PREVALENCE, HAEMATOLOGY AND TREATMENT OF STRONGYLOSIS IN GOATS

By

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THESIS

Submitted in partial fulfilment of the requirement for the degree of

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DECLARATION

I hereby declare that this thesis entitled **"PREVALENCE, HAEMATOLOGY AND TREATMENT OF STRONGYLOSIS IN GOATS"** 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 the thesis, entitled **"PREVALENCE, HAEMATOLOGY AND TREATMENT OF STRONGYLOSIS IN GOATS"** is a record of research work done independently by **Dr. Arun Shaju, T.,** 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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We, the undersigned members of the Advisory committee of **Dr. Arun Shaju, T.,** a candidate for the degree of Master of Veterinary Science in Preventive Medicine, agree that the thesis entitled **"PREVALENCE, HAEMATOLOGY AND TREATMENT OF STRONGYLOSIS IN GOATS"** may be submitted by Dr. Arun Shaju, T., in partial fulfilment of the requirement for the degree.

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ARUN SHAJU, T.

Dedicated to
My Parents and Teachers

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Introduction

1. INTRODUCTION

In animal production system, the functional value of small ruminants as renewable resources for poor people is widely recognized. Goats have a significant impact on rural health and the nutrition of several million people especially those below the poverty line in India. Apart from their main function in the production of meat, milk, fiber and skin, they also have value for transport, sport, prestige, employment, rural nutrition and as experimental animals. They are also valuable for production of blood (for serum), fertilizer (blood, bone and dung) and horns (Devendra, 1981). Goat farming should thus be encouraged as a potent source of occupation, income and also a livelihood for a large number of small and marginal farmers and also landless labourers.

Parasitic infections especially with gastro-intestinal nematodes is the most common problem affecting the health of goats. They pose a potential source of economic loss for the goat husbandry in India (Saha *et al.*, 1996).

In this context, this study was intended to help in assessing the prevalence and magnitude of gastro-intestinal helminthiasis especially strongylosis in Kerala.

Though the gastro-intestinal helminthiasis is not causing much loss due to heavy mortality, indirect losses due to production loss and due to other diseases are common. One of the main effect of helminthiasis is anaemia and

subsequent susceptibility to other diseases. In order to assess the effect of strongylosis in goats, haematological studies were also aimed in this project.

A variety of anthelmintics with different modes of action are available and used regularly by the farmers. But only little work has been carried out in Kerala, on their efficacy in goats. This work tries to evaluate the efficacy of different anthelmintics, so as to throw some light on the therapeutic measures that may yield effective and economical results.

Hence the present study was undertaken with following objectives:

1. To study the prevalence of gastro-intestinal helminthiasis especially strongylosis in goats.

2. To understand the haematological changes in strongylosis of goats.

3. To find the efficacy of Ivermectin, Doramectin, Fenbendazole, Levamisole and Closantel in the treatment of strongylosis in goats.

2. REVIEW OF LITERATURE

2.1 Prevalence of gastro-intestinal parasites in goats

2.1.1 Kerala

Sathianesan and Peter (1970) recorded *Haemonchus contortus, Trichostrongylus colubriformis, T. axei, Strongyloides papillosus, Capillaria caprae, Bunostomum trigonocephalum, Gaigeria pachyscelis, Oesophagostomum asperum, O. columbianum, O. quilons and Trichuris globulosa* in indigenous goats of Kerala.

Rajamohan and Paily (1971) observed an incidence of 68.7 per cent Strongylosis among goats brought to Veterinary Hospital, Trichur during 1966-'69.

Incidence of *Haemonchus contortus* was 75 per cent in indigenous goats and 67.3 per cent in farm bred goats of Kerala. Overall incidence rate of gastro-intestinal nematodes was 97.8 per cent in indigenous goats and 89 per cent in farm reared goats (Sathianesan and Peter, 1971).

An autopsy survey on causes of goat mortality was carried out in department of Pathology, College of Veterinary and Animal Sciences, Mannuthy during a 11 year period from 1965 to 1975. Among the 454 carcasses examined, parasitic gastro-enteritis was the cause of death in 6.83 per cent cases. Coccidiosis accounted for 20.2 per cent of mortality. Incidence was

high in kids and 90.09 per cent of mortality in kids below three months was due to coccidiosis (Rajan *et al.*, 1976).

Coccidiosis was the reason for 1.7 per cent of deaths among kids, belonging to All India Co-ordinated Research Proejct (AICRP) on goats for milk production, at the College of Veterinary and Animal Sciences, Mannuthy (Manomohan *et al.*, 1979).

Jacob and Pillai (1988) found that the overall prevalence of *Eimeria* spp. in 786 samples collected from goats of Kerala Agricultural University Goat farm; Government Goat farm, Kommeri and goats brought to the Veterinary hospitals of Kerala Agricultural University during August 1984 to February 1987.was found to be 63.23 per cent.

A survey on common nematode parasites of goats in Thrissur district was carried out by Jeyathilakan and Sathianesan (1997). Out of 200 faecal samples examined, 77.5 per cent samples were positive for gastro-intestinal nematode infection. Strongyle type of eggs were detected in 62 per cent samples. *Haemonchus contortus* was found to be the commonest species with 72.25 per cent prevalence. Infections of *Strongyloides, Trichuris* and mixed type were found to be in 35, 15.5 and 26 per cent samples respectivley.

2.1.2 India

A survey of helminthic parasites in the faeces of goats in Assam was carried out *by* Endrejat (1964). The percentage prevalence for *Haemonchus, Trichostrongylus, Oesophagostomum, Strongyloides, Moniezia, Cooperia,*

Paramphistomidae, *Fasciola*, *Trichuris* and *Bunostomum* were 56, 49, 35, 24, eight, six, five, three, two, one respectively. Coccidial oocysts were found in 32 per cent samples.

An epidemiological study of caprine haemonchosis in Orissa revealed that more than 85 per cent of goats were infected with *Haemonchus contortus* and out of which the kids below six months of age were seriously affected (Sahoo, 1984).

Faecal samples of 75 goats belonging to a private farmer in Tamil Nadu were examined by Rahumathulla *et al.* (1985). Out of this, 68 goats (90.67 per cent) were infected with helminths. Strongyle infections were recorded in 88.24 per cent samples. Tapeworm infection was seen in 41.18 per cent samples. Eggs of Amphistomes and *Fasciola* were seen in four and three samples respectively.

Coccidial enteritis was found to be the cause of 19 per cent mortality among kids of Jamunapari goats in semi-arid conditions (Vihan *et al.*, 1986).

Out of 769 faecal samples examined from goats in Maharashtra, 655 (85.18 per cent) samples were infected with parasites. Strongyle eggs were found in 50.20 per cent. Eggs of *Trichuris*, *Moniezia* and coccidial oocysts were seen in 34.98, 2.86 and 61.9 per cent samples respectively (Raote *et al.*, 1987).

Analysis of 510 intestinal tracts of goats procured from three slaughter houses of Calcutta during July to December 1987, revealed that 28.82 per cent tracts were infected with *Oesophagostomum columbianum* (Nayak *et al.*, 1988).

Yadav and Tandon (1989) in a study screened 1228 goats from a subtropical and humid zone in Meghalaya state of India, for gastro-intestinal nematodes. The overall rate of infection was 86.8 per cent. The survey recorded six nematode species with *Haemonchus contortus* (52.7 per cent), *Bunostomum trigonocephalum* (41.7 per cent), *Oesophagostomum columbianum* (38.4 per cent), *Trichuris globulosa* (24.3 per cent), *Oesophagostomum aspersum* (19.6 per cent) and *Trichuris ovis* (3.5 per cent).

Prevalence of *Schistosoma indicum* in goats of Karnal and Kurukshethra districts of Haryana were found to be 47.8 per cent (Chaudhri *et al.*, 1994).

Jithendran and Bhat (1996) found 4.1 per cent incidence of Dicrocoeliosis in goats of Himachal Pradesh.

Prevalence of helminths was recorded as 26.16 per cent in sheep of North Gujarat. *Trichostrongylus* was present in 17.83 per cent samples. *Trichuris*, Amphistomes and *Moniezia* were seen in 6.09, 0.9 and 0.18 per cent samples respectively. Liver flukes and mixed infestation were seen in 0.54 per cent samples (Momin *et al.*, 1996).

Saha *et al.* (1996) observed 75.83 per cent incidence of gastro-intestinal nematodes in goats in West Bengal. The study added that variations in the

incidence of infections of gastro-intestinal nematodes can be related to different agro climatic conditions and animal husbandry practices of regions under survey.

Out of 630 faecal samples collected randomly from goats of Assam, the prevalence rate for helminthic infection in adult and young goats were 46.01 per cent and 27.4 per cent respectively. The infection rates for nematodes were 19.25 and 8.15 per cent, for trematodes the incidence rates were 14.2 and 3.98 per cent and for cestodes, 12.56 and 15.27 per cent in adult and young goats respectively. Among these, most prevalent helminth was found to be *Haemonchus contortus* (Talukdar, 1996).

Jithendran (1998) examined 158 faecal samples randomly collected from migratory goats of Himachal Pradesh and found 100 per cent prevalence for *Strongylosis. Fasciola,* Amphistome, *Dicrocoelium, Schistosoma, Dictyocaulus, Moniezia, Trichuris* and *Eimeria* were found in 8.9, 2.5, 2.5, 0.6, 1.3, 1.3, 17.1 and 15.2 per cent of samples.

Post mortem examination of 2538 goats of Mathura region of Uttar Pradesh revealed parasitic diseases as cause of death in 12.8 per cent goats (Sharma *et al.*, 1998). Among these the causes of death were *Coccidiosis* (6.7 per cent), *Haemonchosis* (3.46 per cent), *Hydatidosis* (6.7 per cent), *Coenurosis* (1.4 per cent) and *Monieziasis* (0.15 per cent).

Parasitic infestation were the cause of death in 24.78 per cent of 456 goat carcasses examined in and around Khanapara area of Guwahati, Assam. Among this, 25.66 per cent were due to *Haemonchosis* alone (Upadhaya *et al.*, 1998).

2.1.3 Global

Fagbemi and Dipeolu (1982) examined faecal samples of 829 goats of Badeku group of villages in Nigeria and found that 29 per cent of the samples were positive for strongyle eggs. And among 645 goats of Eruwa group of villages in Nigeria, the prevalence for strongylosis was 41 per cent. The study added that low worm counts might be due to strict and sanitary management system in a traditional setting which precludes acquisition of heavy infection through grazing in confined areas.

Vercruysse (1982), observed 85 per cent prevalence of coccidial oocysts among domestic goats of Senegal.

Islam (1984) conducted faecal sample examination of 750 goats from Zambia. Out of these 404 (53.86 per cent) were found to be infected with gastro-intestinal parasites. The percentage prevalence of *Oesophagostomum columbianum, Haemonchus contortus, Moniezia expansa, Trichuris ovis, Trichuris axei, Gaigeria pachyscelis, Chabertia ovina, Strongyloides papillosus, Nematodirus spathiger, Paramphistomum cervi, Cooperia punctata*

and *Fasciola hepatica* were found to be 25.73, 23.46, 18.26, 12.13, 7.06, 6.53, 5.73, 4.26, 2.53, 1.46, 1.06 and 0.66 per cent respectively.

Faecal samples of 422 domestic goats of South East England were examined in a study conducted by Norton (1986). Out of these 98 per cent of samples revealed coccidial oocysts.

Njanja *et al.* (1987) conducted a study in goats in Kenya and recorded that *Haemonchus contortus* accounted for more than 95 per cent of total eggs present in faecal samples examined.

In Pernambuco state of Brazil, a prevalence study on gastro-intestinal nematodes of goats conducted by Charles (1989) showed that *Haemonchus, Strongyloides* and *Oesophagostomum* were the most prevalent nematodes found.

Aken *et al.* (1990) observed the pattern of nematode infestation in goat breeding farm in North-Western Sri Lanka, and reported *Haemonchus contortus* and *Oesophagostomum columbianum* as the main parasites in goats.

A prevalence survey of gastro-intestinal parasites in dairy goats in Maryland, USA, conducted during the year 1981 revealed that 94 per cent of the goats were found to be infected with at least one type of parasite. Sixty per cent of Does and 33 per cent of Kids had strongyle parasites. *Trichuris ovina* was seen in 0.9 per cent of goats. Sixty eight per cent of both Does and Kids

had coccidial oocysts in their faeces. Tape worms were seen in six per cent of adult goats' faeces (Ashraf and Nepote, 1990).

Fakae (1990) studied the epidemiology of helminth infection in West African dwarf sheep and goats of Eastern Nigeria for 12 months. The infection were due to *Haemonchus contortus* (87.1 per cent), *Trichostrongylus* spp. (63.8 per cent), metacestodes of *Taenia hydatigena* (30.2 per cent), *Oesophagostomum columbianum* (22.4 per cent), *Strongyloides* spp. (18.8 per cent), *Cooperia* spp. (17.2 per cent), *Gaigeria pachyscelis* (six per cent), *Moniezia expansa* (six per cent), *Bunostomum trigonocephalum* (4.3 per cent), *Trichuris ovis* (3.5 per cent), *Capillaria* spp. (0.9 per cent) and *Paramphistome* (0.9 per cent).

A coprological survey of 702 samples of goats from Central Spain revealed that 35.18 per cent were found to be positive for strongylid infection (Fuente and Alunda, 1992).

Postmortem examinations of sheep and goats before, during and after rainy season at three locations in South West Mauritania, recorded that *Haemonchus contortus* was the most prevalent helminth (Jacquiet *et al.*, 1992).

Fritsche *et al.* (1993) observed that 97 per cent out of 104 randomly selected sheep and goats in Gambia were infected with gastro intestinal helminths. Percentage prevalence of *Trichostrongylus colubriformis*, *Oesophagostomum columbianum*, *Haemonchus contortus*, *Strongyloides*

papillosus, Gaigeria pachyscelis, Cooperia spp., Trichuris ovis and *Moniezia benedeni* were 96, 82, 67, 55, 38, 49, 12 and 43 per cent respectively.

Coprological examination of goats from four different districts of Kenya with varying climatic conditions was conducted by Kanyari (1993). The prevalence of coccidial oocysts was found to be 84 per cent. Among males and females, prevalence was 78 per cent and 79 per cent respectively. The prevalence was 85 per cent for goats less than one year of age and 78 per cent for goats above one year of age.

A survey of gastro-intestinal parasites in South Eastern Nigerian goats showed that strongylosis was the most prevalent gastro-intestinal parasitism (73.4 per cent in wet season and 49.2 per cent in dry season). Coccidial infection was seen in 46.6 per cent animals in wet season and 16.3 per cent animals in dry season (Anene *et al.*, 1994).

Pandey *et al.* (1994) studied the prevalence of gastro-intestinal nematodes in communal land goats of Zimbabwe. The four dominant species, *Haemonchus contortus, Trichostrongylus axei, Trichostrongylus colubriformis* and *Oesophagostomum columbianum* were present in 88 to 97 per cent of animals. Other nematodes *like Strongyloides papillosus, Bunostomum* spp. and *Trichuris* spp. were seen in nine, three and 21 per cent of the goats respectively.

Mollah *et al.* (1996) examined 250 abomasi of black Bengal goats in Bangladesh and found that 210 (84 per cent) had helminth infestation caused by *Haemonchus contortus* (70.4 per cent) and *Trichostrongylus* spp. (64 per cent).

Faecal samples of 960 red sokoto (maradi) goats of Nigeria was examined by Nwosu *et al.* (1996). Strongyle type of eggs were recorded in 93 per ent of samples. Other egg types found were of *Strongyloides, Trichuris, Skrjabinema, Dicrocoelium* and *Moniezia* with 83, 44, 0.9, 2.3 and 31 per cent respectively.

Gatongi *et al.* (1998) observed a prevalence of over 90 per cent for *Haemonchus contortus* in red maasai sheep and small East African goats of Kenya. *Haemonchus contortus* was found to be contributing to 80 per cent of the total worm burden.

In a study on goats of north eastern Brazil, the most prevalent nematodes in the decreasing order were found to be *Trichostrongylus, Haemonchus* and *Oesophagostomum* (Silva *et al.*, 1998).

2.2 Effects of season on Helminthiasis in goats

Gordon (1948) opined that heaviest burden of *Oesophagostomum columbianum* generally occur during the cooler months of the year from infestations usually acquired during the warmer months.

Fifty millimetre or more rainfall and 15-27°C mean monthly temperature were found optimum for pasture transmissions of *Haemonchus* and 50 mm or more rainfall and only six to 20°C, as optimum condition for transmission of *Trichostrongylus* (Levine, 1963).

Sathianesan and Peter (1971) found no seasonal variation in the incidence of helminthiasis in goats of Kerala.

Arambulo and Moran (1981) opined that the climate in a certain locality is one of the factors that determine the type and severity of parasitic infection in grazing animals.

Vercruysse (1982) observed no seasonal fluctuation in the prevalence or oocyst output of coccidia in sheep and goats of Senegal.

A study conducted in goats of subtropical and humid zone of India suggested that the prevalence of gastro intestinal nematode infection did not show any marked difference with season or sex of the host (Yadav and Tandon, 1989).

Rahman (1991) studied on incidence of nematode species in goats from south west District of Penang Island of West Malaysia. The study concluded that in humid tropical environments, faecal egg counts were associated with total rainfall.

Kanyari (1993) opined that farmers regularly drench their goats for helminth control but not against coccidian parasites. The study added that coccidial oocysts can undergo sporulation in adverse climates causing infections equally effective in varying climatic conditions.

Seasonal incidence of gastro-intestinal nematodes of goats in West Bengal was highest in winter (79.41 per cent), moderate in monsoon (76.4 per cent) and lowest in summer (72.28 per cent) (Saha *et al.*, 1996).

Talukdar (1996) studied prevalence of helminthiasis of goats in Assam and stated that infection was highest (35.34 per cent) in summer and lowest (13.95 per cent) in winter with 23.6 per cent and 31.82 per cent in spring and autumn seasons respectively. Helminths, especially gastro-intestinal nematodes, rumen flukes, liver flukes and tape worms were seen prevalent throughout the year.

A study conducted on epidemiology of gastro-intestinal nematodes on migratory sheep and goats of Himachal Pradesh recorded high intensity of infection during June to August months (Jithendran, 1998). The study added that monsoon months makes the environment favourable for development and survival of preparasitic stages leading to increased availability of infective stages in pasture.

Incidence of Haemonchosis was higher with rainy season than in summer as recorded by Katoch *et al.* (2000) in a study conducted in goats of Mathura region.

2.3 Effect of strongylosis on blood parameters of goats

Leland *et al.* (1960) in a study recorded that the total leukocyte counts remained within normal limits in sheep infected with small stomach worms, *Trichostrongylus axei*. However a pronounced increase in total leucocytic counts were found during extreme pathogenic stage. Infection with *Haemonchus contortus* were not found to alter the circulating leucocyte picture.

Clark *et al.* (1962) observed that a blood sucking *Haemonchus contortus* can suck about 0.05 ml blood per day.

In sheep infected with 51,500 *Haemonchus contortus* larvae, haemoglobin concentration went down to about 7 g/dl blood by 18 weeks post infection (Evans *et al.*, 1963).

No significant difference in total leucocytic count was seen in sheep infected with small stomach worm *Trichostrongylus colubriformis* larvae (Gallagher, 1963).

Sahai (1966) observed a decrease in haemoglobin level, packed cell volume, total erythrocytic count and leucocytic count along with neutrophilia, monocytosis, eosinophilia and lymphopenia in kids infected with *Haemonchus contortus* and *H. bispinosus*.

Al-Quaisy *et al.* (1987) observed a decrease in PCV values following Haemonchosis in goats which was directly attributed to the blood sucking activity of the worm.

Blackburn *et al.* (1991) opined that as worm infection with *Haemonchus contortus* increases, PCV decreases in goats.

Blackburn *et al.* (1992) found a decrease in PCV in *Haemonchus contortus* infected goats.

Pralomkarn *et al.* (1994) observed no change in the values of haemoglobin and PCV in goats with gastro-intestinal nematode infection. Also no significant change in the number of eosinophils, basophils, lymphocytes and monocytes were recorded.

Parasitic infection significantly affected PCV and haemoglobin values in Thai native and crossbred goats raised in village environments of Southern Thailand. However, no effects on differential leucocytic counts were visible (Kochapakdee *et al.*, 1995).

A study on experimental *Haemonchus contortus* infection in Does revealed that haemoglobin and PCV values of infected animals were significantly lower than non infected animals except in the first fortnight post infection during which no significant difference in haemoglobin value is noticed (Howlader *et al.*, 1996).

Howlader and Huq (1997) observed that PCV values and haemoglobin values of *Fasciola gigantica* infected goats were significantly lower than non infected animals.

Howlader *et al.* (1997) observed a reduction in the number of circulating erythrocytes in growing goats following an experimental *Haemonchus contortus* infection. However, no significant influence on total leucocyte count were noticed. The study added that peripheral blood picture might be varied under different conditions in Haemonchosis.

Lan *et al.* (1998) observed a decrease in total erythrocytic counts and haemoglobin values in goats heavily infected with helminths. Leucocyte count and eosinophils were found increased whereas neutrophils decreased in number.

An increase in eosinophil count in parasitic gastroenteritis in sheep was recorded (Maiti *et al.*, 1999).

2.4 Efficacy of anthelmintics in goats

2.4.1 Ivermectin

Efficacy of Ivermectin in sheep at a dose rate of 200 μg kg^{-1} body weight administered orally was assessed by Hall *et al.* (1981). The percentage reduction in worm counts was more than 99 per cent against H*aemonchus* spp., *Trichostrongylus* spp. and *Ostertagia* spp.

Swan and Gross (1985) conducted studies to assess the efficacy of Ivermectin against induced gastro-intestinal nematode infection in goats. The dose rate was 200 μg kg^{-1} body weight. Efficacy against *Haemonchus contortus, Oesophagostomum columbianum, Ostertagia circumcincta, Strongyloides papillosus* and *Trichostrongylus colubriformis* was found to be more than 99 per cent.

Efficacy of Ivermectin at a dose rate of 0.2 mg kg^{-1} body weight administered orally was assessed against experimentally induced infection of adult *Haemonchus contortus, Ostertagia* spp., *Trichostrongylus columbriformis* and *Cooperia curticei* in goats. Five days after treatment, the drug was found to reduce the postmortem worm counts by 99 per cent (McKenna and Watson, 1987).

Njanja *et al.* (1987) conducted a study to ascertain the efficacy of Ivermectin against naturally occurring nematode infections of goats in Kenya. The efficacy approached 100 per cent for reduction in egg counts and elimination of *Haemonchus contortus*, at a dose rate of 200 μg kg^{-1} body weight administered subcutaneously.

Oral administration of Ivermectin at the dose rate of 0.2 mg kg^{-1} body weight in goats had a 100 per cent efficacy in reducing faecal egg counts, while the same dose given subcutaneously had 94 per cent efficacy only (Pearson and Rutherford, 1988).

Shastri (1989) studied the efficacy of Ivermectin in 40 goats of Maharashtra and found 97.5 per cent efficacy against *Haemonchus contortus* and *Trichostrongylus* spp. by four to five days after treatment. The dose rate was 200 μg kg^{-1} body weight by subcutaneous administration.

Black Bengal goats, naturally infected with Strongylosis were given Ivermectin at a dose rate of 200 μg kg^{-1} body weight administered subcutaneosuly. Faeal egg count reduction was found to be 100 per cent by seventh day post medication (Roy *et al.*, 1990).

Hoyt *et al.* (1992) studied the efficacy of Ivermectin against experimental infections of *Haemonchus contortus* and *Trichostrongylus colubriformis* in goats. The dose rate was 200 μg kg^{-1} body weight given subcutaneously. Efficacy based on EPG counts at five and 12 days after treatment was 99 per cent and 98.5 per cent respectively.

Ivermectin at a dose rate of 200 μg kg^{-1} body weight by subcutaneous route was found 100 per cent effective against naturally occurring gastro-intestinal nematodes of sheep (Kumar and Joshi, 1992).

Efficacy of Ivermectin at 200 μg kg^{-1} body weight administered orally in goats was evaluated on the basis of EPG count of faecal sample. The result indicated that the drug was 100 per cent effective against natural strongylosis in goats (Maiti *et al.*, 1994).

Efficacy of Ivermectin in Pashmina (cashmere) goats at a dose rate of 200 μ kg^{-1} body weight given subcutaneously was assessed by Mukherjee *et al.* (1994). The drug was found 100 per cent effective in removing nematode eggs of *Trichostrongylus, Strongyloides, Trichuris* and *Nematodirus* by ninth day post treatment.

Singh *et al.* (1994) observed a 100 per cent reduction in the output of ova by nematode worms by seventh day post treatment with Ivermectin. The drug was tried at a dose rate of 200 μg kg^{-1} body weight given subcutaneously, against natural nematode infection of sheep and goats in Punjab.

Efficacy of Ivermectin against *Haemonchus contortus, Trichostrongylus* and *Oesophagostomum* spp. was assessed in goats by Mwamachi *et al.* (1995). The drug at a dose rate of 0.2 and 0.3 mg kg^{-1} body weight administered subcutaneously was found to reduce faecal worm egg counts by 73 per cent and 92 per cent respectively.

Kumar *et al.* (1996) reported that Ivermectin was 99.8 , 98.5 , 92.5 and 93 per cent effective against *Haemonchus contortus, Trichostrongylus* spp., *Trichuris ovis*, and *Oesophagostomum* spp. respectively in sheep at a dose rate of 200 μg kg^{-1} body weight subcutaneously.

Ivermectin at a dose rate of 200 μg kg^{-1} body weight subcutaneously was found to be 100 per cent effective by fifth day against natural infections of *Strongyloides* spp., *Haemonchus* spp., *Trichostrongylus* spp.,

Oesophagostomum spp., *Trichuris* spp., *Gaigeria pachyscelis* and *Bunostomum* spp., in Black Bengal goats (Pramanik *et al.*, 1996).

Yadav *et al.* (1996) reported that Ivermectin at the dose rate of 0.2 mg kg^{-1} given subcutaneously reduced the faecal egg count in sheep by 100 per cent by 10 days post treatment.

Pramanik *et al.* (1999) recorded the efficacy of Ivermectin as 100 per cent against strongyle infections by third day post treatments. The drug was tried at the dose rate of 200 μg kg^{-1} body weight in Black Bengal goats.

2.4.2 Doramectin

Goudie *et al.* (1993) opined that Doramectin is highly effective in the treatment of economically important cattle nematodes. Adult *Dictyocaulus viviparus* and larval (L4) *Ostertagia ostertagi* were completely cleared by doses 50, 100 and 200 μg kg^{-1} body weight administered subcutaneously. Against adult *Cooperia oncophora*, the percentage efficacies were 37, 80 and 97 per cent with doses of 50, 100 and 200 μg kg^{-1} body weight respectively.

Sisodia *et al.* (1996) found 100 per cent efficacy with Doramectin against naturally occurring gastro intestinal nematodes of sheep in Rajasthan by seven days post treatment. The drug was administered subcutaneously at the dose rate of 200 μg kg^{-1}.

Doramectin at a dose rate of 0.2 mg kg^{-1} body weight administered subcutaneously to goats were found 99 and 30 per cent effective against *Strongyloides papillosus* and *Skrjabinema* sp. respectively by nine days post medication (Gonenc *et al.*, 1997).

2.4.3 Levamisole

Efficacy of Levamisole at a dose rate of 7.5 mg kg^{-1} body weight orally in sheep was assessed by Hall *et al.* (1981), by worm counts at slaughter. The percentage reduction in worm counts against *Haemonchus* spp., *Ostertagia* spp. and *Trichostrongylus* spp. were 100, 95.2 and 84.2 respectively.

Levamisole recorded an efficacy of 97 per cent at against *Haemonchus*, *Ostertagia* and *Trichostrongylus* at a dose rate of 8 mg kg^{-1} body weight orally, in feral goats of NewZealand (Kettle *et al.*, 1983).

Chaudhri *et al.* (1984) tried Levamisole hydrochloride in three forms against gastro-intestinal nematodes in sheep. The drug was tried at a dose rate of 7.5 mg kg^{-1} body weight each in powder and tablet forms, both administered orally. Also another group was given Levamisole at a dose rate of 182 mg per 30 kg body weight, administered subcutaneously. In all the cases, the drug was found to be 100 per cent effective in reducing faecal egg counts by seventh day post medication.

Guha and Banerjee (1987) tried Levamisole at a dose rate of 8 mg kg^{-1} body weight administered orally in 16 goats in West Bengal. All the goats were

naturally infected with gastro intestinal nematodes. The efficacy of drug was found to be 93.4 per cent against bursate nematodes, by seventh day post treatment, on the basis of egg count reduction.

Efficacy of Levamisole at a dose rate of 8 mg kg^{-1} body weight orally was assessed against experimentally induced infection of adult *Hemonchus contortus, Ostertagia* spp., *Trichostrongylus colubriformis* and *Cooperia curticei* in goats. Five days post treatment, post mortem worm counts recorded reduction with 99.2, 81, >99.99 and 97.8 per cent respectively (McKenna and Watson, 1987).

Levamisole, as an anthelmintic against gastro-intestinal nematode infection of goats in Brazil was assessed by Charles *et al.* (1989). The drug was drenched at a dose of 5 mg kg^{-1} body weight. Post mortem worm counts showed that the reduction is mean total worm burden was 57.4 per cent, whereas an 80.2 per cent reduction was recorded with *Haemonchus contortus* alone.

Levamisole at a dose rate of 7.92 mg kg^{-1} body weight was found to be 99 per cent effective against adult *Haemonchus contortus* and 99.7 per cent effective against adult *Trichostrongylus colubriformis* in goats (Coles *et al.*, 1989).

Yadav and Uppal (1992) tried Levamisole at a dose rate of 7.5 mg kg^{-1} body weight administered orally in goats and recorded an efficacy of 62.9 per

cent against *Haemonchus contortus* and *Trichostrongylus* spp. by ten days post treatment.

Mwamachi *et al.* (1995) tried to assess the efficacy of Levamisole in goats of Kenya. The faecal worm egg counts of *Haemonchus contortus*, *Trichostrongylus* spp. and *Oesophagostomum* spp. was assessed before treatment (day zero) and after treatment (average of day 10 and 11). The result was found to be 78 per cent and 93 per cent for dose rates of 15 and 22.5 mg kg^{-1} body weight respectively, when administered orally.

Against *Haemonchus* sp., *Trichostrongylus* sp. and *Oesophagostomum* sp. Levamisole was found to be 51.89, 78.46 and 93.20 per cent effective in goats by three, five and seven days post treatment respectively. The drug was administered intramuscularly at a dose rate of 7.5 mg kg^{-1} body weight (Pramanik *et al.*, 1996).

Sisodia *et al.* (1996) studied the anthelmintic efficacy of Levamisole hydrochloride against naturally occurring gastro intestinal nematodes of sheep in Rajasthan. The drug administered at a dose rate of 7.5 mg kg^{-1} body weight orally recorded an efficacy of 96.95 per cent by seventh day post treatment.

Yadav *et al.* (1996) reported that Levamisole at a dose rate of 7.5 mg kg^{-1} body weight administered subcutaneously reduced faecal egg counts of naturally infected goats by 99 per cent. The study was carried out in goats of Bareilly district of Uttar Pradesh.

Pramanik *et al.* (1999) recorded the efficacy of Levamisole as 51.89 per cent against strongyle infections on third day post treatment. The study was carried out in Black Bengal goats of West Bengal with a dose rate of 7.5 mg kg^{-1} body weight.

2.4.4 Fenbendazole

Controlled tests on experimentally infected cattle showed that Fenbendazole was over 99 per cent effective against immature stages of *Ostertagia ostertagi, Trichostrongylus axei, Cooperia oncophora, Oesophagostomum radiatum* and *Dictyocaulus viviparus* at a dose rate of 5 mg kg^{-1} body weight (Duwel, 1979).

A field trial of Fenbendazole given orally at a dose rate of 5 mg kg^{-1} body weight in goats recorded a 100 per cent anthelmintic effect against gastro intestinal strongylids as judged by faecal egg counts (Kirsch, 1979).

Fenbendazole was tried against mixed infections with gastro-intestinal nematodes in goats by Haque *et al.* (1984). The drug was found 100 per cent effective by seventh day post medication at a dose of 5 mg kg^{-1} body weight orally.

Rahumathulla *et al.* (1985) observed 77.94 per cent and 100 per cent efficiency in removing the eggs of strongyle spp. in goats on third and fifth day respectively, by giving Fenbendazole orally, at the dose rate of 5 mg kg^{-1} body weight.

Efficacy of Fenbendazole against experimental haemonchosis in Black Bengal kids was studied by Sahoo and Misra (1988). On the basis of faecal egg count reduction by fifth day of treatment, the drug was found 100 per cent effective at the dose rate of 5 mg kg^{-1} body weight administered orally.

Efficacy of Fenbendazole in Pashmina (Cashmere) goats at the dose rate of 5 mg kg^{-1} body weight orally was assessed by Mukherjee *et al.* (1994). The drug was found 100 per cent effective against *Strongyloides*, *Trichuris* and *Nematodirus* and 94.16 to 100 per cent effective against *Trichostrongylus* by ninth day post treatment.

Singh *et al.* (1994) observed an efficacy of 99.11 per cent in reducing mean EPG by seventh day post treatment by using Fenbendazole at a dose rate of 5 mg kg^{-1} body weight orally against natural nematode infections in sheep and goats of Punjab.

An efficacy of 25 per cent was recorded by Mwamachi *et al.* (1995) by using Fenbendazole at the dose rate of 5 mg kg^{-1} body weight against *Haemonchus contortus*, *Trichostrongylus* spp. and *Oesophagostomum* spp.

Shahardar *et al.* (1995) observed that Fenbendazole at the dose rate of 7.5 mg kg^{-1} body weight was found 100 per cent effective against strongyles by day two post treatment in Kashmiri deer (Hangul).

Fenbendazole at 5 mg kg^{-1} body weight when given orally to 20 sheep naturally infected with gastro-intestinal nematodes was found to be 99.23 per

cent effective as revealed by faecal examination and faecal cultures on seventh day post treatment (Sisodia *et al.*, 1996).

Yadav *et al.* (1996) reported that Fenbendazole at a dose rate of 5 mg kg^{-1} body weight given orally, reduced faecal egg counts of naturally infected goats by 50 per cent.

2.4.5 Closantel

Closantel was found to be very effective in sheep, against *Haemonchus contortus* at a dose rate of 7.5 mg kg^{-1} body weight (Dash, 1986).

Under field conditions in a tropical environment of Papua New Guinea Closantel at an oral dose of 7.5 mg kg^{-1} body weight gave virtually complete protection against *Haemonchus contortus* for atleast four weeks in sheep (Owen, 1988).

Uppal *et al.* (1992) observed that Closantel at a dose rate of 10 mg kg^{-1} body weight could bring 100 per cent reduction in faecal egg counts in goats naturally infected with *Haemonchus contortus.*

Closantel at a dose rate of 10 mg kg^{-1} body weight was found to be 99.9 per cent and 100 per cent effective in reducing faecal egg count by day seven and 14 post treatment respectively. The drug was tried in kids against natural infections of *Haemonchus contortus* (Yadav *et al.*, 1992).

Uppal *et al.* (1993) recorded 100 per cent efficacy with Closantel against Levamisole resistant *Haemonchus contortus* in goats at a dose rate of 10 mg kg^{-1} body weight.

Dorny *et al.* (1994) found 100 per cent efficacy with Closantel in goats of Peninsular Malaysia against natural infection of *Haemonchus contortus* at a dose rate of 5 mg kg^{-1} body weight.

Faecal worm egg counts of *Haemonchus contortus*, *Trichostrongylus* spp and *Oesophagostomum* spp. were reduced by 48 per cent by day 11 following a treatment of Closantel at a dose rate of 5 mg kg^{-1} body weight in sheep (Mwamachi *et al.*, 1995).

Closantel was observed to be 100 per cent effective against experimental infections of *Haemonchus contortus* in goats. The drug was tried at the dose rate of 10 mg kg^{-1} body weight orally (Yadav *et al.*, 1995).

Closantel at 10 mg kg^{-1} body weight orally was found 99 per cent effective against infections of *Haemonchus contortus* in sheep (Yadav *et al.*, 1996).

2.5 Control of parasitic diseases

Pout (1969) opined that many coccidial oocysts were normally removed from the epizootiologic cycle by complete dryness, exposure to direct sunlight and high temperature.

Control systems of helminths could either depend on anthelmintics alone or integrate anthelmintics with grazing management. Use of anthelmintics could be for curative purposes, or strategic approach, treating at specific times or suppressive drenching at regular intervals. Occasional curative treatment was better than suppressive drenching for delaying resistance development (Prichard *et al.*, 1980).

Barragry (1984) suggested slow rotation of anthelmintics with different chemical groups where the alteration must occur between generation interval of parasites. The study added that reinfestation after dosing due to incorrect management practices was still the common cause of worm control problem and should not be mistakenly interpreted as anthelmintic resistance.

LeJambre (1984) suggested that increased stocking rates could result in increased nematode burdens in Angora goats.

Healthy kids could support heavy infection with mixed species of coccidia, but stress caused by changes in food and surroundings, travel and regrouping, adverse weather and weaning could precipitate disease (Norton, 1986).

Owen (1988) opined that all animals grazing together should be treated and kept in the same area for as long as possible in order to obtain the maximum benefit in pasture cleanliness from the use of a drug with sustained activity.

Hoyt *et al.* (1992) was of the opinion that as anthelmintic resistance or anthelmintic ineffectiveness become more prevalent, control of gastro-intestinal parasites will become more difficult.

To limit the number of anthelmintic treatments and consequent slow down of the resistance development, alternative control strategies based on epidemiological studies and use of novel forms of drugs like sustained anthelmintic action or of sustained release devices should be developed. A sustained activity not only prevents reinfection but also dramatically reduce pasture contamination (Dorny *et al.*, 1994).

To prevent, or at least delay the development of anthelmintic resistance, there was an urgent need to formulate sustainable endoparasite worm control measures that do not rely entirely on anthelmintics, to evaluate the efficacies of available anthelmintics regularly and to make farmers aware that high frequency of treatment, underdosing and continuous use of one anthelmintic group will predispose to rapid development of anthelmintic resistance (Mwamachi *et al.*, 1995).

Materials and Methods

3. MATERIALS AND METHODS

The study was carried out in the Department of Veterinary Epidemiology and Preventive Medicine of College of Veterinary and Animal Sciences, Mannuthy during June 1999 to June 2000.

3.1 Materials

3.1.1 Glasswares and Chemicals

In this study, Borosil brand of glasswares, Laxbro plastics and analytical or guaranteed reagent grade chemicals were used. The materials were processed using standard methods (Hoskins, 1967) and sterilized either in hot air oven or autoclave, depending upon the materials to be sterilized.

3.1.2 Animals

A total of 782 faecal samples from goats were screened under this study for the presence of strongylosis.

3.1.2.1 Source of samples

The source of samples could be broadly categorised into three.

a. Random samples collected from goats belonging to University Goat and Sheep farm (UGSF), Mannuthy.

b. Samples randomly collected from goats brought at University Veterinary hospitals at Mannuthy and Kokkalai.

c. Samples randomly collected during various field visits.

The areas included under field study were Thrissur Municipality, Koorkenchery, Ollukkara, Arimbur, Kolazhy, Kaiparamba, Panjal, Nenmanikkara, Vallachira, Nattika, Vadanappilly panchayats of Thrissur district and Edathanattukkara panchayat of Palakkad district.

3.1.3 Collection of faecal samples

Five to ten grams of fresh faecal samples were collected from the goats in a container and were subjected to parasitological examination.

3.1.4 Collection of blood

Five ml of blood was collected in EDTA vials from those goats which came under treatment study and also from ten controls. These ten control animals were apparently healthy and their faecal samples were negative for any ova of parasites.

3.1.5 Examination of blood

3.1.5.1 Haemoglobin estimation

1. Sahli's Haemoglobinometer
2. 0.1N Hydrochloric Acid

3.1.5.2 Packed cell volume estimation (Wintrobe method)

1. Wintrobe haematocrit tube
2. Five ml syringe with long needle
3. Centrifuge with 3000 rpm capacity

3.1.5.3 Total erythrocytic count

1. Haemocytometer
2. Microscope
3. Hayem's solution

3.1.5.4 Total leucocytic count

1. Haemocytometer
2. Microscope
3. Thomas' fluid

3.1.5.5 Differential leucocyctic count

1. Wright's stain
2. Microscope
3. Immersion oil

3.1.6 Anthelmintics used in the treatment of strongylosis

1. Inj. Ivermectin▲
2. Inj. Doramectin*
3. Inj. Levamisole●
4. Tab. Levamisole✣
5. Tab. Fenbendazole ❁
6. Liq Closantel ❣

3.2 Methods

3.2.1 Examination of faecal samples

The faecal samples were examined by direct and concentration methods of centrifugation sedimentation and centrifugation floatation techniques (Bowman and Lynn, 1995). The ova of various gastro-intestinal parasites were identified as specified by Soulsby (1982).

▲IVECTIN; 1% w/v, Indian Immunologicals Ltd.

*DECTOMAX; 1% w/v; Pfizer Ltd.

●HELMONIL; 18.2% w/v; Alved Pharma andFoods Pvt. Ltd.

✣HELMONIL; 150 mg; Alved Pharma and Foods Pvt. Ltd.

❁PANACUR; 150 mg; Hoechst Roussel Vet. Pvt. Ltd.

❣ZYCLOZ; 15% w/v; Cadila Health Care Pvt. Ltd.

3.2.1.1 Direct method of examination of faecal sample

A pinhead size of faeces was mixed with little amount of water directly on a glass slide. A coverslip was applied and examined under low power (100x) of microscope.

3.2.1.2 Centrifugation sedimentation technique

One gram of faeces was thoroughly emulsified in about 10 ml of water using a mortar and pestle. This emulsion was then strained through a sieve into a petridish. Straining will remove all the coarser particles. The filtrate thus obtained was taken in a centrifugation tube and centrifuged at 1000 revolutions per minute for two minutes. The supernatant fluid was then poured off retaining only small quantity required to re-emulsify the sediment. A drop of this emulsified material was then placed on a glass slide, covered with cover glass and examined under low power (100 x) of the microscope and then with high power (400x).

3.2.1.3 Centrifugation floatation technique

One gram of faecal sample was thoroughly mixed in about 10 ml of water in a mortar and pestle. The mixture was then strained through a sieve into a petridish. The filtrate thus obtained was taken in a centrifugation tube and centrifuged at 1000 rpm for two minutes. The supernatant fluid was decanted out and the sediment was then suspended in saturated solution of common salt (Specific gravity 1.18-1.19). The tube was again centrifuged at

1000 rpm for fifteen minutes. After centrifugation, tube was kept vertically in a stand with saturated salt solution, slowly added upto the brim till a convex surface was formed. The tube was kept undisturbed for twenty minutes. After twenty minutes, a clean coverslip was applied to the surface of the fluid, removing just a drop of topmost layer of the fluid. The coverslip was then placed as a glass slide and examined under low power (100x) of microscope and then with high power (400x).

3.2.2 Counting of strongyle eggs

The faecal samples of those goats which were included under treatment study were subjected to Stoll's dilution method for counting strongyle eggs per gram (EPG) as described by Soulsby (1982).

One gram of faeces was mixed with 15 ml of water using a mortar and pestle. The mixture was then strained to remove coarser particles. Using a, glass pipette, 0.15 ml of filtrate was then taken in a glass slide. Coverslip was placed and examined under low power (100x) of microscope. The whole area was then examined and strongyle eggs were counted.

Calculation

The number of strongyle eggs counted was multiplied with 100 to obtain the strongyle eggs per gram of faecal sample.

3.2.3 Collection of blood

Blood was collected from 109 animals subjected for treatment study, on the day of treatment for the estimation of haematological parameters. Blood collected from ten control animals were also subjected for haematological studies.

The blood was collected from jugular vein. Site was clipped and properly disinfected with spirit. Five ml of blood was collected from each animal in a sterile EDTA vial using a 20 G needle. Three blood smears were also made, from each animal.

3.2.4 Examination of blood

3.2.4.1 Haemoglobin

Haemoglobin content was determined by the acid haematin method, using Sahli's haemoglobinometer (Benjamin, 1985).

3.2.4.2 Packed cell volume (PCV)

PCV were estimated as per the method described by Wintrobe (1981).

3.2.4.3 Total erythrocytic count and total leucocytic count

These parameters were determined by the method described by Benjamin (1985).

3.2.4.4 Differential leucocytic count (DLC)

Differential leucocytic count was carried out by the method elaborated by Schalm *et al.* (1975).

3.2.5 Treatment study

One hundred and nine goats which were positive for strongylosis were subjected to treatment study. Each drug was tried in a minimum of ten cases. The treatment was given as per the following table.

Group	Drug	Dose	Route of administration	No. of animals treated
I	Inj. Ivermectin	200 µg/kg bw	S/c	10
II	Inj. Doramectin	200 µg/kg bw	S/c	28
III	Inj. Levamisole	7.5 mg/kg bw	S/c	20
IV	Tab. Levamisole	7.5 mg/kg bw	Orally	20
V	Tab. Fenbendazole	5 mg/kg bw	Orally	10
VI	Liq. Closantel	10 mg/kg bw	Orally	21

3.2.6 Counting of strongyle eggs post treatment

Faecal samples of these 109 goats were again collected on third day post treatment and the strongyle eggs per gram of faeces was estimated as per the above method (Soulsby, 1982).

3.2.7 Efficacy of drug

Efficacy of anthelmentics under study was assessed using the following formula (Njanja *et al.*, 1987).

$$\text{Percentage efficacy} = \frac{\text{Mean EPG before treatment} - \text{Mean EPG after treatment}}{\text{Mean EPG before treatment}} \times 100$$

3.2.8 Statistical analysis

The haematological values from strongylosis positive and control goats were subjected to statistical analysis as per Snedecor and Cochran (1994).

4. RESULTS

Prevalence of strongylosis in goats were studied by examining the 782 faecal samples during June 1999 to June 2000. The samples were randomly collected from University goat and sheep farm, Mannuthy; University Veterinary hospitals at Mannuthy and Kokkalai and from various parts of Thrissur and Palakkad districts.

Among the 283 goats found positive for strongylosis, 109 goats were treated with various drugs, viz., Ivermectin, Doramectin, Levamisole (both parenteral and oral), Fenbendazole and Closantel. The efficacy of these drugs against strongylosis were assessed by studying the differences in strongyle eggs per gram of faeces, pre-treatment and third day post-treatment and presented in the Table 7.

Blood parameters viz. Haemoglobin, packed cell volume, total erythrocytic count, total leucocytic count and differential leucocytic count of the treated 109 goats were studied and presented in the Table 6.

4.1 Prevalence of strongylosis and other gastro-intestinal parasitism in goats

4.1.1 Overall prevalence

The results are presented in Table 1 and Fig.1.

Table 1. Overall prevalence of gastro-intestinal parasites in goats

Prevalence	Samples positive for strongyle eggs	Samples positive for other parasites					
		Eimeria	*Strongy-loides*	*Trichuris*	*Moniezia*	Amphi-stome	*Schisto-soma*
Number	283	494	132	42	21	10	2
Percentage	36.19	63.17	16.88	5.37	2.69	1.28	0.26

Out of 782 faecal samples screened during June 1999 to June 2000, 283 (36.19 per cent) samples were found positive for strongyle eggs.

Strongyloides, Trichuris, Moniezia, Amphistome and *Schistosoma* eggs were found in 132 (16.88 per cent), 42 (5.37 per cent), 21 (2.69 per cent), 10 (1.28 per cent) and two (0.26 per cent) respectively. Coccidial oocysts were also present in 494 (63.17 per cent) samples.

4.1.2 Month-wise prevalence

The results are presented in Table 2 and Fig.2.

Prevalence of strongylosis were highest during the month of September 1999 and lowest during June 2000. Incidence of Amphistome were found increased during the February month of year 2000.

Prevalence of *Eimeria* was observed as above 30 per cent throughout the year except during November 1999. Incidence of *Schistosoma* with 8.33 per

cent was noticed only during the month of August 1999. Prevalence of *Trichuris* was found to be exceeding 20 per cent only during February 2000. Highest prevalence of *Strongyloides* was recorded in the month of December, 1999 with 50.7 per cent.

4.1.3 Area-wise prevalence

The results are presented in Table 3 and Fig.3.

Kaiparamba panchayat of Thrissur district recorded highest percentage prevalence for eggs of Strongyles and *Moniezia*. Prevalence of Strongylosis were lowest in Kolazhy panchayat of Thrissur district. Presence of *Strongyloides* eggs were found highest in Edathanattukkara panchayat of Palakkad district. Incidence of Amphistome in Nattika panchayat (Thrissur district) was 8.54 per cent which was the highest compared to other areas. *Schistosoma* eggs were seen in two (0.48 per cent) samples collected from Ollukkara panchayat of Thrissur district.

4.1.4 Prevalence in goats of University goat and sheep farm, Mannuthy

The results are presented in Table 4; Figures 4 and 5. During June 1999, one hundred and forty six samples were screened from University Goat and Sheep farm. Among these 69 samples (47.26 per cent) were found positive for strongylosis. Coccidial oocysts were present in 112 (76.71 per cent) samples. *Strongyloides, Trichuris* and Amphistome eggs were found in 17 (11.64 per

cent) and eight (5.48 per cent) samples and in one (0.68 per cent) sample respectively. Nineteen samples were found negative for any parasitic ova.

During June 2000, two hundred and twenty one samples were screened and out of these 41 (18.55 per cent) samples were found positive for strongyle eggs. Coccidial oocysts were found in 182 (82.35 per cent) samples.

The incidence of strongylosis in June 1999 was found significantly higher than June 2000 ($P<0.01$).

4.1.5 Sex-wise prevalence

The results are presented in Table 5 and Fig.6.

One hundred and one samples from male goats were screened. Among these, 36 (35.64 per cent) samples were found positive for strongylosis. *Eimeria, Strongyloides, Trichuris, Moniezia* and *Schistosoma* eggs were found in 47 (47.53 per cent), 23 (22.77 per cent), seven (6.93 per cent), eight (7.92 per cent) and two (1.98 per cent) samples respectively.

Among 681 samples collected from female goats, 247 (36.27 per cent) samples were found positive for strongyle eggs. *Eimeria, Strongyloides, Trichuris, Moniezia* and Amphistome were found in 447 (65.64 per cent), 109 (16.01 per cent), 35 (5.14 per cent), 13 (1.91 per cent) and 10 (1.47 per cent) samples respectively. The incidence of *Eimeria* in females and *Moniezia* in males were found to be significantly higher than their opposite sex ($P<0.01$).

4.2 Examination of blood in strongyle infected and control group of goats

The results are presented in Table 6 and Fig.7.

4.2.1 Haemoglobin estimation

Among the strongyle positive group, the mean value for haemoglobin in blood was 11.66 ± 0.22 g/dl. The haemoglobin value for control group was 12.4 ± 0.63 g/dl of blood. The change was not significant.

4.2.2 Packed cell volume (PCV)

The mean value for PCV of infected goats were 23.9 ± 0.75 per cent which was significantly different ($P<0.05$) from the mean PCV values of control group (27.3 ± 0.89 per cent).

4.2.3 Total erythrocytic count

The mean total erythrocytic count was 11.19 ± 0.34 millions/mm^3 for strongylosis affected goats and 10.99 ± 0.70 millions/mm^3 for control goats. There was no significant difference between these values.

4.2.4 Total leucocytic count

The mean total leukocytic counts for infected and control groups were 13.99 ± 0.45 and 13.84 ± 0.79 thousands/mm^3 respectively with no significant difference between these two values.

4.2.5 Differential leucocytic count

There was no significant difference between the mean differential leukocytic count of infected and control goats, except for the eosinophil count. The percentage values for eosinophils for strongyle positive and control goats were 4.9 ± 0.26 and 3.1 ± 0.59 respectively and these were significantly different ($P<0.05$).

4.3 Comparative efficacy of drugs in treating strongylosis in goats

The results are presented in Table 7 and Fig.8.

4.3.1 Ivermectin

Ivermectin was tried in ten goats and the efficacy was found to be 92.35 per cent.

4.3.2 Doramectin

Doramectin was found to be 98.13 per cent effective against naturally occurring strongylosis in goats.

4.3.3 Levamisole (Parenteral)

An efficacy of 97.46 per cent was noticed with parenteral Levamisole against strongylosis in goats.

4.3.4 Levamisle (Oral)

Oral Levamisole was 100 per cent effective against naturally acquired strongylosis in goats at a dose rate of 7.5 mg kg^{-1} body weight.

4.3.5 Fenbendazole

Fenbendazole at a dose rate of 5 mg kg^{-1} body weight was found 94.29 per cent effective in goats.

4.3.6 Closantel

Closantel was the least effective drug with an efficacy of 86.17 per cent against naturally occurring strongylosis in goats.

The percentage efficacies of all the drugs were significantly different ($P<0.05$) with each other except between parenteral Doramectin and parenteral Levamisole.

Table 2. Month-wise prevalence of gastro-intestinal parasites in goats

Month	Number of samples screened	Sample positive for strongyle eggs		Samples positive for other parasites											
				Eimeria		*Strongyloides*		*Trichuris*		*Moniezia*		Amphistome		*Schistosoma*	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
June 1999	146	69	47.26	112	76.71	17	11.64	8	5.48	-	-	1	0.68	-	-
July 1999	58	19	32.76	24	41.38	16	27.59	8	13.79	2	3.45	1	1.72	-	-
Aug. 1999	24	6	25	8	33.33	7	29.16	3	12.5	1	4.16	-	-	2	8.33
Sept. 1999	25	15	60	8	32	-	-	5	20	-	-	-	-	-	-
Oct. 1999	19	9	47.37	11	57.89	1	5.26	-	-	-	-	-	-	-	-
Nov. 1999	53	24	45.28	11	20.75	9	16.98	1	1.89	-	-	-	-	-	-
Dec. 1999	71	39	54.93	48	67.61	36	50.7	2	2.82	8	11.27	-	-	-	-
Jan. 2000	24	8	33.33	14	58.33	6	25	3	12.5	-	-	-	-	-	-
Feb. 2000	28	12	42.86	16	57.14	7	25	6	21.43	2	7.14	6	21.43	-	-
Mar. 2000	54	17	31.48	21	38.89	18	33.33	3	5.56	6	11.11	1	18.5	-	-
April 2000	43	19	44.19	28	65.12	12	27.91	2	4.65	2	4.65	1	2.33	-	-
May 2000	16	5	31.25	11	68.75	3	18.75	1	6.25	-	-	-	-	-	-
June 2000	221	41	18.55	182	82.35	-	-	-	-	-	-	-	-	-	-
Total	782	283	36.19	494	63.17	132	16.88	42	5.37	21	2.69	10	1.28	2	0.26

Table 3. Area-wise prevalence of gastro-intestinal parasites in goats

Panchayat/ Municipality	Number of samples screened	Sample positive for strongyle eggs		Samples positive for other parasites											
				Eimeria		*Strongyloides*		*Trichuris*		*Moniezia*		Amphistome		*Schistosoma*	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Thrissur Municipality	28	13	46.43	9	32.14	6	21.43	3	10.71	3	10.71	-	-	-	-
Koorkenchery	51	18	35.29	22	43.14	14	27.45	8	15.69	1	1.96	1	1.96	-	-
Ollukkara	415	131	31.57	310	74.7	26	6.27	14	3.37	1	0.24	1	0.24	2	0.48
Arimbur	45	19	42.22	10	22.22	7	15.56	1	2.22	-	-	-	-	-	-
Kolazhy	04	-	-	-	-	1	25	-	-	-	-	-	-	-	-
Kaiparamba	25	20	80	20	80	10	40	1	4	6	24	-	-	-	-
Panjal	17	6	35.29	9	52.94	4	23.53	3	17.65	-	-	-	-	-	-
Nenmanikkara	08	5	62.5	8	100	-	-	-	-	-	-	-	-	-	-
Edathanattukkara	41	16	39.02	25	61	22	53.66	-	-	-	-	-	-	-	-
Vallachira	07	2	28.57	5	71.43	2	28.57	-	-	-	-	-	-	-	-
Nattika	82	29	35.57	37	45.12	25	30.49	9	10.98	8	9.76	7	8.54	-	-
Vadanappilly	59	24	40.68	39	66.1	15	25.42	3	5.08	2	3.39	1	1.69	-	-
Total	782	283	36.19	494	63.17	132	16.88	42	5.37	21	2.69	10	1.28	2	0.26

Table 4. Prevalence of gastro-intestinal parasites in goats of UGSF, Mannuthy during two different periods

Period	Number of samples screened	Sample positive for strongyle eggs		Samples positive for other parasites											
				Eimeria		*Strongyloides*		*Trichuris*		*Moniezia*		Amphistome		*Schistosoma*	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
June 1999	146	69	47.26[a]	112	76.71	17	11.64	8	5.48	-	-	1	0.68	-	-
June 2000	221	41	18.55[b]	182	82.35	-	-	-	-	-	-	-	-	-	-
Total	367	110	29.97	294	80.11	17	4.63	8	2.18	-	-	1	0.27	-	-

Values with different superscripts in the same column are statistically significant (P<0.01)

Table 5. Sex-wise prevalence of gastro-intestinal parasites in goats

Sex	Number of samples screened	Sample positive for strongyle eggs		Samples positive for other parasites											
				Eimeria		*Strongyloides*		*Trichuris*		*Moniezia*		Amphistome		*Schistosoma*	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Male	101	36	35.64	47	46.53[a]	23	22.77	7	6.93	8	7.92[c]	-	-	2	1.98
Female	681	247	36.27	447	65.64[b]	109	16.01	35	5.14	13	1.91[d]	10	1.47	-	-
Total	782	283	36.19	494	63.17	132	16.88	42	5.37	21	2.69	10	1.28	2	0.26

Values with different superscripts in the same column are statistically significant (P<0.01)

Table 6. Blood parameters of strongyle positive and control group of goats

Haematological parameters	Mean haematological values	
	Control goats	Infected goats
Haemoglobin (g%)	12.40 ± 0.63	11.66 ± 0.22
Packed cell volume (%)	27.30 ± 0.89[a]	23.90 ± 0.75[b]
Total erythrocytic count (10^6/mm^3)	10.99 ± 0.70	11.19 ± 0.34
Total leucocytic count (10^3/mm^3)	13.84 ± 0.79	13.99 ± 0.45
Lymphocytes (%)	60.00 ± 4.24	57.10 ± 1.25
Neutrophils (%)	35.50 ± 3.73	37.47 ± 1.25
Eosinophils (%)	3.10 ± 0.59[c]	4.90 ± 0.26[d]
Monocytes (%)	1.75 ± 0.25	1.47 ± 0.16
Basophils (%)	--	--

Values with different superscripts in the same row are statistically significant (P<0.05)

Table 7. Efficacy of drugs against strongylosis in goats

Drug	Number of animals treated	EPG before treatment (mean)	EPG on third day post treatment (mean)	Efficacy percentage
Inj. Ivermectin	10	2745	210	92.35[a]
Inj. Doramectin	28	1125	21	98.13[bg]
Inj. Levamisole	20	1180	30	97.46[cg]
Tab. Levamisole	20	1000	0	100.00[d]
Tab. Fenbendazole	10	1050	60	94.29[e]
Liq. Closantel	21	824	114	86.17[f]

Values with no common superscripts are statistically significant (P<0.05)

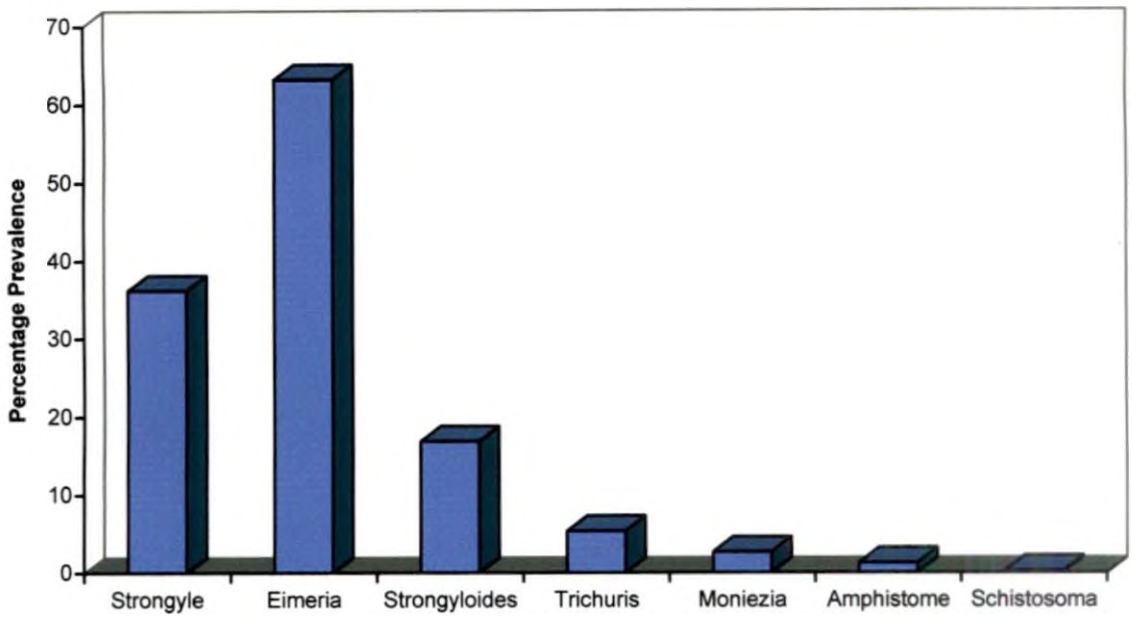


Fig. 1. Overall prevalence of gastro-intestinal parasites in goats

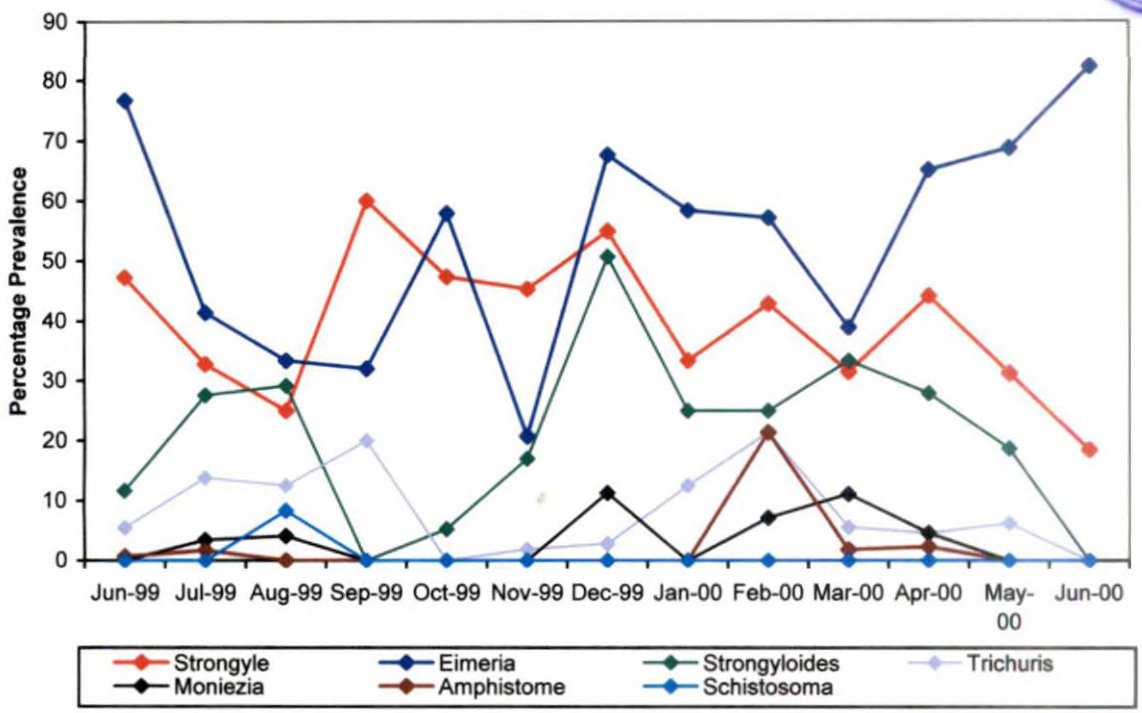
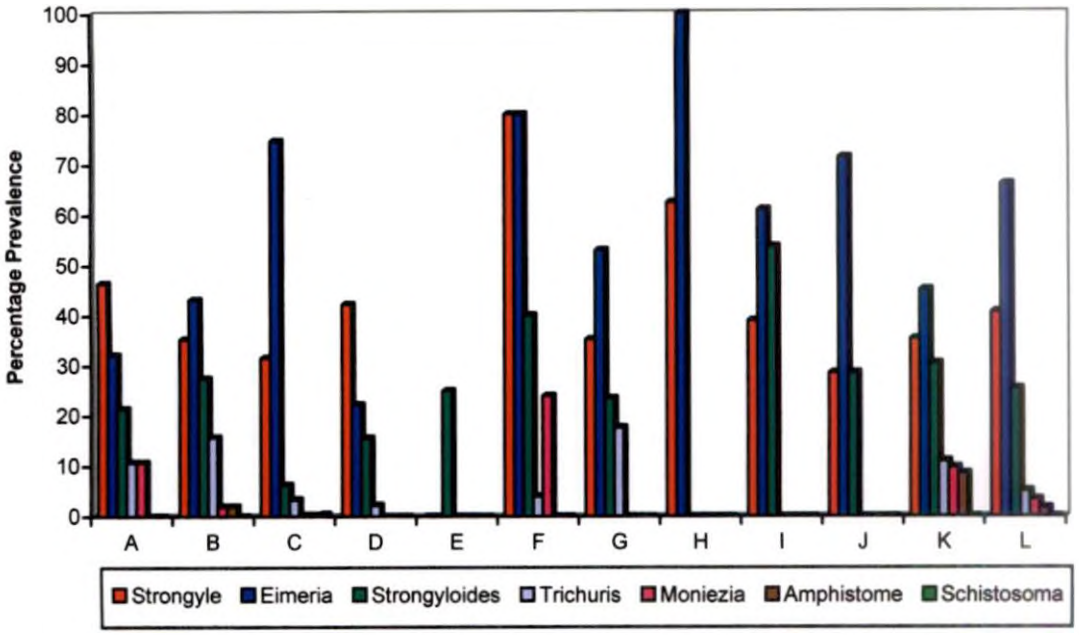


Fig. 2. Month-wise prevalence of gastro-intestinal parasites in goats



A Thrissur B Koorkenchery C Ollukkara D Arimbur
E Kolazhy F Kaiparamba G Panjal H Nenmanikkara
I Edathanattukkara J Vallachira K Nattika L Vadanappilly

Fig. 3. Area-wise prevalence of gastro-intestinal parasites in goats

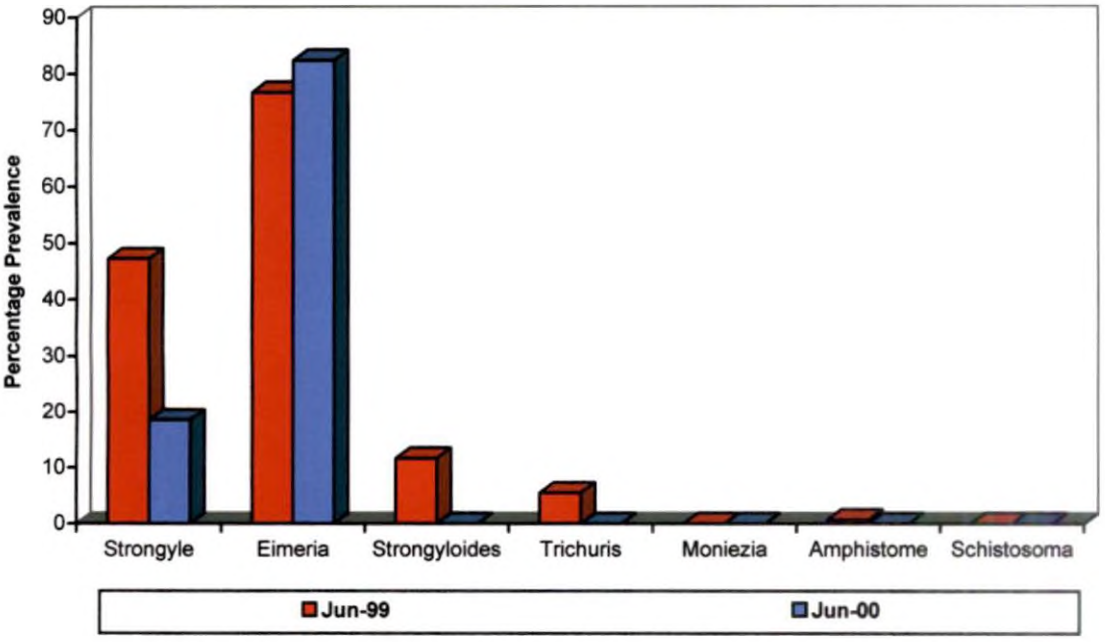


Fig. 4. Prevalence of gastro-intestinal parasites in goats of UGSF, Mannuthy during two different periods

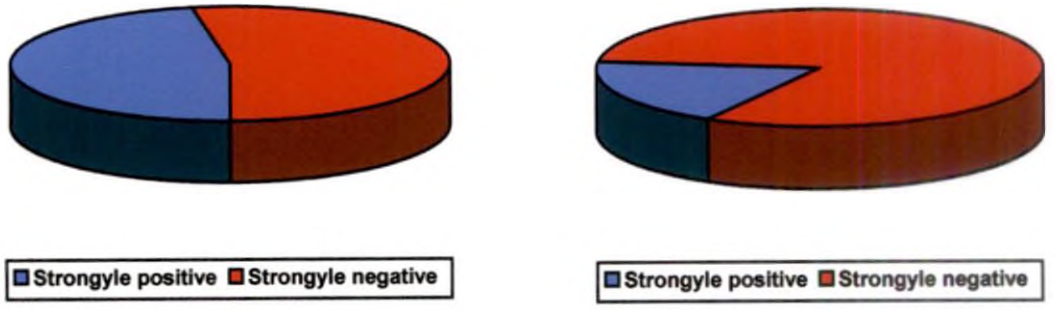


Fig. 5. Prevalence of strongylosis in goats of UGSF, Mannuthy during two different periods

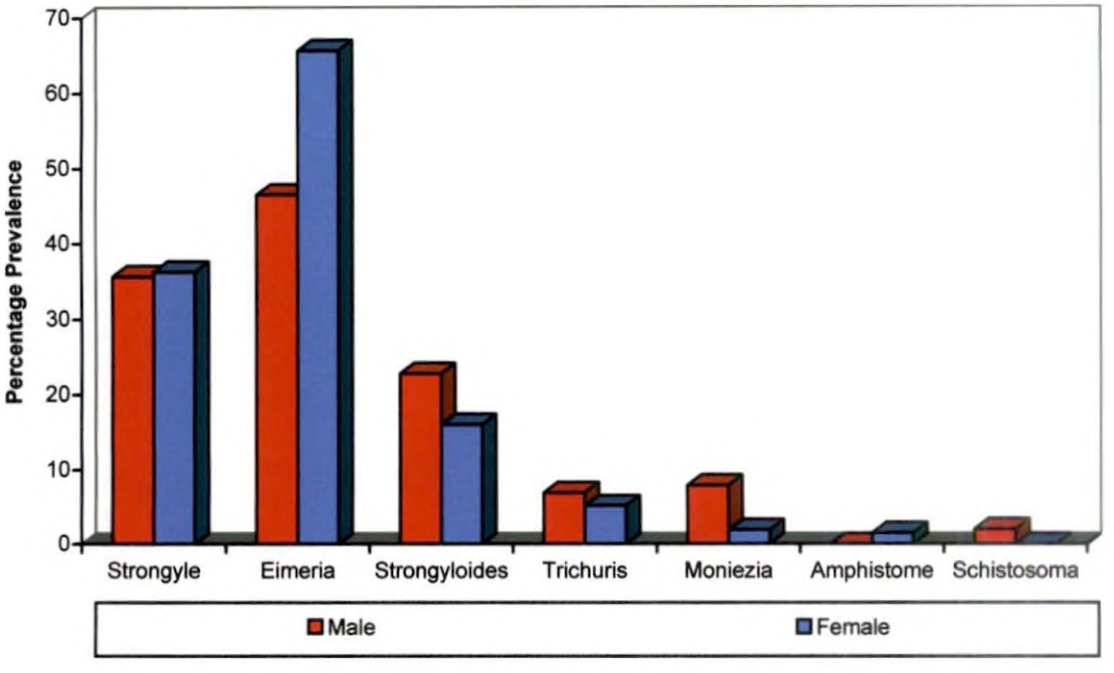
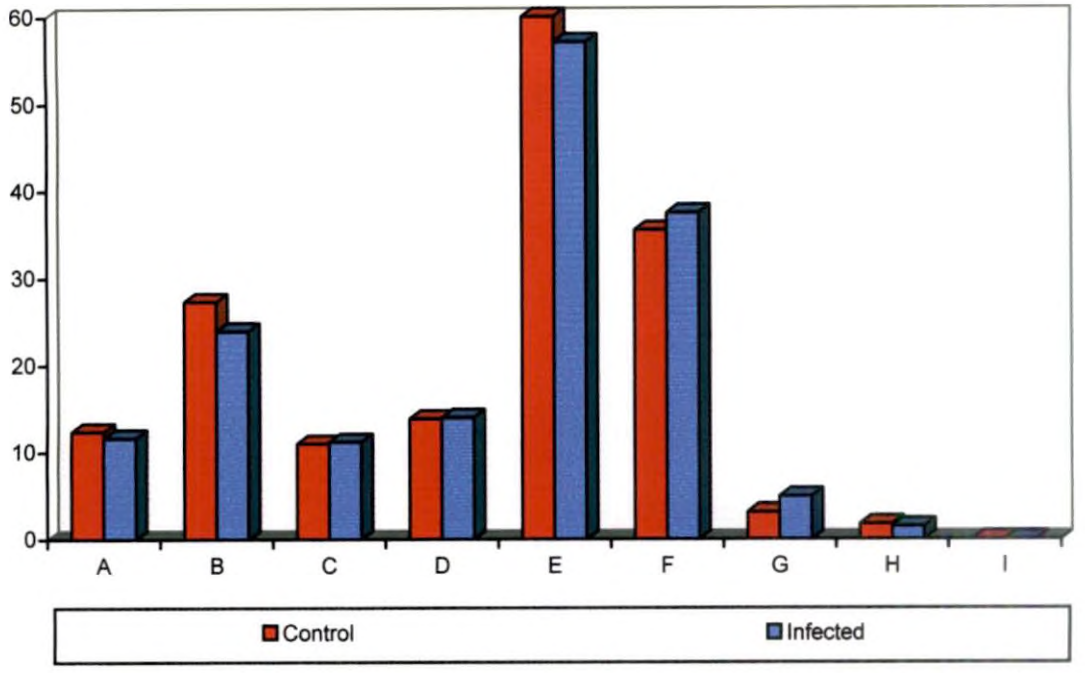
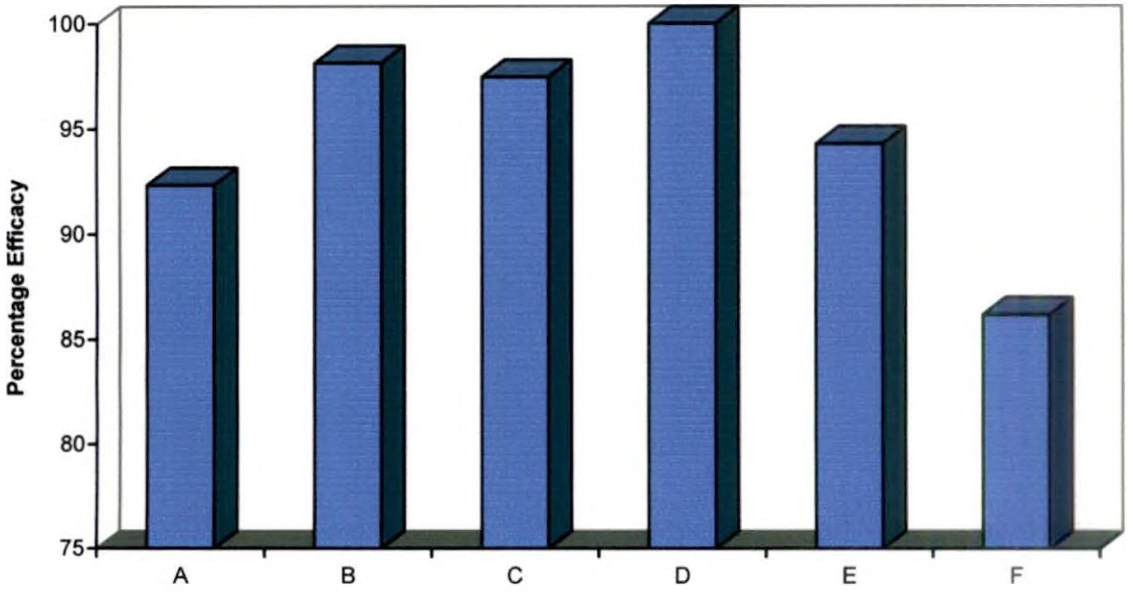


Fig. 6. Sex-wise prevalence of gastro-intestinal parasites in goats



A Haemoglobin (g%) B PCV (%) C Total RBC count (10^6/mm^3)
D Total WBC count (10^3/mm^3) E Lymphocytes (%) F Neutrophils (%)
G Eosinophils (%) H Monocytes (%) I Basophils (%)

Fig. 7. Blood parameters of strongyle positive and control group of goats



A Ivermectin B Doramectin C Levamisole (Parenteral)
D Levamisole (Oral) E Fenbendazole F Closantel

Fig. 8. Efficacy of drugs against strongylosis in goats

Plate 1.

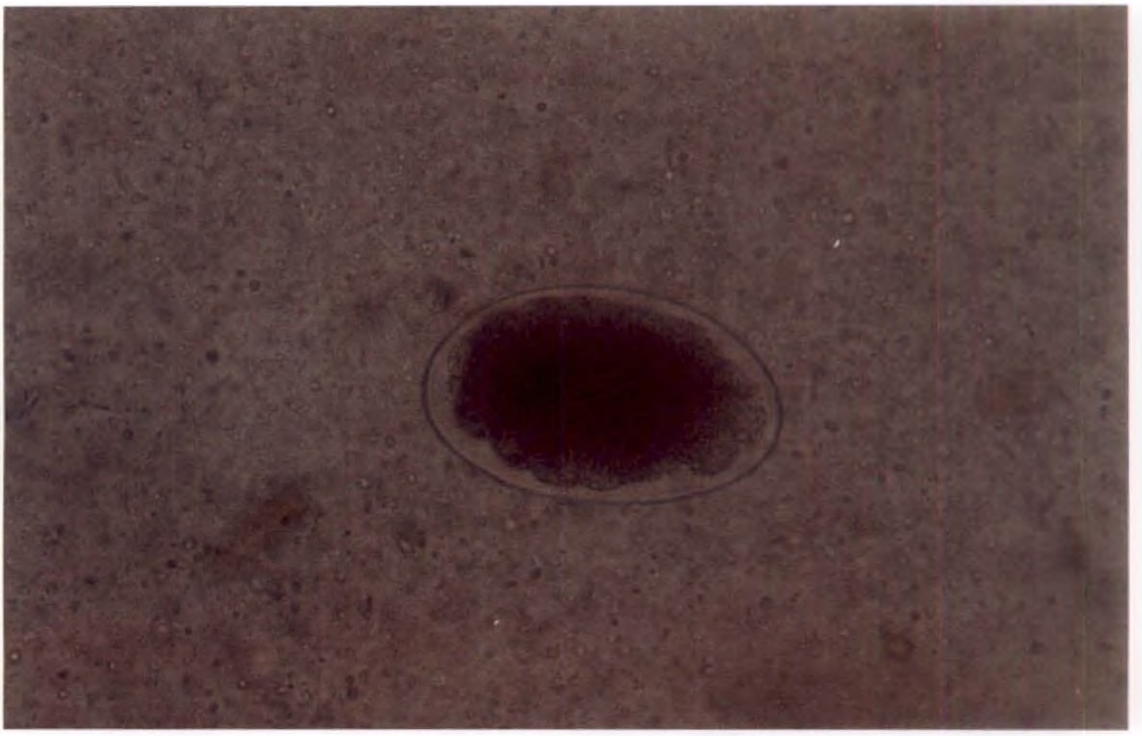
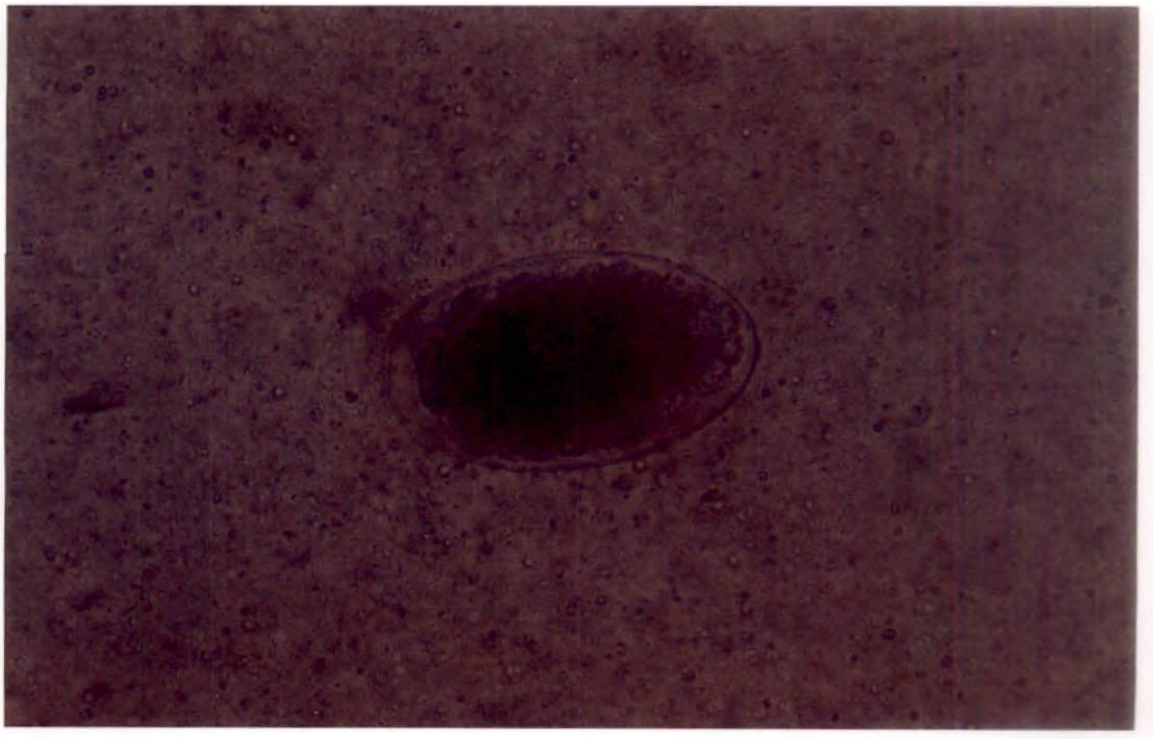


Plate 2.



Plates 1 & 2. Strongyle ova from goat (X400)

5. DISCUSSION

In the present study, seven hundred and eighty two faecal samples of goats collected from various parts of Thrissur and Palakkad districts were examined for the presence of gastro-intestinal parasites. The period of study extended from June 1999 to June 2000. Out of these, 283 samples were positive for strongyle eggs. One hundred and nine goats infected with strongyle worms were subjected to treatment study with various drug viz., Ivermectin, Doramectin, Levamisole (both parenteral and oral), Fenbendazole and Closantel. The haematological parameters of these goats were also compared with that of ten healthy goats.

5.1 Prevalence of strongylosis and other gastro-intestinal parasitism in goats

5.1.1. Overall prevalence

Out of 782 faecal samples screened, 283 (36.19 per cent) samples were found positive for strongyle eggs.

As per the earlier reports from Kerala by Rajamohan and Paily (1971), Sathianesan and Peter (1971) and Jeyathilakan and Sathianesan (1997) a higher incidence rates for strongylosis in goats were observed. Several other works from other states of India and abroad also had reported a high prevalence for

strongylosis in goats (Rahumathulla *et al.*, 1985; Anene *et al.*, 1994; Nwosu *et al.*, 1996 and Jithendran, 1998).

The percentage prevalence of *Strongyloides* and *Trichuris* type of eggs were observed as 16.88 and 5.37 per cent respectively in the present study. However, an earlier report from Kerala by Jeyathilakan and Sathianesan (1997) observed a higher prevalence of 35 and 15.5 per cent respectively. Several other workers from abroad also had observed a higher prevalence for *Strongyloides* and *Trichuris* in goats. (Fritsche *et al.*, 1993 and Nwosu *et al.*, 1996).

The present study revealed a decline in the incidence of strongylosis in goats, when compared with earlier reports from Kerala. Similar trend was observed with the prevalence of *strongyloides* and *Trichuris* also. The general awareness in the control of parasitism, among the farmers of Kerala, due to the extension work of department of Animal Husbandry could be an important factor in reducing the incidence of strongylosis in goats. Added to this were strict and sanitary management system, employed by most of the farmers coupled with grazing in confined areas, which precludes acquisition of heavy infection. The above opinion agrees with the observation made by Fagbemi and Dipeolu (1982).

Incidence rates of cestodes and trematodes were found low compared to the nematodes in the present study. This is in accordance with various works

conducted by Endrejat (1964); Islam (1984); Rahumathulla *et al.* (1985); Fakae (1990) and Jithendran, (1998).

Present study detected a 0.26 per cent prevalence for *Schistosoma* eggs in goats. These samples were obtained from an area with several ponds, which inturn might have provided a favourable environment for the survival and spread of intermediate hosts, like snails. Though Jithendran (1998) obtained results similar (0.6 per cent) to this study, Chaudhri *et al.* (1994) reported a higher incidence (47.8 per cent) among goats of Haryana, which is stated to be due to the abundance of intermediate hosts in that part of India.

Incidence of coccidial oocysts were recorded in 494 (63.17 per cent) samples, and the present finding coincides with the report of Jacob and Pillai (1988), who observed a 63.23 per cent incidence in goats of Kerala. Prevalence studies of *Eimeria* in goats by several other workers like Vercruysse (1982); Norton (1986); Raote *et al.* (1987); Ashraf and Nepote (1990) and Kanyari (1993) also enlightened similar or higher incidences. This indicates that there was not much decline, in coccidial incidence over the years. The reason could be the lack of adoption of routine prophylactic measures against *Eimeria* in goats, since the farmers are not educated about the prophylaxis against coccidiosis as is being done against helminthosis. Kanyari (1993) was also of the same opinion for the higher incidence of coccidiosis in goats.

5.1.2 Month-wise prevalence

This study could not identify any seasonal variation in the incidence of strongylosis in goats, though the incidence was highest during September 1999 and lowest during June 2000. Observations made by Yadav and Tandon (1989) on seasonal variations of gastro-intestinal nematodes were in accordance with above finding. The reason could be that the climatic conditions (moisture and temperature) favourable for survival and spread of infection, was present throughout the year, with mild variations between the different seasons.

Similarly no fluctuation was observed in the incidence of *Strongyloides*, *Trichuris* and *Moniezia* with the change of season.

Present study could not observe any seasonal influence in the incidence of *Eimeria* also. Vercruysse (1982) also made a similar observation. The reason for this could be the ability of coccidial oocysts to undergo sporulation, thus resisting adverse climatic conditions and causing infections equally effective in varying climatic conditions. Kanyari (1993) agreed to the above opinion.

Presence of *Schistosoma* eggs with a prevalence of 8.33 per cent was reported in August 1999. The monsoon months might have provided a favourable environment for the survival and spread of intermediate hosts like snails, leading to the increased availability of infective stages.

5.1.3 Area-wise prevalence

Highest prevalence of strongylosis was recorded from Kaiparamba panchayat. Most of the samples collected from this panchayat were from areas close to small streams, where the soil was found to be damp and moist. The fact that the moisture content of soil helps in the survival of strongyle eggs from dessication might explain the reason for the above finding.

The reason for higher prevalence of Amphistome noticed in Nattika panchayat might be due to the increased moisture content observed in the soil of that area. This could have provided a congenial environment for the spread and survival of the intermediate hosts like snails. Nattika panchayat happens to be a coastal area.

The reasons for the prevalence of *Schistosoma* in the Ollukkara panchayat might be due to the presence of several ponds in that area. This could have provided a congenial environment for the spread and survival of the intermediate hosts like snails.

5.1.4 Prevalence in goats of University goat and sheep farm, Mannuthy

The incidence of strongyles were significantly lower ($P<0.01$) in June 2000, than June 1999. This may be due to the introduction of a new schedule of deworming using recent anthelmintics at University goat and sheep farm, Mannuthy during the year 2000. For the same reason the incidence of other

gastro-intestinal helminths were not observed in this farm during the latter period.

5.1.5 Sex-wise prevalence

Prevalence of strongyles were almost same with both males and females. Yadav and Tandon (1989) also could not find any relationship between the presence of a particular species and sex of the host. There was significant increase ($P<0.01$) in the incidence of coccidial oocysts among females and *Moniezia* eggs among males when compared to their opposite sex. Kanyari (1993) observed almost same prevalence for coccidial oocysts among the both sexes of goats.

5.2 Examination of blood in strongyle infected and control group of goats

5.2.1 Haemoglobin estimation

The difference in the mean values of haemoglobin between control and infected group were found to be non significant.

Reports by Sahai (1966), Kochapakdee *et al.* (1995) and Lan *et al.* (1998) were of the view that there will be significant lowering of haemoglobin values in goats when infected with gastro-intestinal helminths.

However, Pralomkarn *et al.* (1994) supported the findings of the present study. A possible explanation for this might be that the degree of infections

were too low to cause any significant lowering of the level of haemoglobin. This was in accordance with the opinion of Howlader *et al.* (1996).

5.2.2. Packed cell volume (PCV)

The mean values of PCV of infected goats were found significantly lower ($P<0.05$) than the control group. Various other workers like Sahai (1966), Al-Quaisy *et al.* (1987), BlackBurn *et al.* (1992); Kochapakdee *et al.* (1995) and Howlader *et al.* (1996) supported the above finding. The reason could be attributed to the blood sucking activities of strongyle worms. The difference in the trends with haemoglobin and PCV as observed in the present study was explained by report of Kochapakdee *et al.* (1995) which stated that the parasitic infection affects PCV initially and takes three more weeks to show its effect on haemoglobin.

5..2.3 Total erythrocytic count

Present study found no significant difference in the mean values of total erythrocytic count between strongylosis affected and control animals.

Howlader *et al.* (1997) observed that RBC count of haemonchosis affected animals did not differ significantly from control animals if the worms were in the developmental stage. So in the present study the amount of blood lost due to by strongylosis might be too small to be reflected in the peripheral blood picture.

5.2.4 Total leucocytic count

Results of this study did not show any significant difference in the mean total leucocytic count between strongylosis affected and control animals.

These findings were in agreement with results observed by Howlader *et al.* (1997).

The reason might be that the degree of infections in the present study were too low to evoke WBC response, which was supported by Howlader *et al.* (1997).

5.2.5 Differential leucocytic count

Except for a significant increase ($P<0.05$) in mean values of eosinophils, mean values of other blood cells viz., neutrophils, lymphocytes, basophils and monocytes showed no difference between control and infected groups. The increase in eosinophil count due to parasitism was observed by workers like Sahai (1966) and Lan *et al.* (1998) also. However Kochapakdee *et al.* (1995) reported no effect in differential leucocytic count due to parasitism.

5.3 Comparative efficacy drugs in treating strongylosis in goats

5.3.1 Ivermectin

Ivermectin as an anthelmintic against naturally acquired strongylosis was found 92.35 per cent effective. Higher efficacies of Ivermectin were

observed by Shastri (1989), Roy *et al.* (1990), Pramanik *et al.* (1996) and Pramanik *et al.* (1999) in strongylosis.

5.3.2 Doramectin

Efficacy of Doramectin against strongylosis was recorded 98.13 per cent in this study. Sisodia *et al.* (1996) observed a higher efficacy against ovine gastro-intestinal nematodes with Doramectin.

5.3.3 Levamisole

For Levamisole administered parenterally, present study observed an efficacy of 97.46 per cent. Efficacies higher than this were reported by Yadav *et al.* (1996) whereas Pramanik *et al.* (1996) observed a lower efficacy for parenteral Levamisole.

An efficacy of 100 per cent was seen with Levamisole as an anthelmintic against naturally occurring strongylosis when administered orally. Similar observations in sheep were made by Hall *et al.* (1981) and Chaudhri *et al.* (1984). However, Yadav and Uppal (1992) reported a lower efficacy in goats with Levamisole when given orally.

Efficacy of orally administered Levamisole was found to be significantly higher ($P<0.05$) than parenterally administered Levamisole as an anthelmintic against caprine strongylosis. Chaudhri *et al.* (1984) observed no

difference in efficacy between oral and parenteral administration of Levamisole in sheep.

5.3.4 Fenbendazole

Fenbendazole was found 94.29 per cent effective against naturally occurring strongylosis of goats in the present study.

Higher efficacies of Fenbendazole against gastro-intestinal nematodes of goats were reported by Kirsch (1979), Sahoo and Misra (1988) and Singh *et al.* (1994). However, Rahumathulla *et al.* (1985) observed a lower efficacy in goats by third day post medication.

5.3.5 Closantel

Orally administered Closantel was found least effective against strongylosis of goats in the present study.

However higher percentages of efficacies with Closantel were reported by Uppal *et al.* (1992), Yadav *et al.* (1992), Uppal *et al.* (1993), and Yadav *et al.* (1995).

From the above results, following conclusions are made.

The three drugs which had an anthelmintic efficacy above 95 per cent were Levamisole (orally), Doramectin and Levamisole (parenterally). Though the efficacy of Doramectin was slightly higher than parenteral Levamisole, the

difference was not significant. Hence considering the cost and availability factors, Levamisole (Parenteral) can be very well recommended above Doramectin. But then, Levamisole (orally) not only registered a cent per cent efficacy in the present study, but also it is cheaper and easy to administer. Hence there should be no doubt in recommending Levamisole orally over and above all other anthelmintics. Meanwhile this study emphasises on the use of Fenbendazole also, considering the wide safety of margin and the cost factor which is comparable with Levamisole.

Summary

6. SUMMARY

Prevalence of strongylosis in goats were studied by examining 782 faecal samples during June 1999 to June 2000. These samples were randomly collected from University goat and sheep farm, Mannuthy; University Veterinary Hospitals at Mannuthy and Kokkalai and from various parts of Thrissur and Palakkad districts.

Among the 283 goats found positive for strongylosis, 109 goats were treated with different drugs, viz., Ivermectin, Doramectin, Levamisole (both parenteral and oral), Fenbendazole and Closantel. The efficacy of these drugs were assessed by studying the difference in strongyle eggs per gram of faeces, pre-treatment and third day post-treatment.

Blood parameters viz., haemoglobin, packed cell volume, total erythrocytic count, total leucocytic count and differential leucocytic count of the 109 goats under treatment study were estimated.

Out of 782 faecal samples screened, 283 (36.19 per cent) samples were found positive for strongyle eggs. *Strongyloides*, *Trichuris*, *Moniezia*, ,Amphistome and *Schistosoma* eggs were found in 132 (16.88 per cent), 42 (5.37 per cent) , 21 (2.69 per cent), 10 (1.28 per cent) and two (0.26 per cent) samples respectively. Coccidial oocysts were also present is 494 (63.17 per cent) samples.

No seasonal influence was observed in the prevalence of strongylosis in goats. Similar trend was noticed with the incidence of *Strongyloides*, *Trichuris*, *Moniezia* and *Eimeria* also. *Schistosoma* was reported during the month of August 1999.

Higher prevalence of strongylosis was seen in Kaiparamba panchayat of Thrissur district. Prevalence of Amphistome was found higher in Nattika panchayat of Thrissur district. *Schistosoma* eggs were detected from Ollukkara panchayat of Thrissur district.

There was significant decrease in the incidence of caprine strongylosis in University goat and sheep farm, during June 2000, when compared to June 1999. Also no influence of sex was observed on the prevalence of strongylosis in goats.

On blood examination of strongyle positive goats, no significant difference was observed with control animals on mean values of haemoglobin, total erythrocytic count, total leucocytic count, lymphocytes, neutrophils, monocytes and basophils. However significant change ($P<0.05$) was noticed in mean values of PCV and eosinophils between strongylosis affected and control goats.

While comparing the efficacy of drugs, Levamisole (orally) was found most effective with cent per cent result. Closantel was the least with 86.17 efficacy against naturally occurring strongylosis in goats. Ivermection,

Doramectin, Levamisole (parenteral) and Fenbendazole recorded efficacies of 92.35, 98.13, 97.46 and 94.29 per cent respectively. Orally administered Levamisole was found superior to parenterally administered Levamisole in efficacy against naturally acquired strongylosis in goats.

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PREVALENCE, HAEMATOLOGY AND TREATMENT OF STRONGYLOSIS IN GOATS

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ABSTRACT OF A THESIS

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ABSTRACT

Prevalence of strongylosis in goats were studied by examining 782 faecal samples collected during June 1999 to June 2000. Strongylosis was present in 283 (36.19 per cent) goats. No seasonal influence on the prevalence of strongylosis was observed. Similarly infections with *Strongyloides*, *Trichuris*, *Moniezia* and *Eimeria* were also found in all seasons.

Kaiparamba panchayat of Thrissur district recorded the highest prevalence for strongylosis.

A significant decrease ($P<0.01$) in the incidence of caprine strongylosis in University goat and sheep farm, Mannuthy was noticed during June 2000, when compared to June 1999. No influence of sex was observed on the prevalence of strongylosis in goats.

Haematological examination of strongyle infected goats, revealed a significant change ($P<0.05$) in the mean values of PCV and eosinophils, when compared to that of control goats.

Levamisole given orally, was found most effective (100 per cent) while Closantel was least effective (86.17 per cent) against naturally occurring strongylosis in goats. Oral Levamisole was found superior to parenteral Levamisole in efficacy against caprine strongylosis in goats.