misra et al. (1972a). Abnormal changes in the internal environment of the rumen was detrimental to the life of micro-organisms. Starvation or under-feeding decreases the protozoal population in the rumen liquor (Alonso, 1979). In the present study though the internal environment of the rumen was not altogether changed from the normal, decreased protozoal motility might be due to insufficient supply of substrates necessary for their optimum growth and multiplication. Protozoal motility in diseased animals became normal following the improvement in feed intake as a result of modified therapy (Table 11).

5.2.3. Sedimentation activity time.

Mean sedimentation activity time of 14.7 ± 0.539 minutes observed in animals of the healthy control (Table 3) was well within the normal ranges of 8.0-18.0 minutes (Misra et al., 1972a) and 14.625 ± 0.65 minutes (Thomas, 1983). Lower sedimentation activity time values of 4.0 to 8.0 minutes (Dirksen, 1979) and 3.0-9.0 minutes (Blood et al., 1983) for exotic animals and higher values of 20.33 ± 2.77 minutes in Indian cross-bred cattle were also reported (Alikutty, 1981). Such variation could be usual as microbial activity in the rumen was dependent upon the internal environment of the rumen,

composition of feeds, breed of animal, stage of digestion and the level of rumen content from where the sample was collected (Alonso, 1979).

In animals with non-specific anorexia the significant increase in sedimentation activity time from the normal value of 14.7 ± 0.539 minutes to 17.65 ± 0.76 minutes in diseased animals suggested a decreased rate of microbial fermentation in the rumen (Tables 5 and 7). Prolongation of sedimentation activity time without changes in the pH of rumen liquor was also reported in primary indigestion (Misra et al., 1972b and Thomas, 1983). Decreased microbial fermentation could be due to lack of sufficient supply of substrates in the rumen because of anorexia prevailed. Following the modified line of therapy the sedimentation activity time gradually became normal when the animals started consuming their normal ration (Table 7 and Fig. 3).

5.2.4. Biochemical characters.

5.2.4.1. pH.

Mean pH of rumen liquor (6.62 ± 0.104) recorded in healthy control group agrees with the normal values reported by Misra et al. (1972a), Alikutty (1981), Thomas (1983) and Blood et al. (1983). The pH of the rumen liquor depends upon the composition and nature of the feed which in turn influence the production of total volatile fatty acids, ammonia nitrogen and secretion of saliva (Hoflund, 1967 and Prasad et al., 1972).

Mean value of rumen pH (6.78 ± 0.01) in diseased animals was not significantly different from the mean value for the healthy cattle (Tables 5 and 7). This indicated that bovine non-specific anorexia was not primarily due to dietary abnormalities as there was no abrupt change in the type of feeds consumed by those animals before the onset of disease.

5.2.4.2. Ammonia nitrogen.

Mean value of ammonia nitrogen in the rumen liquor of healthy cattle was 8.1 ± 0.38 mg per cent (Table 3) and it was in fair agreement with the normal values of 5.0 to 25.0 mg per cent (Phillipson, 1977) and 8.8 to 11.3 mg per cent (Prasad, 1977). Statistically significant variation observed in the present study could be due to lack of intake of concentrate ration. Juhasz (1962) and Jenkins (1982) observed that inadequate intake of concentrate ration contributed to ammonia toxicity in the rumen, because it diminished the production of fermentation acids. In the absence of carbohydrates, fermentation of proteins including microbial cells yields ammonia. Prasad (1977) and Scariabrick (1984) reported an inverse relationship with increased total volatile fatty acids and low ammonia nitrogen, indicated good microbial activity. Increased ammonia nitrogen and decreased total volatile fatty acids concentration indicated poor microbial activity. Poor microbial activity in the present study as revealed by prolongation of sedimentation activity time and poor protozoal motility could be a contributory factor for

the elevated ammonia nitrogen level in the rumen. Similar elevation in the rumen ammonia nitrogen level as a result of decreased utilization of ammonia by the rumen microbes in the absence of sufficient soluble carbohydrates was also made by Hungate (1966). Further, concentration of ammonian nitrogen may be increased due to endogenous metabolism of non-growing microbes. Cytolytic bacteria may also digest and ferment other rumen organisms when soluble carbohydrates were scarce and this may also lead to increase the ammonia nitrogen level in the rumen liquor. The ammonia nitrogen level in the group III animals were gradually reduced from third day onwards following the intake of concentrate ration as a result of modified therapy (Table 7 and Fig. 3).

5.2.4.3. Total volatile fatty acids.

Mean value of total volatile fatty acid concentration in the rumen liquor of healthy cattle was 72.8 ± 2.31 mEq/L (Table 3). It was comparable to the values reported by Phillipson (1977) and Dirkson (1979) but lower than the values of 87.8 ± 3.3 mEq/L and 90.69 ± 2.27 mEq/L reported by Joshi and Misra (1976) and Alikutty (1981), respectively. Concentration of total volatile fatty acids in the rumen liquor was influenced by the type of feed, stage of digestion and sampling of the rumen liquor (Alonso, 1979).

Mean value of total volatile fatty acids concentration in rumen liquor of diseased animals was 56.60 ± 3.34 mEq/L. Decreased levels of total volatile fatty acids in the rumen

liquor in digestive disorders of cattle were reported by Hoflund (1967), Prasad et al. (1973) and Joshi and Misra (1975). Low total volatile fatty acids levels in group II and III animals in the present study (Tables 5 and 7) might be due to lack of intake of concentrate ration and straw and reduced fermentation in the rumen. Dirksen (1979) also observed that the total volatile fatty acids concentration were low in cattle that have lost appetite or on fed rations poor in quality or have digestive disorders accompanied by inactivation of the flora and fauna. Following the modified line of therapy, when animals started feed intake, the volatile fatty acids concentration in the rumen liquor increased considerably (Table 7 and Fig.3).

5.3. Liver function status

5.3.1. Total serum protein, albumin and albumin:globulin ratio.

Mean value of total protein, albumin and albumin/globulin ratio in the serum in healthy control group (Table 4) were in fair agreement with normal value for cattle reported by Doxey (1971), Tasker (1978), Dirksen (1979), Pillai (1980), Blood et al. (1983) and Benjamin (1985).

Significant reduction in the total protein, albumin and albumin/globulin ratio in the serum were observed in diseased animals (Tables 6 and 8 and Fig.5). This could be an indication of hepatic insufficiency in non-specific anorexia.

Changes in the total protein, albumin and albumin/globulin ratio in the serum in cattle with hepatic insufficiency were also reported by Prasad et al. (1973), Prasad and Joshi (1975), Sethuraman and Verma (1979), Bienick (1979) and Barnouin et al. (1981).

5.3.2. Total serum cholesterol.

The total serum cholesterol levels observed in the diseased animals did not reveal any significant changes. The values recorded in the healthy and diseased animals of the present study ranged between 80-150 mg per cent and 80-185 mg per cent respectively. Such wide variation in the normal level of serum cholesterol in cattle was reported by Tasker (1978), Baumgartner and Skalicky (1979), Sharon et al. (1982) and Blood et al. (1983). Because of this wide variation in the normal cholesterol level changes due to hepatic insufficiency were not reflected in the serum. Dirksen (1979) opined that total serum cholesterol was of limited usefulness in detecting liver diseases because of its wide variability and its susceptibility to various internal and external factors such as age, sex, breed, stage of pregnancy, lactation, type of feed and season.

5.3.3. Blood glucose.

Mean blood glucose level in healthy cattle was 61.78 ± 0.69 mg per cent and was comparable with normal values reported by Tasker (1978), Baumgartner and Skalicky (1979), Sharon

et al. (1982), Blood et al. (1983) and Benjamin (1985). In the present study diseased animals had significantly decreased blood glucose levels (Table 10 and Fig. 4). This could be the effect of liver insufficiency and lack of concentrate intake by the affected animals. Mullen (1976) and Blood et al. (1983) reported a decline of blood glucose level in hepatic insufficiency. Propionic acid contribute to the major source of (50-60%) blood glucose of the ruminants and the concentration of propionic acid in the rumen increased when animals were fed on concentrate ration rich in soluble sugars and starches (Breazile, 1971; Phillipson, 1977 and Macdonald et al., 1980).

5.3.4. Total serum bilirubin.

Mean value of total bilirubin in the serum of healthy cattle was within the normal range reported by Doxey (1971), Tasker (1978), Dirksen (1979), Baumgartner and Skalicky (1979), Sharon et al. (1982), Blood et al. (1983) and Benjamin (1985). Significant increase in the serum bilirubin observed in diseased animals were suggestive of hepatic insufficiency (Table 10 and Fig. 4). Increased level of serum bilirubin in hepatic insufficiency were also reported by Dwivedi et al. (1972), Mattilib et al. (1976), Bienick (1981) and McSherry et al. (1984). The increased serum bilirubin level in the present study might be due to interference of biliary excretion due to hepatic cell damage. The associated hepatic insufficiency in non-specific anorexia could presumably be due to ingestion

of fungus affected groundnut cake as reported earlier by Rajan et al. (1988).

5.4. Treatment

Non-specific anorexia in cattle treated with alkaline stomachic and rumenatorics were found ineffective. Animals remained anorectic oven on the fifth day of therapy, rumination suspended and rumen motility was feeble in strength and rate was one per minute. Milk production further reduced and animals became weak and emaciated. Comparison of data between the first, third and fifth day of therapy, did not reveal any significant variation in any of the parameters in rumen liquor and blood (Tables 5 and 6).

On the third day of observation appreciable clinical improvement was observed in group III animals given modified therapy. Improvement was shown by increased feed intake, resumption of rumination and stronger rumen motility which was one per minute in rate. Slight increase in milk yield was also noticed. On the fifth day animals became clinically normal and began to consume normal ration and milk production increased considerably. Ammonia nitrogen level decreased from 12.8 $\pm$ 0.59 mg per cent to 10.8 $\pm$ 0.57 mg per cent, total volatile fatty acids concentration increased from 55.5 $\pm$ 3.93 mEq/L to 66.3 $\pm$ 5.82 mEq/L in the rumen liquor and blood glucose level increased from 40.69 $\pm$ 3.55 mg per cent to 51.48 $\pm$ 2.21 mg per cent on the third day of therapy

were found to be statistically significant (Tables 7 and 8 and Fig. 3 and 4). On the fifth day of treatment ammonia nitrogen level further decreased to 10.6 ± 0.79 per cent and total volatile fatty acids concentration increased to 70.4 ± 5.47 mEq/L in the rumen liquor. Increase in the blood glucose level to 54.43 ± 1.51 mg per cent, serum albumin to 3.04 ± 0.05 g per cent and albumin/globulin ratio in the serum to 0.87 ± 0.03 observed in group III animals on the fifth day were also found to be statistically significant ($P < 0.05$) (Tables 7 and 8 and Fig. 3 and 4). The variation in the ammonia nitrogen level and total volatile fatty acids concentration in the rumen liquor on the third and fifth day in group III animals might be due to improvement in the intake of concentrate ration and microbial fermentation. Increase in the blood glucose, albumin and albumin/globulin ratio in the serum could be due to the effect of resumption of normal hepatic function and increase in the proportion of glucogenic volatile fatty acids in the rumen.

Modified line of therapy was found to be superior to the conventional therapy for the clinical management of non-specific anorexia. This was indicated by the significant reduction in the sedimentation activity time and increase in the total volatile fatty acids concentration in the rumen liquor and decrease in the total serum bilirubin levels in animals with modified therapy (Table 11). Parenteral administration of 25 per cent solution of dextrose and vitamin D-

complex with liver extract hastened the recovery in animals of group III by improving the functional status of the liver. Similar effects on parenteral administration of glucose and vitamin B complex in cases of liver disorders in large animals were observed (Blood et al., 1983 and Jenkins, 1982). Parenteral use of vitamin B complex has been recommended in bovine anorexia (Kadvekar and Murkibhavi, 1971; Prasad, 1979 and Prasad and Rekib, 1979). According to Jenkins (1982) liver could resist many forms of injuries when its stored carbohydrates and proteins were adequate and its functional efficiency impaired when hepatocytes were laden with fat. A high glycogen content could protect the liver cells from damages and supplementation of water soluble vitamins will act as cofactors for carbohydrate metabolism which assists the repair of liver damage.

Summary

6. SUMMARY

Based on the data for the period from 1978 to 1982 non-specific anorexia in cattle had the maximum incidence during the year 1979-1980 and maximum cases recorded from November to April every year.

Twenty selected clinical cases of non-specific anorexia presented at the University Veterinary Hospital, Mannuthy were divided into groups of ten each (Group II and Group III) and utilized for this study. Course of the disease was followed daily and samples of rumen liquor and blood were collected for analysis on the first, third and fifth day of admission in the clinic. Important clinical signs of this syndrome were inappetance, mucopurulent nasal discharge, dryness of the muzzle followed by peeling of its epithelium, constipation or diarrhoea, weakness, emaciation and also marked reduction in the milk yield in the lactating animals. As the disease progressed varying degree of anorexia prevailed. Their rectal temperature was normal, pulse weak and rapid, respiration normal but sometimes laboured and the visible mucous membranes were pale or became icteric in the later stages of the disease. Rate of rumen motility was reduced and feeble in strength with rumination remaining suspended. Samples of rumen liquor were collected from ten apparently healthy and twenty diseased cattle on the first, third and fifth day of observations and analysed for physical, microbial and biochemical characters. Blood samples were collected at

similar intervals and analysed for glucose, total cholesterol, total bilirubin, total protein, albumin and albumin-globulin ratio in the serum. Conventional therapy comprising oral administration of alkaline stomachics in group II animals and modified line of therapy comprising parenteral administration of 25 per cent solution of dextrose and vitamin-B-complex with liver extract and oral stomachics in group III animals were adopted.

No significant changes in the physical characters and the pH of the rumen liquor in the diseased animals were noticed during this study. Protozoal motility was poor (+) to vigorous (+++) and sedimentation activity time was prolonged significantly on the first day of admission in the clinic. Increase in the ammonia nitrogen level and decrease in total volatile fatty acids concentration in the rumen liquor observed on the first day were significant. Blood glucose, total bilirubin, total protein, albumin and albumin-globulin ratio in serum were changed significantly in the affected animals.

Significant changes in the above parameters in group II animals were further enhanced on third and fifth days of the observation. The decrease in the ammonia nitrogen level and the increase in the total volatile fatty acids concentration in the rumen liquor observed on the third and fifth day in animals of group III were statistically significant. Blood glucose, albumin and albumin-globulin ratio in the serum were also increased significantly on the fifth day in group III animals.

Following modified line of therapy the diseased animals of group III became normal within three to five days. Clinical improvement was indicated by increased appetite, revival of rumen motility and rumination and also increased milk yield in the lactating animals. Decrease in the ammonia nitrogen level and increase in the total volatile fatty acids concentration in the rumen liquor of group III animals were significant on the fifth day of therapy. Increase in blood glucose, albumin, albumin-globulin ratio in the serum were also found statistically significant, which suggested that impairment of liver function could possibly be responsible for the development of anorexia. The modified line of therapy was found to be superior to conventional therapy for the clinical management of non-specific anorexia in cattle.

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