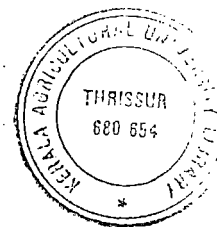


INCIDENCE OF LEUKAEMIA AND LEUKAEMOID REACTIONS IN CATTLE IN KERALA



BY

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THESIS

Submitted in partial fulfilment of the
requirement for the degree

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1980

DECLARATION

I hereby declare that this thesis entitled "INCIDENCE OF LEUKAEMIA AND LEUKAEMOID REACTIONS IN CATTLE IN KERALA" 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.

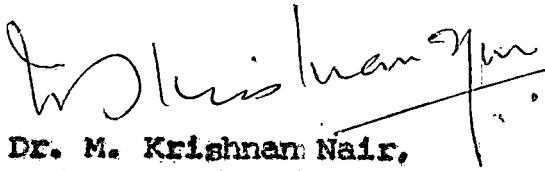
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CERTIFICATE

Certified that this thesis entitled "INCIDENCE OF LEUKAEMIA AND LEUKAEMOID REACTIONS IN CATTLE IN KERALA" is a record of research work done independently by Sri. R. Vijayan 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.

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Dr. M. Krishnan Nair,
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*In memory
of
my beloved mother*

CONTENTS

	Page
Introduction	1
Review of Literature	3
Materials and methods	21
Results	25
Tables	29
Discussion	32
Summary	36
References	37
Annexure	
Abstract	

INTRODUCTION

INTRODUCTION

Bovine leukaemia is a lympho-proliferative disease characterised by the development of aggregations of neoplastic cells in different organs and showing a corresponding variety of clinical signs. This condition was described first by Siedamgrotzy in 1876 and then by Jhone in 1879 (Abramova et al., 1974). Various names are being used to describe this neoplastic disease - lympho-sarcoma, lymphoma maligna, lymphomatosis, leukaemia, leukosis, lymphadenosis and lymphoblastoma (Benedixen, 1965).

Extensive studies are in progress in different countries about the various aspects of bovine leukaemia. Benedixen (1961) was of the opinion that many countries have started investigation on bovine leukaemia because they have become aware of the disease as an animal health hazard. In India this condition has not yet been considered as a serious problem and there are only few reports on its occurrence.

It was thought that in Kerala there could be a possibility of occurrence of this condition because of the import of animals from countries like Australia where leukosis had been shown to be endemic. Being an emerging disease which cannot only affect the production potential of the animal but also cause mortality, bovine leukaemia needs special attention for the early detection so that necessary steps

may be taken to control the disease and ultimately eradicate this, if it is found that there is incidence of this disease in Kerala.

In leukaemoid reactions, the peripheral blood picture may resemble that found in leukaemia, eventhough the pathological process and the clinical manifestations are different.

This investigation was taken up to find out the incidence and magnitude of bovine leukaemia and leukaemoid conditions in Kerala.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Incidence

During the period between 1920 and 1930 a large number of reports appeared, mainly based on meat inspection statistics, describing the high incidence of leukotic tumours in slaughter cattle in Germany (Benedixen, 1965). From United States Schlotthauer (1928), Feldman (1929) reported on the incidence of leukotic tumours in cattle. Since then there had been numerous investigations to assess the incidence and magnitude of bovine leukosis in that country (Lewis and Savage, 1930; Boyd, 1934; Sautter and Sellers, 1968).

The occurrence of bovine leukaemia was reported from Britain in 1928, Bulgaria in 1930, Netherland in 1937, France in 1955, Estonia in 1959, Belgium in 1960 and Israel in 1960 (Benedixen, 1965).

In Michigan with a cattle population of 500,000 Conner (1966) found that the overall incidence was approximately 19 per 100,000 annually. The age specific incidence increased to 36 per 100,000 at 8 years and above. Hare (1964) reported that the disease occurred in all ages and all breeds in Great Britain. A high incidence was also noticed in 1 to 2 years old and the lesion primarily affected the thymus.

A 100 per cent increase in the tumour incidence was observed for all Sweden from 1945 to 1965 and the observation signalled the start of intensified work on the etiology and pathogenesis of leukosis in that country. The incidence of bovine leukosis in the most heavily affected district in Denmark was about 60 per 100,000 head of cattle in 1960 and about 15 in 1963 (Benedixen, 1965).

To locate and find out the animals in the sub-clinical phase of bovine leukaemia, a countrywide investigation was carried out in West Germany by systematic blood examination (Benedixen, 1965). Theilen et al. (1967) conducted a haematologic survey of 434 cattle from 71 herds on the Island of Jersey and reported two cases of lymphosarcoma.

A similar work was done to investigate the leucocytic values in apparently healthy cattle in Queensland, Australia to assess the incidence of enzootic bovine leukosis. Blood samples from 706 cattle were screened and this formed a basis for determining a critical point for the assessment of lymphocytosis of individual animals (Granzien, 1968).

Anderson and Jarrett (1968) conducted a survey of all neoplasms found in the 100 abattoirs throughout the Great Britain during one year and reported that there was no evidence of the enzootic form. The incidence of lymphosarcoma was 58 per million in cattle in Great Britain.

Recent studies conducted by Balaschke and Balaschke (1969) in northern parts of Germany where the enzootic type of bovine leukosis was common for last 20 to 40 years confirmed that the disease was progressing in its incidence. They also reported that in the mountain areas of East Germany, leukosis occurred in 17 per cent of all farms and accounted for 3.9 death per 1000 cows.

Anderson et al. (1971) reported that bovine leukaemia occurred in cows of all ten livestock-reporting districts of Minnesota every year during the period of 1961 to 1965. The minimal incidence estimated was 14.7 case of the adult form of leukaemia per 100,000 dairy cows per year. The incidence rate for cows in the 6 to 9 year old category was more than twice that for cows in the two to five year old category.

Lymphosarcoma in twin female calves, apparently the first to be observed in Canada was reported by Chander et al. (1977).

In India, Prasad and Chandrasekharan (1968) observed a case of generalised lymphosarcoma in a foetus of an Ongole cow in Tamil Nadu. A case of bovine leukosis in a four month old bull calf in which the leukotic lesions were present in numerous lymphnodes and spleen was reported by

Narasimhamurthy and Rao (1968). Singh (1970) conducted a study of the pathology of bovine lymphosarcoma and reported that the incidence of the disease on the basis of gross lesions in various slaughter houses in India was 12 per cent and 3.7 per cent in male and female buffaloes respectively.

Prasad and Chandrasekharan (1971) examined 1163 neoplasms collected at Madras during the preceding 20 years and found that 13 of them were lymphoid neoplasms. The organs affected were skin and subcutis, lymphnodes, spleen, liver and intestine. In some cases conjunctiva was also found affected. According to Singh (1973) there was about 1.097 per cent incidence of lymphosarcoma in buffaloes in Utter Pradesh. A case of chronic lymphoid leukaemia with involvement of the lymphnodes of forestomachs, abomasum and intestine was reported in an aged bullock in Orissa (Nayak et al. 1975).

From Kerala Mariamma and Rajamohan (1975) reported a case of lymphosarcoma in a graded Brown Swiss cow showing clinical signs of diarrhoea, weakness, emaciation and triplefold enlargement of palpable lymphnodes. The blood smear showed no detectable abnormalities. This was the first observed instance of a lymphoid neoplasm in bovines in Kerala. A case of lymphosarcoma in goat had been encountered earlier (Rajan and Sivadas, 1973).

Etiology

Benedixen (1961) suggested that bovine leukaemia could be classified as two types - the enzootic tumourous form and the sporadic type which included the juvenile leukosis and the skin leukosis of adult animals. He further opined that according to the evidence available the former was transmissible while the other type was not.

In the search for virus associated bovine leukaemia a virus designated as Bovine Leukaemia Virus (BLV), morphologically similar to c-type leukaemia virus of other species was consistently detected in cultured lymphoid cells from cattle with leukaemia or from non-leukaemic cattle with persistent lymphocytosis (Miller et al. 1969). Wittmann and Urbaneck (1969) found virus particles occasionally in milk and tissues. They could also transfer the disease to new born calves by giving whole blood. They found that the infected animals developed antibodies directed against an antigen present.

The strict requirement for the four deoxy ribonucleoside triphosphate practically identified BLV as an RNA tumour virus. The BLV possesses a high molecular weight RNA-reverse transcriptase complex and a density averaging 1.155 g/ml in sucrose solution (Portetelle et al. 1976).

Ferrer et al. (1976) had shown that an ether sensitive antigen, a structural component of BLV, was present in soluble form in supernatant fluids of infected cultures. They also established that BLV is a syncytia inducing virus.

The potential relatedness of BLV to other known RNA oncogenic viruses was screened by Portetelle et al. (1976). The Avian myeloblastosis virus (AMV), Mason-Pfizer Monkey Virus (MPMV), Simian Sarcoma associated Virus (SSV-1) and Feline Leukaemia Virus (FeLV) were unrelated to BLV, but Rauscher Leukaemia Virus (RLV) showed a slight but reproducible relatedness to BLV.

The transmission studies of bovine leukaemia have shown that an infection of cell free c-type bovine leukosis virus suspension into nine day old calves developed persistent lymphocytosis. C-type particle could be demonstrated electron microscopically to be present in the leucocyte cultures (Schmidth et al. 1976).

In the case of lymphocyte cultures Kaaden et al. (1976) observed that the virus particles were always surrounded by cell debris and the virion was roughly spherical (diameter 40-90 nm).

Bovine leukosis is likely to be transmitted both horizontally to susceptible new born calves and vertically

to progeny. The possibility of horizontal transmission of bovine leukosis by colostrum, milk, saliva, urine, foetal fluids and blood sucking insects has been considered by Benedixen (1959). Vertical transmission from dam to offspring through the placenta and the spermatozoa was also suggested.

It was established that enzootic bovine leukaemia is an infectious disease both on epidemiological and biochemical grounds (Kaaden et al. 1976; Portetelle et al. 1976; Ferrer et al. 1976 and Guillemain et al. 1976).

Clinical signs

It was demonstrated that a number of animals in affected herds seemed to be in a precancerous or sub-clinical phase of the disease in which a change in the white cell picture, lymphocytosis, was the only sign of disturbance. According to Benedixen (1976) this period was preceded by an incubation period of varying length and that the majority of affected animals never showed signs of sub-clinical or clinical disease unless examined haematologically.

During the sub-clinical phase only qualitative or quantitative changes of lymphocytic fraction occurred and there was no sign of disturbed general condition. The localisation of the neoplastic masses determined the clinical manifestations (Benedixen, 1961).

A variety of non specific clinical signs of bovine leukaemia has been reported. Benedixen (1961) noted mainly inappetence and emaciation. Some of the animals showed symptoms of digestive tract disease similar to those found in dietetic or metabolic disorders. Chronic recurring tympanites, circulatory disturbances such as marked pulsation and distension of the jugular vein, abnormal heart sounds and oedemas due to venous congestion were also reported.

Simon and Brewer (1963) reported a clinical case of lymphosarcoma in a calf. The calf at the time of birth was alert and had no fever. The tarsal joints, the navel and the prefemoral lymphnodes appeared five to ten times enlarged.

Meisner and Inhorn (1973) were of the opinion that symptoms of early leukaemia might be confused with those variety of non-malignant haematologic disorders including certain anemias, myelofibrosis and leukaemoid reactions.

Leukosis was identifiable only in the later clinical stages when enlarged lymphnodes, liver and spleen and pale mucous membrane and anemia were seen (Knyazeva, 1964). Diagnosis of lymphosarcoma was often difficult and it should be differentiated from traumatic pericarditis, indigestion, lameness and paralysis (Johauns, 1965).

The clinical diagnosis could be based upon tumourous changes of palpable lymphnodes or organs. If the changes were absent, as and when tumours were restricted to the inner organs, only non-specific signs such as weariness, inappetence and emaciation were seen on clinical examination. In many animals general condition was undisturbed inspite of extensive tumourous changes. The yield was often unaffected until the terminal phase. In some animals transitory elevation of body temperature to 104° to 105°F was observed (Benedixen, 1965).

The lymphoid tissues were found as the most constant site for leukotic changes. Benedixen (1961) reported that in 98 per cent of the clinical cases one or more swollen lymphnodes were observed on clinical examination. Partial or asymmetrical enlargement of the lymphnodes was observed in about 75 per cent of the cases and in that type the leukotic tumour changes were most prominent in the inner organs, ie., heart, liver, spleen, abomasal wall or uterine wall and the corresponding lymphnodes.

The consistency of the lymphnode was resilient, the surface was smooth and emollition and fluctuation could not be demonstrated. Histopathology of lymphnodes showed hyperplasia of lymphoid elements, displacement of germinal centres, peripheral extension of lymphocytes and abnormal

number of lymphoblasts suggesting lymphosarcoma (Simon and Brewer, 1963).

Of the 69 sheep infected with bovine leukosis virus, 24 developed lymphosarcoma and died after 13 to 66 months. Circulating lymphocytes were increased to leukaemic levels (70,000 to 403,000/ cmm^{of} blood) only in eight sheep and they died within 2 to 3 months. Various lymphnodes and visceral organs including heart, abomasum, uterus, kidney and urinary bladder were commonly affected. The skin was involved in one sheep and the liver in another (Olson and Baumgartener, 1976).

Hofirek and Groch (1977) encountered haemal lymphnode formation as a good indication of haemopoietic activity. No significant correlation however, was found between their formation in healthy cows and haematologically positive leukotic cows. They also emphasised that histological examinations were successfully used for identification of reactive lymphnodes which showed a reduction in size or total atropy^h of the lymphatic follicle and marked hyperaemia of haemal sinus. The formation of these nodes was found at the base of the neck, base of lumbar area and in the pelvic cavity.

According to Blood and Henderson (1974) in the thoracic cavity leukotic changes were often found in heart, pericardial mediastinum, pulmonary lymphnodes and parietal lymphnodes of the thorax. It became difficult to decide by ordinary clinical examination whether the thoracic organs were affected with leukotic changes.

Among the organs of the abdominal cavity, microscopic alterations were observed in liver, spleen, abomasal wall and intestine. The leukotic infiltrations of the digestive tract as a rule, became the cause for non-specific signs like inappetence, indigestion, ileus or diarrhoea. Nodular or diffuse leukotic infiltrations of the kidney and genital organs were observed. (Simon and Brewer, 1963).

Diagnosis

According to Benedixen (1965) bovine leukosis was characterized in the pre-tumoural phase by persistent lymphocytosis. In several countries the presence of lymphocytosis had been widely used to detect herds affected with the enzootic form of the disease. The rare occurring Normoleukocythemic cases of bovine leukosis (Aleukemic leukosis) should also be accounted (Mammerickx et al. 1976). Isolation of type-c virus particles from bovine leukaemic lymphocytic cultures made possible to design serological methods for the diagnosis of bovine leukosis (Ferrer, 1972;

Olson et al. 1973).

Olson et al. (1973) applied Immune diffusion test (ID) as a diagnostic procedure for enzootic bovine leukosis specific antibodies. Ressang (1976) was of opinion that haematological diagnosis of bovine leukaemia had serious restriction in relation to persistent lymphocytosis since the same could occur for a longer or shorter period due to conditions other than bovine leukaemia (Trypanosomiasis, Chronic bacterial and fungal infections etc.). Therefore he suggested the applicability of indirect fluorescent antibody technique (ID FAT), Indirect immunoperoxidase test (ID IPT), Micro complement fixation test (MCFT) and the Gel diffusion test (GDT) for early diagnosis of bovine leukaemia. By utilizing the above mentioned serological techniques Ressang (1976) pointed out that two haematologically positive and bovine leukaemia suspect animals were absolutely sero-negative and of 19 animals which had lymphocytosis only 17 had antibody to BLV.

Ferrer et al. (1976) found radio immune assay as the much more sensitive method for the detection of antibodies to the internal BLV antigen. Levy et al. (1976) investigated the presence of antibodies to the BLV in four cases of lymphosarcoma and found that all had an antibody titre equal

to or higher than 32.

From the results of a comparative study between diagnostic methods (antigen and antibody detection with immuno diffusion test and haematology) for the detection of bovine leukaemia, the demonstration of leukosts specific antigen had been reported as the most reliable method (Mistscherlich et al. 1976).

Pierce et al. (1977) observed no constant relationship between the serum concentration of immunoglobulin IgM and IgG and the concentration of blood lymphocytes in 289 Holstein-Friesian heifers and cows from a dairy herd in which lymphoma had been identified repeatedly.

Muscoplat (1974) reported that the frequency of surface immunoglobulin (sIg), a B-lymphocyte marker was demonstrated approximately in 19 per cent of peripheral blood lymphocytes from calves affected with acute lymphocytic leukaemia.

Webber et al. (1974) mentioned that the use of increased presence of lymphocytic nuclear pockets as a test criterion for a rapid and reliable method for the early diagnosis of bovine leukaemia.

New born mice were inoculated orally and subcutaneously with cultured blood or lymphocytes from two leukaemic cattle.

Splenomegally was the predominant lesion from a donor leukaemic cow in which the leukaemic condition was characterized by splenomegally. There was no response in mice inoculated with blood or milk leucocytes from a donor cow died due to generalised lymphosarcoma (Yilmazar et al. 1970).

* Gotze's Leukosis Key

Total number of leucocytes per cmm	Percentage of lymphocytes and lymphocyte like cells.	
Animals more than three years old		
Up to 10,000	Up to 60%	Normal
10,000 to 18,000	60 to 75%	Suspect
18,000 & more	over 75%	Leukotic
Animals less than three years old		
Up to 12,000	Up to 65%	Normal
12,000 to 18,000	65 to 75%	Suspect
18,000 and more	over 75%	Leukotic

Gotze et al. (1954) developed leukosis key* as a basis for haematologic evaluation.

Benedixen (1957) described an evaluation procedure, based on the determination of normal lymphocytic values of animals of different age group and division into three groups: Group I-

normal; Group II - dubious (suspicious); Group III - lymphocytosis.

Benedixen's key

(Total lymphocytes per cmm values used to classify cattle into 3 groups)

Age in years.	Group I Normal.	Group II Suspicious	Group III Leukaemic
0-1	< 10,000	10,000-12,000	7 12,000
1-2	< 9,000	9,000-11,000	7 11,000
2-3	< 7,500	7,500- 9,500	7 9,500
3-4	< 6,500	6,500- 8,500	7 8,500
7 4	< 5,000	5,000- 7,000	7 7,000

*Tolle (1964) had established the upper limits of leucocytic values, taking the age factor into consideration.

*The Gottinger key

Age in years.	Evaluation of lymphocytes/cmm		
	Normal	Dubious	Pathologic
0-1	< 10,000	10,000-13,000	7 13,000
1-2	< 9,000	9,000-12,000	7 12,000
2-3	< 7,500	7,500-10,000	7 10,000
3-6	< 6,500	6,500- 9,000	7 9,000
7 6	< 5,500	5,500- 7,500	7 7,500

Cordebar (1970) compared the three keys proposed by Gotze (1954), Benedixen (1957) and Tolle (1964) for the haematological diagnosis of bovine leukaemia and found that Benedixen's key was the most accurate.

Sodonkova et al. (1975) demonstrated glycogen granules in the leucocytes and lymphoid cells of peripheral blood and bone marrow in leukaemic cattle through PAS reaction.

Rademacher et al. (1977) using the azo-dye coupling technique to demonstrate the alkaline phosphatase activity in neutrophils, found that values were 142 ± 24 units in 16 healthy cows and 13.5 ± 13 units in 25 leukotic cows.

In a screening procedure for bovine leukaemia Mammerickx et al. (1976) noticed that the 15 animals which reacted normally in the haematological examination were found positive in the serological test. When the results obtained were compared, agreement between tests was 219 and disagreement 26 cases. The discrepancy between haematological and serological tests were explained by the authors stating the following three possibilities.

1. These cases represented aleukemic-leukaemia, not detected by the haematological examination.
2. These cases represented animals recently infected by the virus.

3. These cases represented animals efficiently fighting against virus infection (immune reaction without disease).

Leukaemoid reactions

In leukaemoid reaction the peripheral blood findings resemble those found in leukaemia with the important difference that, leukaemia is a neoplastic proliferation and malignant in nature but leukaemoid reactions are benign proliferations (Miale, 1967). The haematological observations might simulate those of leukaemia and so many workers had remarked that leukaemoid reactions had very often caused difficulty in differential diagnosis, if the procedure only involved haematological examination (Miale, 1967; Wintrobe et al. 1974).

Leukaemoid reactions occur in association with a variety of infections, intoxications, malignant diseases and even in severe haemorrhage or sudden haemolysis. Bone marrow aspiration and biopsy, together with careful examination of these materials by culture and special stains, were helpful in the differential diagnosis (Hughes, 1959).

A lymphatic leukaemoid reaction similar to Chronic lymphocytic leukaemia was found associated with disease conditions like dermatitis herpetiformis, exfoliative dermatitis, cancer of the stomach and military tuberculosis

(Wintrobe et al. 1974).

The lymphocytic leukaemoid reaction was experimentally produced by Pertusis organisms in mice. It was postulated that the organisms liberated a substance that attached to lymphocytes and prevented their homing to lymphoid organs; lymphocytosis developed due to decreased egress of lymphocyte from the blood (Wintrobe et al. 1974).

Garg and Silber (1972) indicated that determination of leucocytic alkaline phosphatase helped in the differential diagnosis of myeloproliferative disease. They found that this enzyme level was elevated in polycythemia vera, thrombocythemia, leukaemoid reaction, mongolism and stress, where as the level decreased in monocytic leukaemia.

Meisner and Inhorn (1973) were of the opinion that non-malignant haematologic disorders like an^aemias, myelofibrosis and leukaemoid reactions could be differentiated from leukaemia either by the presence of spontaneous division of peripheral blood cells in 24 hours cultures or the finding of specific chromosome abnormalities or both.

MATERIALS AND METHODS

MATERIALS AND METHODS

A number of private and Government farms and Veterinary institutions were selected covering all the 11 districts of Kerala for the collection of blood from bovines.

1. Livestock farm, Mannuthy and College Veterinary Hospitals, Mannuthy and Trichur (Trichur District).
2. Peoples Dairy, Vytella (Ernakulam District).
3. Mavelikkara Veterinary Hospital (Allepp^ey District).
4. Kurishumala Asram farm and Veterinary Polyclinic, Palai (Kottayam District).
5. Veterinary Polyclinic, Thodupuzha (Iddukki District).
6. Kuriottumala Dry stock farm, Punalur (Quilon District).
7. Kodappanakunnu farm; Jersey farm, Vidura and livestock farm, Vellayani (Trivandrum District).
8. University livestock farm, Thiruvazhankunnu (Palghat District).
9. Aryavidyasala livestock farm, Kottakkal (Malappuram District).
10. District Veterinary Hospital, Calicut (Calicut District).
11. Pariyaram livestock farm, Payyannore (Cannanore District).

A total of 550 animals were screened. The sex and age of each animal was recorded. It was ascertained whether

there was any enlargement of superficial lymphnodes in these animals.

Blood was collected in clean vials by jugular puncture using 16 gauge hypodermic needle. Sodium citrate was used as anticoagulant at the rate of 2 to 4 mg for every millilitre of blood collected. The evaluation of blood was based on total leucocytic count per cmm, lymphocytic count per cmm and differential count of leucocytes.

Leucocyte count:

The technique described by Schalm (1965) was followed.

Reagent

Thoma's fluid:- Dissolved 0.25 g of powdered gentian violet in a little quantity of water. Added two ml of glacial acetic acid and diluted to 100 ml with water.

Procedure

Blood was drawn into the white cell pipette upto 0.5 mark and diluted to the mark 11 with Thoma's fluid. After discarding the fluid in the stem of the pipette, the haemocytometer was charged with the diluted blood. The number of leucocytes in the four corner squares each one having an area of one sq.mm was counted and was multiplied by 50, to get the total number of leucocytes per cubic millimeter of blood.

Differential leucocytic count

The method described by Schalm (1965) was adopted.

A properly stained, uniformly thin smear of blood was examined under the oil immersion lens of a microscope and the percentage distribution of the various types of leucocytes was determined by counting a total of 200 leucocytes.

Reagents

1. Wright's stain:- 0.2 g of Wright's eosin methylene blue stain powder dissolved in absolute methyl alcohol (Acetone free) was transferred to a bottle and kept tightly stoppered in the dark for two weeks. It was filtered before use.

2. Phosphate buffer solution of pH 6.6:- Dissolved 3.80 g of disodium hydrogen phosphate and 5.47 g of monopotassium phosphate in water and diluted to 1000 ml.

Procedure

The smears were prepared directly from fresh blood on clean grease free slides. They were dried, kept on a rack and floated with 20 drops of Wright's stain. After one to two minutes 20 drops of phosphate buffer were added and mixed thoroughly by blowing until a metallic film appeared on the surface of the stain. After five minutes the stain was

washed off with tap water. Then the stained smears were dried and examined under oil immersion objective of a microscope. A differential count of 200 leucocytes in each smear was made. The total lymphocyte count per cubic millimeter was calculated by multiplying the total leucocytes with the percentage of lymphocytes.

Evaluation

The evaluation was based on the number of leucocytes per cubic millimeter, the lymphocyte count per cubic millimeter and the differential count of blood leucocytes. For the diagnosis of bovine leukaemia Benedixen's Key (1957) was followed.

RESULTS

RESULTS

The values of total leucocyte and lymphocyte counts per cubic millimeter of blood and the differential leucocytic count of the animals examined are presented as Annexure. The clinical status and the sex and age of the animals are also included in the data.

Out of the 550 animals screened 24 were of age below one year, 52 between one and two years, 61 between two and three years, 103 ranged between three and four years and the remaining 310 were above four years (Table I). Among this, 114 showed enlarged lymphnodes with or without any clinical disease, 80 were clinically diseased animals and 356 were apparently normal clinically.

Even in the animals which showed enlargement of the lymphnodes, it was not very marked to suggest a frank neoplasm or other disease processes.

Based on the age and number of lymphocytes per cubic millimeter, it was attempted to divide the animals into three groups as per Benedixens Key: normal, suspicious and leukaemic. All the animals screened in the present study came under the first group, (normal) since the lymphocytic values fell within the range for normal animals. None of the samples showed evidence of leukaemoid reaction.

The leucocytic values (leucocytes per mm^3 , lymphocyte per cent and lymphocytes per mm^3) for the different age group of clinically normal animals are given in table II. The values for the animals with enlarged lymphnodes are given in table III.

It was found that in clinically normal animals the total leucocyte count for the below one year age group ranged from 3600 to 6200 (mean 5644.44 ± 275.94), for the one to two year age group from 3200 to 9250 (mean 4733.33 ± 264.33), for the two to three year age group from 2200 to 5600 (mean 4441.67 ± 110.31), for the three to four year age group from 2200 to 6100 (mean 4279.45 ± 96.33) and for the above four year age group from 2000 to 6200 (mean 4142.07 ± 88.34). The corresponding values for the animals with enlarged lymphnode were found to be 2750 to 7150 (mean 4925 ± 581.33) in below one year age group, 3100 to 7600 (mean 442.86 ± 243.96) in one to two year age group, 3600 to 4950 (mean 4085.71 ± 115.48) in two to three year age group, 3100 to 4800 (mean 3978.13 ± 128.29) in three to four year age group and 2400 to 5450 (mean 3852.64 ± 119.28) in the above four year age group.

In clinically normal animals the lymphocyte per cent for the below one year age group ranged

from 52 to 68 (mean 62.33 ± 1.69), for the one to two year age group from 52 to 83 (mean 76.88 ± 1.52), for the two to three year age group from 28 to 82 (mean 62.95 ± 1.39), for the three to four year age group from 28 to 74 (mean 62.33 ± 0.92) and for the above four year age group from 32 to 85 (mean 65.32 ± 2.54). The corresponding values for the animals with enlarged lymphnode were found to be 66 to 87 (mean 74.88 ± 2.47) in below one year age group, 69 to 89 (mean 81.62 ± 1.68) in one to two year age group, 71 to 91 (mean 77.50 ± 1.78) in two to three year age group, 68 to 79 (mean 74.31 ± 0.83) in three to four year age group and 44 to 88 (mean 73.27 ± 2.91) in the above four year age group.

It was found that in clinically normal animals the values of lymphocytes per mm^3 for the below one year age group were 1872 to 4834 (mean 3653.44 ± 265.54), for the one to two year age group 2400 to 3944 (mean 3152.75 ± 136.76), for the two to three year age group 1342 to 3504 (mean 2778.26 ± 131.76), for the three to four year age group 902 to 3477 (mean 2754.45 ± 71.24) and for the above four year age group 1296 to 4080 (mean 2642 ± 52.24). The corresponding values for the animals with enlarged lymphnode were found to be 1932 to 6221 (mean 3701.88 ± 484.64) in the below one year age group, 2255 to 6156 (mean 3598.10 ± 192.87) in one to two year age group, 2592 to 3782 (mean 3156.29 ± 90.74) in two to three year age group, 2294 to

3648 (mean 2965.13 ± 94.33) in three to four year age group and 1838 to 3871 (mean 2809.51 ± 64.01) in the above four year age group.

Among the 114 animals which showed enlarged lymphnodes, 22 were having lymphocyte per cent above 80, without much variation in absolute lymphocyte count. The lymphocytes in the blood smears did not show any cytological abnormality to indicate neoplastic property.

TABLES

Table I. The age-wise distribution of animals screened

Sl. No.	Age Group (year)	Number of animals screened.
1	0-1	24
2	1-2	52
3	2-3	61
4	3-4	103
5	7 4	310

Table II. Statistical calculations of leucocytic values in clinically normal cattle

Sl. No.	Age group (years)	No. of samples	Leucocytes per cmm.		Lymphocytes percent		Lymphocytes per cmm.	
			Average	S.	Average	S.	Average	S.
1	0-1	9	5644.44	± 275.94	62.33	± 1.69	3653.44	± 265.54
2	1-2	24	4733.33	± 264.33	67.88	± 1.52	3152.75	± 136.76
3	2-3	42	4441.67	± 110.31	62.95	± 1.39	2778.26	± 131.76
4	3-4	73	4279.45	± 96.33	62.33	± 0.92	2754.45	± 71.24
5	7 4	208	4142.07	± 88.34	65.32	± 2.54	2642.24	± 52.24

Table III. Statistical calculations of leucocytic values in cattle with enlarged lymph gland

Sl. No.	Age Group (years)	No. of Samples	Leucocytes per cmm.		Lymphocytes per cent		lymphocytes per cmm.	
			Average	S.	Average	S.	Average	S.
1	0-1	8	4925.00	± 581.33	74.88	± 2.47	3701.88	± 484.64
2	1-2	21	4442.86	± 243.96	81.62	± 1.68	3598.10	± 192.87
3	2-3	14	4085.71	± 115.48	77.50	± 1.78	3156.29	± 90.74
4	3-4	16	3978.13	± 128.29	74.31	± 0.83	2965.13	± 94.33
5	/ 4	55	3852.64	± 119.28	73.27	± 2.91	2809.51	± 64.01

DISCUSSION

DISCUSSION

The results of the present investigation have shown that bovine leukaemia is not endemic in some of the organised farms in this State. Eventhough the population of 550 animals which was screened is very small to give a generalised statement, the absence of either clinical cases or of animals with a haematological picture of suspected bovine leukaemia is very significant.

special attention was paid to animals which had even a slight enlargement of lymphnodes. The blood values did not indicate that the animals were suffering from bovine leukaemia.

The pattern of bovine leukaemia could be fairly separable on the basis of lesion, distribution, age incidence and general incidence. Age distribution peaks occur about six to eight months of age and again six to eight years of age. The first include the juvenile form and the adolescent (thymic type) and the second contains mostly cases of enzootic bovine leukosis. There was neither clinical nor haematological evidence of the occurrence of these types in the population tested.

The existence of haematological changes among leukotic animals is a characteristic phenomenon. Until easier or

more specific methods are available, blood examination can be used as a reliable diagnostic method not only for experimental investigations, but also as a basis of a systematic eradication programme (Benedixen, 1961).

In this connection the reliability and limits of this method will have to be discussed. It must be remembered that different factors - of physiologic and pathologic origin - may cause lymphocytosis of varying time duration.

Taylor (1976), and Robert and Stagg (1976) observed the influence of age factor in the composition of leucocytes. So it has been taken into special consideration. This is seen from table II and III. It is also revealed that the total number of lymphocytes per cubic millimeter decreases within the first four years from 5644.44 ± 275.94 to 4279.45 ± 96.33 and remains there for the rest of the life. This finding is in agreement with Gotze et al. (1954), Benedixen (1961) and Ressang (1976). This phenomenon has been taken into consideration by Gotze et al. (1954) and Benedixen (1957) for the development of the 'Leukosis key'.

Lymphocytosis is also observed under different pathological conditions and in the literature certain viral diseases and intoxications are mentioned (Hughes, 1959; Wintrobe et al. 1974). Leukaemoid reaction with lymphocytosis

needs differential diagnosis with bovine leukaemia. During the present study none of the animals showed leukaemoid blood picture.

Benedixen (1961) mentioned that the reliability of a negative result can be strengthened by repeating the examinations. Here exists an important question in relation between lymphocytosis and the presence of a leukotic agent in the animal. Once the animals are infected, period upto two to three years will often elapse before blood changes can be demonstrated. During this time of incubation the agent is present in the animal body without causing any distinguishable changes. The haemogram in established adult cases can be normal, subleukaemic or leukaemic.

Only two cases of lymphosarcoma, one in a cow (Mariamma and Rajamohan, 1975) and another in a goat (Rajan and Sivadas, 1973) had been recorded in Kerala.

Throughout the world there is some evidence to support the feeling that the incidence of bovine leukaemia has increased in endemic areas and spread to new geographic areas. Eventhough no clinical or suspected cases of bovine leukaemia was detected in the present investigation by haematological screening, constant vigil has to be kept up for the early detection of bovine leukosis since cases have been reported

from other parts of India. This assumes greater importance when it is considered that occasionally animals are imported from countries where bovine leukaemia has been known to occur. The present investigation could only be considered as a pilot study and a more comprehensive work involving a larger population is essential before declaring that bovine leukaemia is not present in Kerala State.

SUMMARY

SUMMARY

In order to study the incidence of leukaemia and leukaemoid reactions in cattle in Kerala, an investigation was undertaken utilising 550 animals from selected private and Government farms and Veterinary institutions from all the 11 Districts of the State. The blood samples were evaluated based upon counting the total number of leucocytes and by differential count of leucocytes. Based on the age and number of lymphocytes per cubic millimeter an attempt was made to divide the animals into three groups as per Benedixen's Key; normal, suspicious and leukaemic. The haematological value of all the animals examined fell within the category of normal animals and so it could be said that bovine leukaemia was not encountered in the bovine population screened in this investigation. None of the samples showed any evidence of leukaemoid reaction. A few animals with enlarged lymphnodes showed lymphocyte per cent above 80, but their absolute lymphocyte values were within the normal range. Lymphocytes in the blood smears did not show any cytological abnormality to indicate neoplastic property. The maximum absolute lymphocytic value noticed was 3701.88 ± 484.64 .

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* Original not consulted.

ANNEXURE

ANNEXURE

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count.					Absolute Lymphocytes per cmm	Remarks.
				L%	N%	E%	M%	B%		
1	5	F	8300	44	49	6	1	0	3652	*ELG
2	1	F	6850	70	28	1	1	0	4795	ELG
3	5	F	5800	45	51	4	0	0	2610	Tail Necrosis
4	4 Months	F	7150	87	12	0	1	0	6221	ELG
5	6	F	3750	49	50	1	0	0	1838	ELG
6	7	F	2450	58	39	2	1	0	1421	Bleeding in udder
7	6	F	3500	76	23	1	0	0	1660	Sub-clinical Mastitis
8	8	M	4000	78	19	3	0	0	3120	Alkaline indigestion
9	3	F	6700	29	70	0	1	0	1943	Mastitis
10	4	F	4750	55	43	1	1	0	2613	Normal
11	3	F	4500	65	25	10	0	0	2925	Teat fistula

*ELG - Enlarged lymph glands.

(Annexure contd.)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count					Absolute Lymphocytes per cmm	Remarks
				L%	N%	E%	M%	B%		
12	2	F	3800	64	32	2	2	0	2432	Infertility
13	10 months	M	5200	67	28	4	1	0	3484	Simple indigestion
14	7	F	4900	62	35	2	1	0	3038	Mastitis
15	5	M	3350	66	30	4	0	0	2211	Wound
16	18	M	3750	58	39	2	1	0	2175	Simple indigestion
17	7	F	5000	58	41	0	1	0	2900	Ketosis
18	4	F	4200	33	63	3	1	0	1386	Acute indigestion
19	5	F	3800	73	22	3	1	1	2774	Acute indigestion
20	3½	F	4200	58	39	2	1	0	2436	Dyspepsia
21	4½	F	4800	86	13	1	0	0	4128	Anorexia
22	6	M	7100	45	52	2	1	0	3195	Yolk gall
23	5	M	5000	42	55	2	1	0	2100	Oedema in dewlap region.

(Annexure contd.)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count					Absolute Lymphocytes per cmm	Remarks.
				L%	N%	E%	M%	B%		
24	6	F	5200	50	47	2	1	0	2600	Ephemeral fever
25	4½	F	11000	58	37	4	1	0	6380	Wound.
26	6	F	2950	61	36	2	1	0	1800	Pyrexia
27	1½	F	10700	74	24	1	1	0	7918	Nasal schistosomiasis
28	3½	F	44200	62	37	1	0	0	2604	Anorexia
29	6	F	6200	69	28	2	1	0	4278	Mastitis
30	4	F	5400	67	29	2	2	0	3618	Wound
31	8	M	5400	74	23	2	1	0	3996	Bronchitis
32	4	F	4800	67	30	1	2	0	3216	Amphistomiasis
33	6	F	6200	59	38	2	1	0	3658	Mastitis
34	2	F	4200	54	41	4	1	0	2268	Diarrhoea

(Annexure contd..)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. NO.	Age years	Sex	TLC per mm	Differential count					Absolute Lymphocytes	Remarks
				L%	N%	E%	M%	B%		
35	8 months	F	5800	66	30	3	1	0	3828	* ELG
36	6	F	4400	74	23	2	1	0	3256	Dermatitis
37	2	F	3800	74	21	3	2	0	2812	Ephemeral fever
38	3½	F	4200	24	20	14	1	1	2688	Mastitis
39	5	F	5800	72	25	2	1	0	2016	**CN
40	2	F	5800	60	38	1	1	0	3480	CN
41	6	F	3800	54	43	2	1	0	2052	CN
42	4	F	3600	69	28	2	1	0	2484	CN
43	3	F	2200	61	35	3	1	0	1342	CN
44	6	F	4800	85	13	2	0	0	4080	CN
45	5	F	5400	69	29	2	0	0	3726	ELG

*ELG - Enlarged lymph glands.

**CN - Clinically Normal.

(Annexure contd..)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count					Absolute Lymphocytes per cmm	Remarks
				L%	N%	E%	M%	B%		
46	4	F	6800	22	74	1	2	1	1496	Mastitis
47	4½	F	3600	76	19	4	1	0	2736	Dermatitis
48	6	F	4200	71	26	2	1	0	2982	C.N.
49	4	F	2200	41	56	2	1	0	902	C.N.
50	5	F	2800	65	34	0	1	0	1820	C.N.
51	5½	F	4600	69	26	3	1	1	3174	C.N.
52	6	F	2400	35	63	0	2	0	8840	C.N.
53	7	F	2800	60	38	0	2	0	1680	C.N.
54	8	M	3200	68	30	1	1	0	2176	C.N.
55	4	F	5100	84	15	0	1	0	4284	Mastitis
56	6	F	4200	64	33	2	1	0	2688	C.N.

(Annexure contd..)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count					Absolute Lymphocytes per cmm	Remarks
				L%	N%	E%	M%	B%		
57	3½	F	3800	72	25	2	0	1	2736	*CN
58	6	F	4100	81	16	2	1	0	3321	Abortion
59	4½	F	3200	71	25	2	1	1	2272	CN
60	2	F	4800	82	17	1	0	1	3888	Infertility
61	4½	F	4800	82	16	1	0	1	3936	Repeat breeder
62	4	F	3100	89	9	1	0	1	2759	Infertility
63	2	F	3800	62	33	3	1	1	2356	Anorexia
64	3	M	4100	66	27	6	1	0	2706	Lameness
65	4½	F	3600	52	44	2	1	1	1872	Maggot wound
66	4	F	3200	76	21	2	1	0	2432	Repeat breeder
67	8mths	F	4800	78	19	2	1	0	3744	Debility

* CN - Clinically normal

(Annexure contd.)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count					Absolute Lymphocytes per cmm	Remarks
				L%	N%	E%	M%	B%		
68	1½	F	3100	82	17	1	0	0	2542	ELG
69	4½	F	3200	84	14	1	0	1	2688	Sterility
70	2½	F	4800	61	36	2	1	0	2928	Anorexia
71	6	F	3800	73	25	1	1	0	2774	Diarrhoea
72	4½	F	2350	86	13	0	1	0	2021	Repeat breeder
73	9 months	F	2750	79	19	1	1	0	2172.50	ELG
74	4	F	2250	81	17	1	0	1	1822.50	Infertile genitalia
75	8	M	4300	64	30	2	2	2	2752	CN
76	7	M	3800	73	25	1	1	0	2774	CN
77	4½	F	3100	82	16	1	0	1	2542	Repeat breeder
78	8	M	5200	58	39	2	1	0	3016	Wound

(Annexure contd..)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count					Absolute Lymphocytes per cmm	Remarks
				L%	N%	E%	M%	B%		
79	6	F	3900	73	23	2	1	1	2847	Parasitic Enteritis
80	8	F	4100	74	25	0	1	0	3034	Ketosis
81	5	F	3200	77	19	1	2	1	2464	ELG
82	8	F	3600	79	20	0	1	0	2844	ELG
83	8 months	F	4100	68	28	2	1	1	2788	Anorexia
84	9 months	F	4600	60	32	6	1	1	2760	Debility
85	6	F	2800	72	26	1	1	0	2016	Ketosis
86	6 months	F	6200	51	40	7	1	1	3162	Umbilical Abscess
87	1½	M	3800	70	25	4	1	0	2660	Tail Necrosis
88	6	F	5800	19	78	2	1	0	1102	Mastitis
89	6	M	4800	69	28	2	1	0	3312	Wound

(Annexure contd..)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age	Sex	TLC per cmm	Differential count			Absolute Lymphocytes per cmm	Remarks		
				L%	N%	E%				
90	6	F	4400	69	25	4	1	1	3036	Mastitis
91	4½	F	3800	70	26	3	1	0	2660	CN
92	6	F	3200	57	36	6	1	0	1824	Mastitis
93	4	F	3400	63	30	3	3	1	2142	Indigestion
94	9	M	4800	51	45	2	1	1	2448	Bronchitis
95	8	M	4400	68	28	2	1	1	2992	Bronchitis
96	6	M	5300	56	38	4	2	0	2968	N/C
97	6	M	5200	56	36	6	1	1	2912	Diarrhoea
98	1½ months	F	4800	49	48	2	1	0	2352	Bronchitis
99	7	F	4800	68	25	6	1	0	3264	Ketosis
100	6	F	6800	29	70	0	1	0	1972	Metritis

(Annexure contd..)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count					Absolute Lymphocytes per cmm.	Remarks
				L%	N%	E%	M%	B%		
101	3½	M	4200	59	39	1	1	0	2478	CN
102	6	F	6200	23	76	0	1	0	1426	Metritis and Cervi-
103	8mths	F	5400	69	26	4	1	0	3726	Debility citis.
104	9mths	F	4800	71	23	3	2	1	3808	ELG
105	2½	F	4800	38	60	1	1	0	1824	Bronchitis
106	2	F	9250	62	33	4	0	1	5735	CN
107	1½	F	4400	71	26	2	1	0	3124	CN
108	1½	F	3800	73	25	1	1	0	2774	CN
109	2	F	4250	79	19	1	1	0	3060	ELG
110	1½	F	4300	62	30	7	1	0	2666	CN
111	1½	F	4800	79	20	0	1	0	3792	ELG

(Annexure contd..)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count					Absolute Lymphocytes per cmm	Remarks
				L%	N%	E%	M%	B%		
112	1½	F	4350	61	37	1	0	1	2653.50	CN
113	1	F	2800	69	29	1	1	0	1932	ELG
114	2	F	4350	66	26	6	1	1	2871	CN
115	2	F	4600	69	27	2	1	1	3174	CN
116	3	F	4200	67	29	2	1	1	2814	CN
117	2	F	7600	81	18	0	1	0	6156	ELG
118	2	F	4350	74	24	0	1	1	3219	ELG
119	3	F	4250	89	9	0	2	0	3782.50	ELG
120	2	F	4200	81	18	0	1	0	1782	ELG
121	2	F	4700	68	10	0	1	0	3402	CN
122	2	F	4400	86	12	1	1	0	3784	ELG

(Annexure contd.)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count					Absolute Lymphocytes per cmm	Remarks
				L%	N%	E%	M%	B%		
123	2	F	3250	87	12	0	1	0	2827.50	ELG
124	2	F	3200	75	24	0	1	0	2400	CN
125	2	F	4400	73	25	0	1	1	3212	CN
126	2	F	4800	85	12	0	2	1	4080	ELG
127	2	F	4400	84	13	0	2	1	3696	ELG
128	2	F	3200	83	16	0	1	0	2656	CN
129	2	F	3250	77	20	1	2	0	2502.50	CN
130	2	F	6800	74	22	2	2	0	5032	ELG
131	4	F	3200	74	25	0	1	0	2368	CN
132	3	M	4600	77	20	1	2	0	3542	ELG
133	2	F	4700	66	33	0	1	0	3102	CN

(Annexure contd.)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count					Absolute Lymphocytes per cmm	Remarks
				L%	N%	E%	M%	B%		
134	2	F	4300	86	13	0	1	0	3698	ELG
135	3	F	3600	86	13	1	0	0	3096	ELG
136	2	F	4350	71	19	8	2	0	3088.50	CN
137	2	F	2750	82	17	1	0	0	2255	ELG
138	2	F	4200	82	17	0	1	0	3444	ELG
139	2	F	4200	64	34	1	1	0	2688	CN
140	2	F	3500	78	17	3	1	1	2730	CN
141	2	F	5450	86	13	1	0	0	4687	ELG
142	2	F	3200	69	29	0	1	1	2208	CN
143	2	F	3500	84	14	1	1	0	2940	ELG
144	2	F	4600	78	20	1	1	0	3588	CN

(Annexure contd.)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count					Absolute Lymphocytes per cmm	Remarks
				L%	N%	F%	M%	B%		
145	3	F	2800	82	17	0	1	0	2296	CN
146	3	F	3400	91	8	0	1	0	3094	ELG
147	6	F	2400	88	10	1	1	0	2112	ELG
148	5½	F	3800	57	41	0	1	1	2166	ELG
149	8	F	2600	79	18	2	1	0	2054	CN
150	5	F	3200	85	14	0	1	0	2720	Repeat breeder
151	8	F	2400	75	18	3	3	1	1800	CN
152	6	F	2200	75	24	1	0	0	1650	CN
153	4½	F	7200	64	34	1	1	0	4608	Mastitis
154	6	F	4200	74	18	4	3	1	3108	CN
155	4½	F	4900	79	19	0	2	0	3871	ELG

(Annexure contd.)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count					Absolute Lymphocytes per cmm	Remarks.
				L%	N%	E%	M%	B%		
156	6	F	4600	49	49	1	1	0	2254	Non-specific Anorexia
157	4	F	4200	56	42	1	1	0	2352	Non-specific Anorexia
158	4½	F	3900	42	53	3	1	1	1638	Non-specific Anorexia
159	6	F	4450	44	51	2	1	2	1958	Non-specific Anorexia
160	4	F	2800	75	16	7	1	1	2100	Non-specific Anorexia
161	6	F	3200	74	14	10	1	1	2368	Non-specific Anorexia
162	6	F	3600	74	23	2	1	0	2664	CN
163	6	F	4100	68	26	4	1	1	2788	CN
164	8	F	4600	57	33	9	1	0	2622	CN

(Annexure contd.)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count:					Absolute Lymphocytes per cmm	Remarks
				L%	N%	E%	M%	B%		
165	6	F	3800	44	38	14	4	0	1672	Wound
166	4	F	4200	66	31	2	1	0	2772	CN
167	6	F	4600	56	29	12	2	1	2576	CN
168	6½	F	4800	54	44	0	1	1	2592	CN
169	3½	F	5100	57	39	3	1	0	2907	CN
170	6	F	3200	74	22	3	1	0	2368	CN
171	6	F	3800	69	27	2	1	1	2622	CN
172	4½	F	3200	71	26	2	1	0	2272	CN
173	8½	F	3600	67	29	2	1	1	2412	CN
174	4½	F	3900	72	24	1	2	1	2808	CN
175	6	F	4100	69	28	2	1	0	2829	CN

(Annexure contd..)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count					Absolute Lymphocytes per cmm	Remarks.
				L%	N%	E%	M%	B%		
176	5	F	4100	58	24	17	1	0	2378	CN
177	6	F	3600	61	26	12	1	0	2196	CN
178	3	F	4450	63	22	12	2	1	2893.50	CN
179	6	F	4100	70	29	0	1	0	2870	ELG
180	4	F	3600	68	18	13	1	0	2448	CN
181	6	F	4400	63	34	2	1	0	2772	CN
182	6	F	3100	78	19	2	1	0	2418	ELG
183	4½	F	3600	66	32	0	1	1	2376	CN
184	6	F	3800	69	27	3	0	1	2662	CN
185	6	F	4800	55	42	2	1	0	2640	CN
186	8	F	3200	72	24	2	1	1	2304	ELG

(Annexure contd..)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count					Absolute Lymphocytes per cmm	Remarks.
				L%	N%	E%	M%	B%		
187	6	F	4100	66	32	1	1	0	2706	CN
188	7	F	3800	66	32	1	1	0	2508	CN
189	6	F	3200	73	25	0	1	1	2336	ELG
190	4	F	4800	76	22	0	1	1	3648	ELG
191	6	F	3200	76	18	4	1	1	2432	ELG
192	4	F	3400	72	23	3	1	1	2448	CN
193	6	F	3600	73	24	2	1	0	2628	ELG
194	4	F	4100	78	20	0	1	1	3198	ELG
195	8	F	3200	76	20	2	1	1	2432	ELG
196	6	F	2800	78	19	1	1	1	2184	ELG
197	9	F	3200	74	23	2	1	0	2368	CN

(Annexure contd..)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count					Absolute Lymphocytes per cmm	Remarks
				L%	N%	E%	M%	B%		
329	6	F	4100	48	43	7	1	1	1968	CN
330	2½	F	4600	52	43	3	1	1	2392	CN
331	6	F	3800	66	27	6	1	0	2508	CN
332	7	F	4450	58	36	4	1	1	2581	CN
333	7	F	3850	64	31	3	1	1	2464	CN
334	2½	F	4800	59	34	5	1	1	2832	CN
335	4	F	3400	67	25	6	1	1	2278	CN
336	4½	F	4450	68	25	6	1	0	3026	CN
337	4	F	3800	69	27	3	1	0	2622	CN
338	3½	F	3800	53	29	16	1	1	2014	CN
339	6	F	3600	72	23	4	1	0	2592	CN
340	6	F	3800	58	37	3	1	1	2204	CN

(Annexure contd..)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count					Absolute Lymphocytes per cmm	Remarks
				L%	N%	E%	M%	B%		
341	7	F	3600	36	60	1	2	1	1296	CN
342	6	F	4200	66	33	0	1	0	2772	CN
343	5	F	3800	62	33	3	1	1	2356	CN
344	4½	F	3200	69	17	12	1	1	2208	CN
345	3½	F	3200	69	27	3	1	0	2208	CN
346	2½	F	4100	66	19	14	1	0	2706	CN
347	4	F	4800	63	20	16	1	0	3024	CN
348	3	F	4900	62	34	2	1	1	3038	CN
349	3½	F	4350	66	30	2	1	1	2821	CN
350	5	F	4100	68	23	8	1	0	2788	CN
351	3½	F	4400	64	26	9	1	0	2816	CN
352	5	F	6100	59	36	3	1	1	3599	CN

(Annexure contd..)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count:					Absolute Lymphocytes per cmm	Remarks
				L%	M%	E%	M%	D%		
353	7	F	4800	61	28	9	1	1	2928	CN
354	4	F	4200	56	36	6	1	1	2912	CN
355	6	F	3950	68	22	9	1	0	2686	CN
356	6	F	3850	68	25	6	1	0	2618	CN
357	3½	F	4200	66	28	4	1	1	2772	CN
358	7	F	6200	59	36	3	1	1	3658	CN
359	3	F	5100	61	30	7	1	1	3111	CN
360	3	F	4950	67	29	2	1	1	3316.50	CN
361	6	F	5450	70	24	5	1	0	3815	ELG
362	3½	F	5100	63	34	1	1	1	3213	CN
363	4	F	5800	59	38	2	1	0	3422	CN
364	4	F	3900	69	18	11	1	1	2691	CN

(Annexure contd..)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count					Absolute Lymphocytes per cmm	Remarks.
				L%	N%	E%	M%	B%		
198	6	F	2600	72	24	2	1	1	1872	CN
199	7	F	3300	68	28	3	1	0	2244	CN
200	9	F	3600	61	33	4	2	0	2196	Debility
201	6	F	3800	58	38	3	1	0	2204	CN
202	9	F	3200	62	34	2	1	1	1984	CN
203	9	F	4200	66	30	3	1	0	2772	CN
204	9	F	4200	67	29	3	1	0	2814	CN
205	9	F	3600	72	24	2	1	1	2592	CN
206	7	F	4600	58	34	6	2	0	2668	CN
207	7	F	3300	62	33	3	1	1	2046	CN
208	8	F	5200	59	34	4	2	1	3068	CN

(Annexure contd.)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age S years	Sex	TLC per cmm	Differential count					Absolute Lymphocytes per cmm	Remarks.
				L%	N%	E%	M%	B%		
209	7	F	4200	72	26	1	1	0	3024	CN
210	9	F	3600	71	19	8	2	0	2556	CN
211	5	F	4445	72	26	1	1	0	3200.40	ELG
212	6	F	4900	64	32	2	1	1	3136	CN
213	2	F	5800	88	38	3	0	1	3364	CN
214	2	F	3850	86	11	1	2	0	3311	ELG
215	11	F	2850	71	26	2	0	1	2023.50	ELG
216	10	F	3200	73	25	1	1	0	2336	ELG
217	11	F	4450	72	19	1	8	0	3204	ELG
218	10	F	3400	68	28	2	1	1	2312	CN
219	11	F	3200	58	35	4	2	1	1856	CN
220	10	F	3400	62	35	2	1	0	2108	CN

(Annexure contd..)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count					Absolute Lymphocytes per cmm	Remarks.
				L%	N%	E%	M%	B%		
221	4	F	3650	66	31	1	1	1	2409	CN
222	9	F	3600	56	38	4	1	1	2016	CN
223	4	F	3400	62	35	2	1	0	2108	CN
224	7	F	3150	68	28	1	2	1	2142	CN
225	5	F	3300	71	27	1	1	0	2343	CN
226	5	F	2900	76	20	2	1	1	2204	ELG
227	3	F	3600	58	36	4	1	1	2058	CN
228	8	F	3600	66	34	8	1	1	2376	CN
229	2	F	5200	62	33	3	1	1	3224	CN
230	1	F	3600	52	43	2	2	1	1872	CN
231	10	F	3600	66	30	2	1	1	2376	CN
232	5	F	4800	73	23	2	1	1	3504	ELG

(Annexure contd..)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential Count					Absolute Lymphocytes per cmm	Remarks.
				L%	N%	E%	M%	B%		
233	1½	F	5800	68	26	3	2	1	3944	CN
234	5	F	4800	72	25	2	1	0	3456	ELG
235	5	F	2900	62	35	2	1	0	1798	CN
236	4	F	4800	71	27	1	1	0	3408	ELG
237	8	F	4450	69	28	2	1	0	3070.50	CN
238	6	F	4900	56	40	2	1	1	2744	CN
239	4	F	3400	68	30	1	1	0	2312	CN
240	8	F	3600	66	30	2	1	1	2376	CN
241	6	F	3550	66	28	3	2	1	2211	CN
242	4	F	3800	62	33	2	2	1	2356	CN
243	6	F	3600	72	25	2	1	0	2592	ELG
244	9	F	6350	62	34	2	1	1	3937	CN

(Annexure contd..)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count					Absolute Lymphocytes per cmm	Remarks
				L%	N%	E%	M%	B%		
245	6	F	5600	56	40	2	1	1	3116	CN
246	8	F	3400	68	29	2	1	0	2312	CN
247	4	F	4200	66	31	1	1	1	2772	CN
248	6	F	4800	62	32	4	1	1	2976	CN
249	3	F	4600	58	37	3	1	1	2668	CN
250	4	F	4400	62	35	2	1	0	2992	CN
251	4	F	3100	74	23	2	1	0	2294	ELG
252	6	F	5450	53	39	6	1	1	2858.50	CN
253	4	F	5100	58	37	3	1	1	2958	CN
254	3	F	3800	62	32	4	1	1	2356	CN
255	6	F	3600	68	29	2	1	0	2448	CN
256	8	F	4200	66	29	3	1	1	2772	CN

(Annexure contd..)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count					Absolute Lymphocytes per cmm	Remarks
				L%	N%	E%	M%	B%		
257	8	F	3950	64	30	4	1	1	2528	CN
258	6	F	3650	66	30	2	1	1	2409	CN
259	9	F	4200	68	22	8	1	1	2856	CN
260	9	F	6350	62	33	3	1	1	3937	CN
261	6	F	5850	56	40	2	1	1	3276	CN
262	2	F	6200	52	36	8	3	1	3224	CN
263	1½	F	3850	71	26	2	1	0	2733.50	CN
264	6	F	3200	68	30	1	1	0	2176	CN
265	4	F	3850	62	35	2	1	0	2387	CN
266	3	F	3600	61	24	3	1	1	2196	CN
267	6	F	3200	68	27	2	1	1	2208	CN
268	4	F	3250	68	27	3	1	1	2210	CN

(Annexure contd..)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count					Absolute Lymphocytes per cmm	Remarks
				L%	N%	E%	M%	B%		
269	2½	F	4800	58	39	2	1	0	2784	CN
270	3½	F	3200	68	27	3	1	1	2176	CN
271	10	F	3200	74	21	2	2	1	2368	CN
272	4	F	3350	69	25	5	1	0	2311.50	CN
273	5	F	3400	63	31	4	1	1	2142	CN
274	4	F	3600	69	29	1	1	0	2454	CN
275	9	F	6200	61	30	5	3	1	3782	CN
276	2	F	3800	69	27	2	1	1	2622	ELG
277	6	F	3600	67	27	4	2	0	2412	CN
288	4	F	4200	66	30	2	1	1	2722	CN
279	3½	F	5100	58	38	2	1	1	2958	CN
280	6	F	3950	66	29	3	1	1	2607	CN

(Annexure contd..)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count					Absolute Lymphocytes per cmm	Results
				L%	N%	E%	M%	B%		
281	8	F	5800	52	36	9	2	1	3916	CN
282	3½	F	3950	68	23	6	2	1	2656	CN
283	8	F	3600	71	24	3	1	1	2556	ELG
284	4	F	3850	69	28	2	1	0	2656.50	CN
285	6	F	3200	71	23	3	2	1	2272	CN
286	4½	F	3800	62	31	4	2	1	2356	CN
287	7	F	3600	59	36	3	1	1	2124	CN
288	8	F	4100	67	30	2	1	0	2747	CN
289	10	F	4600	66	23	8	2	1	3036	CN
290	3	F	3950	69	18	11	2	0	2725.50	CN
291	4	F	5200	62	30	6	1	1	3224	CN
292	4	F	6100	57	33	8	1	1	3477	CN

(Annexure contd..)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count					Absolute Lymphocytes per cmm	Remarks.
				L%	N%	E%	M%	B%		
293	8	F	5800	58	27	13	1	1	3364	CN
294	4	F	4450	62	29	7	1	1	2759	CN
295	4	F	3850	67	30	2	1	0	2579.50	CN
296	5	F	4100	68	28	2	1	1	2758	CN
297	7	F	5400	58	28	11	2	1	3132	CN
298	4	F	3600	71	26	2	1	0	2556	ELG
299	2½	F	3900	69	25	3	2	1	2691	CN
300	3½	F	5100	61	36	2	1	0	3111	CN
301	3½	F	5400	52	45	2	1	0	2808	CN
302	5	F	5800	55	37	6	1	1	3190	CN
303	5	F	4100	65	31	2	1	1	2665	CN
304	4	F	4800	68	27	3	1	1	3264	ELG

(Annexure contd..)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count					Absolute Lymphocytes per cmm	Remarks
				L%	N%	E%	M%	B%		
305	6	F	4600	64	26	9	1	0	2944	CN
306	3½	F	3900	69	28	2	1	0	2691	CN
307	6	F	5200	62	35	2	1	0	3224	CN
308	3	F	3600	66	24	8	1	1	2376	CN
309	7	F	3300	69	26	3	1	1	2277	CN
310	3	F	4200	71	25	2	1	1	2982	ELG
311	9	F	3850	58	39	2	1	0	2233	CN
312	4	F	3800	71	25	3	1	0	2698	ELG
313	7	F	4800	53	27	18	1	1	2544	CN
314	3	F	5100	54	24	21	1	0	2754	CN
315	4	F	5200	56	26	16	1	1	2912	CN
316	5	F	4100	73	23	3	1	0	2993	ELG

(Annexure contd..)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count					Absolute Lymphocytes per cmm	Remarks
				L%	N%	E%	M%	B%		
317	3½	F	4800	63	32	4	1	0	3024	CN
318	6	M	3900	57	28	13	1	1	2223	CN
319	3	F	4600	61	30	8	1	0	2806	CN
320	4	F	2800	68	23	8	1	0	1904	CN
321	9	F	4600	56	39	3	1	1	2576	CN
322	4	F	4800	59	35	4	1	1	2832	CN
323	7	F	3900	69	27	2	1	1	2691	CN
324	3	F	5400	48	44	6	1	1	2592	CN
325	4	F	3900	69	25	4	1	1	2691	CN
326	5	F	4200	61	34	3	1	1	2526	CN
327	3½	F	3600	68	28	3	1	0	2448	CN
328	6	F	3800	68	22	8	1	1	2584	CN

(Annexure contd..)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count					Absolute Lymphocytes per cmm	Remarks
				L%	N%	E%	M%	B%		
365	4	F	4800	66	29	4	1	0	3168	CN
366	4	F	4550	61	28	9	1	1	2775.50	CN
367	3½	F	5600	58	34	6	1	1	3248	CN
368	6	F	4800	62	34	2	1	1	2972	CN
369	6	F	4100	67	31	1	1	0	2747	CN
370	6	F	3200	66	31	2	1	0	2772	CN
371	1	F	5800	68	29	2	1	0	3944	CN
372	8 months	F	6100	66	32	1	1	0	4026	CN
373	1	F	5200	64	35	1	0	0	3328	CN
374	1	F	5800	68	29	2	1	0	3944	CN
375	1	F	6100	63	34	2	0.1	1	4843	CN
376	3	F	4800	66	27	6	1	0	3168	CN

(Annexure contd..)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cum	Differential count					Absolute Lymphocytes per cum	Remarks
				L%	N%	E%	M%	B%		
377	1	F	6200	61	27	11	1	0	3782	CN
388	9 months	F	5800	59	26	13	0	2	3422	CN
389	6	F	4800	66	29	1	1	0	3168	CN
380	4½	F	5100	69	28	2	1	0	3519	CN
381	1½	F	5800	61	27	11	0	1	3538	CN
382	2½	F	4950	56	62	2	0	0	2772	CN
383	4½	F	4600	59	36	4	1	0	2714	CN
384	6	F	4200	69	25	4	1	1	2898	CN
385	3½	F	4800	66	32	1	1	0	3168	CN
386	6	F	5100	61	34	4	1	0	3111	CN
387	1	F	4800	78	20	1	0	1	3744	ELG
388	1	F	6200	60	36	2	1	1	3720	CN

(Annexure contd..)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count					Absolute Lymphocytes per cmm	Remarks
				L%	N%	E%	M%	B%		
389	1½	F	4100	87	11	1	0	1	3567	ELG
390	1	F	4450	79	17	1	1	2	3515.50	ELG
391	1½	F	4600	80	15	2	2	1	3680	ELG
392	3½	F	4100	79	16	3	1	1	3239	ELG
393	2½	F	4800	73	23	2	1	1	3504	CN
394	1½	F	4800	78	17	3	1	1	3744	ELG
395	3½	F	3800	68	25	4	1	1	2584	CN
396	4	F	3600	71	26	2	1	0	2556	ELG
397	6	F	5200	56	41	1	1	1	2912	CN
398	5	F	4800	62	35	2	1	0	2976	CN
399	6	F	4200	62	33	3	1	1	2604	CN
400	4	F	4800	63	34	2	1	0	3024	CN

(Annexure contd..)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count					Absolute Lymphocytes per cmm	Remarks
				L%	N%	E%	M%	B%		
401	8	F	3200	69	34	2	1	0	2208	CN
402	7	F	3800	56	40	3	0	1	2128	CN
403	8	F	3450	66	32	1	1	0	2277	CN
404	4½	F	5200	48	46	4	1	1	2496	CN
405	6½	F	4800	56	41	2	1	0	2688	CN
406	8	F	3800	66	30	2	1	1	2508	CN
407	8	F	3600	72	26	1	1	0	2592	ELG
408	4	F	2800	69	29	1	1	0	1932	CN
409	7	F	3200	62	36	2	0	0	1984	CN
410	6½	F	3200	66	31	2	0	1	2112	CN
411	8	F	5100	52	46	1	1	0	2652	CN
412	6	F	3200	72	25	2	1	0	2304	ELG

(Annexure contd..)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count					Absolute Lymphocytes per cmm	Remarks
				L%	N%	E%	M%	B%		
413	8	F	3800	62	34	3	1	0	2356	CN
414	6	F	4200	66	32	1	1	0	2772	CN
415	6	F	4800	54	41	3	1	1	2592	CN
416	8	F	4600	56	39	2	1	0	2668	CN
417	6	F	3800	59	40	1	0	0	2242	CN
418	6	F	3450	69	27	2	1	1	2390.50	CN
419	7	F	4200	58	40	0	1	1	2436	CN
420	6	F	3200	66	31	2	1	0	2112	CN
421	8	F	3600	69	27	3	0	1	2484	CN
422	6	F	3900	68	29	1	2	0	2652	CN
423	4½	F	4600	53	44	2	1	0	2438	CN
424	6	F	4100	61	36	1	1	1	2501	CN

(Annexure contd..)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count					Absolute lymphocytes per cmm	Remarks
				L%	N%	E%	M%	B%		
425	3½	F	4400	59	37	2	1	1	2596	CN
426	4	F	2800	66	31	2	1	0	1848	CN
427	3½	F	3600	68	30	1	0	1	2448	CN
428	4½	F	4800	48	50	1	1	0	2304	CN
429	7	F	3800	73	25	1	1	0	2774	ELG
430	6	F	3800	72	26	1	0	1	2736	ELG
431	4	F	5200	58	37	3	1	1	3016	CN
432	6	F	4800	63	34	2	1	0	3024	CN
433	4½	F	3600	71	28	1	0	0	2556	CN
434	8	F	3200	72	26	1	0	1	2304	CN
435	7	F	4800	46	52	1	2	0	2208	CN
436	4½	F	3650	64	33	2	1	0	2336	CN

(Annexure contd..)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cum	Differential count:					Absolute Lymphocytes per cum	Remarks
				L%	N%	E%	M%	B%		
437	7	F	8600	42	52	4	1	1	2352	CN
438	6	F	3800	71	26	2	1	0	2698	CN
439	7	F	3800	78	20	1	1	0	2964	ELG
440	6	F	5800	46	52	1	1	0	2668	CN
441	6	F	3100	72	27	1	0	0	2232	ELG
442	8	F	3600	86	12	1	1	0	3268	ELG
443	7	F	3200	72	26	1	1	0	2304	ELG
444	4½	F	4800	38	60	1	1	0	1824	CN
445	6	F	4100	66	32	1	1	0	2706	CN
446	4½	F	4800	56	41	2	1	0	2688	CN
447	7	F	5100	56	42	1	1	0	2856	CN
448	3½	F	4800	56	40	2	1	1	2688	CN

(Annexure contd..)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count					Absolute lymphocytes per cmm	Remarks
				L%	N%	E%	M%	B%		
449	4	F	4450	59	40	1	0	0	2625.50	CN
450	2½	F	5600	51	47	1	1	0	2856	CN
451	6	F	3100	71	20	7	1	1	2201	CN
452	3½	F	6100	40	56	3	1	0	2440	CN
453	7	F	3800	44	48	6	1	1	1672	CN
454	8	F	3800	64	34	1	1	0	2432	CN
455	6	F	3100	69	27	2	1	1	2139	CN
456	4	F	4200	42	83	4	0	1	1764	CN
457	5½	F	4100	60	34	4	2	0	2460	CN
458	5	F	3600	68	28	2	1	1	2448	CN
459	6	F	3100	75	21	3	1	0	2325	CN
460	6	F	3850	68	30	1	1	0	2618	ELG

(Annexure contd..)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count					Absolute Lymphocytes per cmm	Remarks
				L%	P%	E%	M%	B%		
461	4	F	3250	74	23	2	0	1	2405	ELG
462	7	F	3200	69	28	2	1	0	2208	CN
463	6	F	3900	72	24	3	1	0	2808	ELG
464	6	F	4100	64	33	2	1	0	2624	CN
465	3½	F	3950	62	32	4	1	1	2449	CN
466	4	F	4800	63	33	2	1	1	3024	CN
467	6	F	5100	60	38	2	0	0	3060	CN
468	4	F	3800	76	20	2	1	1	2888	ELG
469	2½	F	3600	72	26	1	1	1	2592	ELG
470	6	F	3600	68	24	5	2	1	2448	CN
471	6	F	5800	42	56	1	1	0	2436	CN
472	2½	F	3900	74	13	13	0	0	2886	CN

(Annexure contd..)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count:					Absolute Lymphocytes per cmm	Remarks
				L%	N%	E%	M%	B%		
473	4	F	5200	56	34	8	1	1	2912	CN
474	6	F	4800	51	46	2	1	0	2448	CN
475	3	F	4600	52	43	3	2	0	2392	CN
476	4½	F	5100	48	47	3	1	1	2448	CN
477	6	F	4200	64	28	6	1	1	2688	CN
478	6	F	3100	82	13	5	0	0	2542	ELG
479	8	F	3200	76	21	2	1	0	2432	ELG
480	4½	F	5100	64	31	4	1	0	3264	CN
481	3½	F	3950	68	21	10	1	0	2686	CN
482	6	F	4100	64	32	3	1	0	2624	CN
483	3	F	4800	28	70	1	1	0	1344	CN
484	6	F	3400	68	26	5	1	0	2312	CN

(Annexure contd.)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count:					Absolute Lymphocytes per cmm	Remarks.
				L%	N%	E%	M%	B%		
485	2½	F	4100	72	17	9	1	1	2952	ELG
486	3	F	5400	50	48	1	1	0	2700	CN
487	4	F	6200	28	68	3	1	0	1736	CN
488	6	F	6850	32	66	1	1	0	1822	CN
489	4	F	4200	61	28	10	1	0	2562	CN
490	4½	F	5200	60	28	11	1	0	3120	CN
491	8	F	4400	64	28	7	1	0	2816	CN
492	6	F	4100	76	21	2	0	1	3116	ELG
493	4½	D	3900	72	25	2	1	0	2808	ELG
494	5	F	4100	73	25	2	0	0	2993	ELG
495	6	F	3800	78	16	5	0	1	2964	ELG
496	3	F	4600	72	26	1	1	0	3312	ELG

(Annexure contd.,)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count					Absolute Lymphocytes per cmm	Remarks
				L%	N%	E%	M%	B%		
497	4	F	3950	76	20	4	0	0	3002	ELG
498	4	F	4200	77	21	2	0	0	3234	ELG
499	3	F	3850	74	23	2	1	0	2849	ELG
500	3	F	4200	71	27	1	0	1	2982	ELG
501	3	F	4800	69	28	2	1	0	3312	CN
502	3½	F	4200	72	25	2	1	0	3024	ELG
503	2½	F	5100	66	31	2	0	1	3366	CN
504	3	F	5100	64	33	2	1	0	3264	CN
505	2½	F	4900	66	31	1	1	1	3234	CN
506	3	F	4200	68	30	1	0	1	2856	CN
507	3½	F	4250	66	31	2	1	0	2805	CN
508	3	F	4100	67	30	2	1	0	2747	CN

(Annexure contd..)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cum	Differential count					Absolute Lymphocytes per cum	Remarks.
				L%	N%	E%	M%	B%		
509	3	F	4400	66	32	1	1	0	2904	CN
510	6	F	3950	67	30	2	1	0	2646.50	CN
511	3	F	3800	78	21	0	1	0	2969	ELG
512	3	F	4950	76	22	2	0	0	3762	ELG
513	6	F	3900	74	24	1	1	0	2886	ELG
514	3½	F	3600	72	24	2	1	1	2592	CN
515	3	F	4400	69	28	2	0	1	3036	CN
516	3	F	4100	69	30	1	0	0	2829	CN
517	6	F	4400	68	29	2	1	0	2992	CN
518	2½	F	3950	78	20	1	1	0	3081	ELG
519	3	F	4200	74	24	2	0	0	3108	CN
520	3	F	4800	68	30	2	0	0	3264	CN

(Annexure contd..)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count					Absolute Lymphocytes per cmm	Remarks
				L%	N%	E%	M%	B%		
521	3	F	5200	58	30	12	0	0	3916	CN
522	3	F	4800	61	32	6	1	0	2923	CN
523	11	F	5100	67	30	2	1	0	3417	Cn
524	5	F	4200	74	24	2	0	0	3108	ELG
525	3	F	4100	70	22	7	1	0	2870	CN
526	3	F	4400	71	22	5	1	1	3124	CN
527	6	F	3900	72	26	1	1	0	2808	CN
528	3	F	4100	78	20	0	1	1	3198	ELG
529	6	F	4200	76	22	1	0	1	3192	ELG
530	5	F	3900	76	20	4	0	0	2964	ELG
531	5½	F	4800	69	28	2	1	0	3312	CN
532	5	F	3950	80	19	1	0	0	3160	ELG

(Annexure contd..)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count					Absolute Lymphocytes per cmm	Remarks.
				L%	N%	E%	M%	B%		
533	6	F	4200	74	22	2	1	1	3108	ELG
534	4	F	3800	76	23	1	0	0	2888	ELG
535	4½	F	4100	80	19	1	0	0	3280	ELG
536	4	F	3950	79	19	0	1	1	3120.50	ELG
537	6	F	4100	76	21	2	1	0	3116	ELG
538	5	F	3800	81	17	0	1	1	3078	ELG
539	5	F	3600	78	20	1	1	0	2808	ELG
540	4	F	4800	62	25	2	1	0	2976	CN
541	6	F	5800	36	58	4	1	1	2088	CN
542	4½	F	5600	52	43	4	1	0	2912	CN
543	6	F	4100	79	19	1	1	0	3239	ELG

(Annexure contd..)

HAEMATOLOGICAL VALUES OF ANIMALS SCREENED FOR THE DIAGNOSIS OF BOVINE LEUKAEMIA

Sl. No.	Age years	Sex	TLC per cmm	Differential count					Absolute Lymphocytes per cmm	Remarks
				L%	N%	E%	M%	B%		
544	7	F	5200	68	27	4	1	0	3536	CN
545	6	F	4200	69	24	6	1	0	2898	CN
546	6	F	5200	42	56	1	1	0	2184	CN
547	5	F	5400	52	45	2	1	0	2808	CN
548	7	F	4600	56	42	1	1	0	2576	CN
549	4½	F	5200	58	39	2	0	1	3016	CN
550	4½	F	4200	66	32	2	0	0	2772	CN

(Annexure concl..)

INCIDENCE OF LEUKAEMIA AND LEUKAEMOID REACTIONS IN CATTLE IN KERALA

BY

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ABSTRACT OF A THESIS

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ABSTRACT

The present study was taken up to investigate the incidence of leukaemia and leukaemoid reactions in cattle in Kerala, utilising 550 animals from selected private and Government farms and Veterinary institutions of the State. For the haematological diagnosis Benedixen's key was followed. The haematological values of all the animals examined fell within the category of normal animals and it could be said that bovine leukaemia was not encountered in the bovine population screened in the present investigation. None of the samples showed any evidence of leukaemoid reactions. A few animals with enlarged lymphnodes showed lymphocyte per cent above 80, but their absolute lymphocyte values were within the normal range. The lymphocytes in the blood smears did not show any cytological abnormalities to indicate neoplastic property.