

AN ABATTOIR STUDY ON THE PREVALENCE OF GASTROINTESTINAL NEMATODES OF GOATS IN THE DRY ZONE OF SRI LANKA

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Abstract: During a 12 months study (January to December 1996) gastrointestinal tracts of 218 crossbred goats representing the dry zone of Sri Lanka were collected and examined for the presence of gastrointestinal parasites. Two hundred and seventeen (>99%) of the animals examined were infected with one or more species of nematodes. The worm burden was classified based on the number of adult worms; one hundred and twenty animals (55%) had a low to moderate worm burden (0-1000) and 98 (45%) had a high worm burden (>1000). Five species of nematodes were found in the abomasum and intestines. They were *Oesophogostomum columbianum* (88%), *Haemonchus contortus* (81%), *Trichostrongylus colubriformis* (76%), *Trichostrongylus axei* (59%) and *Trichuris ovis* (59%). The highest of the mean worm burden was due to small intestinal nematodes (1122) while large intestinal nematodes accounted for the lowest (34). The mean total number was 1751. The pattern of worm burden was bimodal and marginally seasonal.

Keywords: Gastrointestinal nematodes, goat, prevalence

INTRODUCTION

Goats are an important source of food and income for smallscale farmers within rural communities of many tropical and sub tropical countries of Asia and Africa.⁶ Sri Lanka, an island in the Indian Ocean with approximately 65,000 square kilometers land area has a goat population of around 500,000 of which about 65 per cent are distributed in the Dry (average annual rainfall: <1250 mm) and Dry Intermediate (average annual rainfall: 1250-2000 mm) Zones of the country. It is estimated that annually about 125,000 animals managed under an extensive system within these areas are slaughtered to meet the goat meat requirements of the country.

Gastrointestinal nematode infections in goats have been recognised as a major constraint to the development of this livestock enterprise in many developing countries of the tropics.²⁵ Studies in Africa and South and South East Asian

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countries have shown that worms of the genera *Haemonchus*, *Trichostrongylus* and *Oesophagostomum* are the common gastrointestinal nematodes affecting small ruminants.^{3,15,18,24} Further it has also been noted that *Haemonchus contortus* is the most pathogenic species responsible for a marked growth retardation and death.

The epidemiology of trichostrongylid worms in goats has been studied in India,³⁰ Pakistan¹⁷, Gambia¹⁰, Mauritania¹⁵, Zimbabwe¹⁸ and Saudi Arabia.⁸ Parasitologists rely on epidemiological data of gastrointestinal parasites to understand the complex host-parasite-environment relationship in order to establish inexpensive, sustainable control strategies, which need to be communicated to farmers. Control programmes based on a sound knowledge of parasite epidemiology¹⁵ produce maximum benefits while lowering the risk of anthelmintic resistance.

In common with other tropical countries, goat farming plays a significant role in the rural economy of Sri Lanka and gastrointestinal nematode infections are recognized as a major cause of morbidity and mortality.^{2,13} According to Van Aken et al.²⁶ *H. contortus* and *Oesophagostomum columbianum* were the only species of nematodes present in a government goat-breeding farm in the Northwestern part of Sri Lanka. Nonetheless, a vast majority of goats are managed by traditional small-scale rural farmers in the Dry Zone where little is known of the gastrointestinal nematodes and their effects on animals. Anthelmintic therapy is not generally practised to control gastrointestinal parasites. If used, it is done in an indiscriminate and *ad hoc* manner since very little information is available on the epidemiology of nematodes infecting the gastrointestinal tract. The objective of this study was to identify the spectrum of gastrointestinal nematodes of goats in the Dry Zone of Sri Lanka, determine their prevalence levels and investigate the distribution in relation to months and season.

METHODS AND MATERIALS

a. Study Area: Samples for this study were collected from goats that originated from different locations of the area designated as the Dry zone; North-western, Southern and North-central Provinces, of Sri Lanka where the average annual rainfall is generally <1250 mm and temperature varied from 21-38°C (Meteorological Department, Colombo). The climate is bimodal, characterized by a warm rainy season from October to January and short dry season from February to March. The month of April is usually rainy and there is a long dry season from May to September.

b. Animals: All animals used were of the local or indigenous breed (12-24 months of age) that were typical of goats raised in the Dry Zone. In general, the animals in the Dry Zone were managed extensively, being turned out to browse in the shrub jungle, communal grasslands or along the road sides during the day for an average period of 6-8 hours and housed at night in stilted sheds fixed with a wooden slatted floor or mud floor.^{11,13,21} During the long dry season the nutritive value of the

vegetation declines to its lowest levels and the animals are then subjected to substantial nutritional stress as no supplementary feeding is provided. Significant deviations from the generally found management were very rarely encountered.

c. Sample collection: Material for the study was collected monthly from goats in the aforementioned areas that were slaughtered at the Colombo municipal abattoir during the 12 month period extending from January to December 1996. On each occasion, 15-20 gastrointestinal tracts were collected and processed to determine the worm burden. The origin of goats also was recorded at the time of sample collection.

d. Recovery of worms: At slaughter, the alimentary tract from the distal oesophagus to the rectum was carefully removed from the carcass after ligatures were placed at either end. To prevent the mixing of abomasal and intestinal contents, further ligatures were placed at the pyloric/duodenal junction, between the small and large intestines and at the proximal end of the caecum. The three segments of the gastrointestinal tract i.e. abomasum, small and large intestines were then separated at the ligatures and processed individually for the estimation of worm burden as described by Ritchie et al.²² The abomasal mucosa was scraped with glass slides and the scrapings digested in pepsin/HCl mixture at 42°C according to a method described by Herlich¹⁴ for the recovery of mucosal larvae.

e. Statistical Analysis: Worm burdens were subjected to one way analysis of variance using a computer statistical package (Minitab 10.1 release, Minitab Inc., State Collage) followed by a between month comparison using the Tukey test. Worm burdens during the months of April and May were not included in the analysis since low number of samples were collected during these months which precluded any meaningful comparison by the Tukey test. Before analysis, the worm counts were log transformed in order to stabilize the variance. Comparisons were considered significantly different at $P < 0.05$.

RESULTS

Around 45% of the examined animals originated from the North-Western Province, particularly from Puttalam and Chilaw and around 40% of the animals were from the Southern Province, particularly from Hambantota. The rest of the animals originated from various locations of the North-Central Province.

A total of 218 gastrointestinal tracts were examined over the 12 month period which included both the wet and dry seasons. An overwhelming majority (217 animals; 99%) of the goats examined were infected with one or more nematode species which included *O. columbianum* (88%), *H. contortus* (81%), *Trichostrongylus colubriformis* (76%), *T. axei* (59%) and *Trichuris ovis* (54%). Two hundred and six animals (94%) were infected with more than one gastrointestinal nematode. The

abomasa were infected with *H. contortus* and *T. axei*, the small intestines were infected with only *T. colubriformis* and large intestines were infected with both *O. columbianum* and *T. ovis*. The prevalence, mean and quantitative range of gastrointestinal nematode infections in the abomasum, small and large intestines are given in Table 1. The average worm burden was greatest in the small intestine followed by the abomasum and then the large intestine. None of the digested abomasal scrapings revealed the presence of mucosal larvae. The seasonal variation of the worm burden in the different parts of the gastrointestinal tract in relation to prevalence, mean and quantitative range is shown in Table 2. Although the overall prevalence of gastrointestinal nematodes in the various segments of the alimentary tract was not markedly different between the seasons, the overall mean worm burden was high during the wet season and reflected the increase in worm counts, particularly of the abomasum and small intestine. The frequency distribution of worms in the three segments of the gastrointestinal tract examined is shown in Table 3. Of the 218 large intestinal tracts, 91 percent harboured less than 100 worms while 76 percent of the abomasa had parasites ranging from 100 to 10,000.

Table 1: Prevalence of gastrointestinal nematodes in different parts of the gut of 217 goats examined in the Dry Zone of Sri Lanka (the animal that was not infected was excluded).

Site	Worm burden		
	Prevalence (%)	Average	Range
Abomasum	85.7	595	0-5500
Small intestine	76.0	1122	0-16450
Large intestine	92.6	34	0-208
Total	100	1751	6-18317

The monthly fluctuation of the abomasal, small intestinal and large intestinal worm burdens is depicted in Figure 1. The total worm burden showed a bimodal distribution, which was characterized by an increase in the worm counts beginning from November with a peak in February followed by a gradual decline up to May. The latter was followed by a second increase in which a peak was observed in July followed by a decline in October. Significantly lower total, abomasal, small intestinal and large intestinal worm burdens were recorded during October ($p < 0.001$). The small intestinal nematode counts mirrored the trend of the total worm burden during the year. The large intestinal and abomasal worm burdens on the other hand followed a bimodal pattern in which the second peak was similar (July) to that of total worm burden but the first peak was in April for large intestinal worm burdens and December, for abomasal worm burdens.

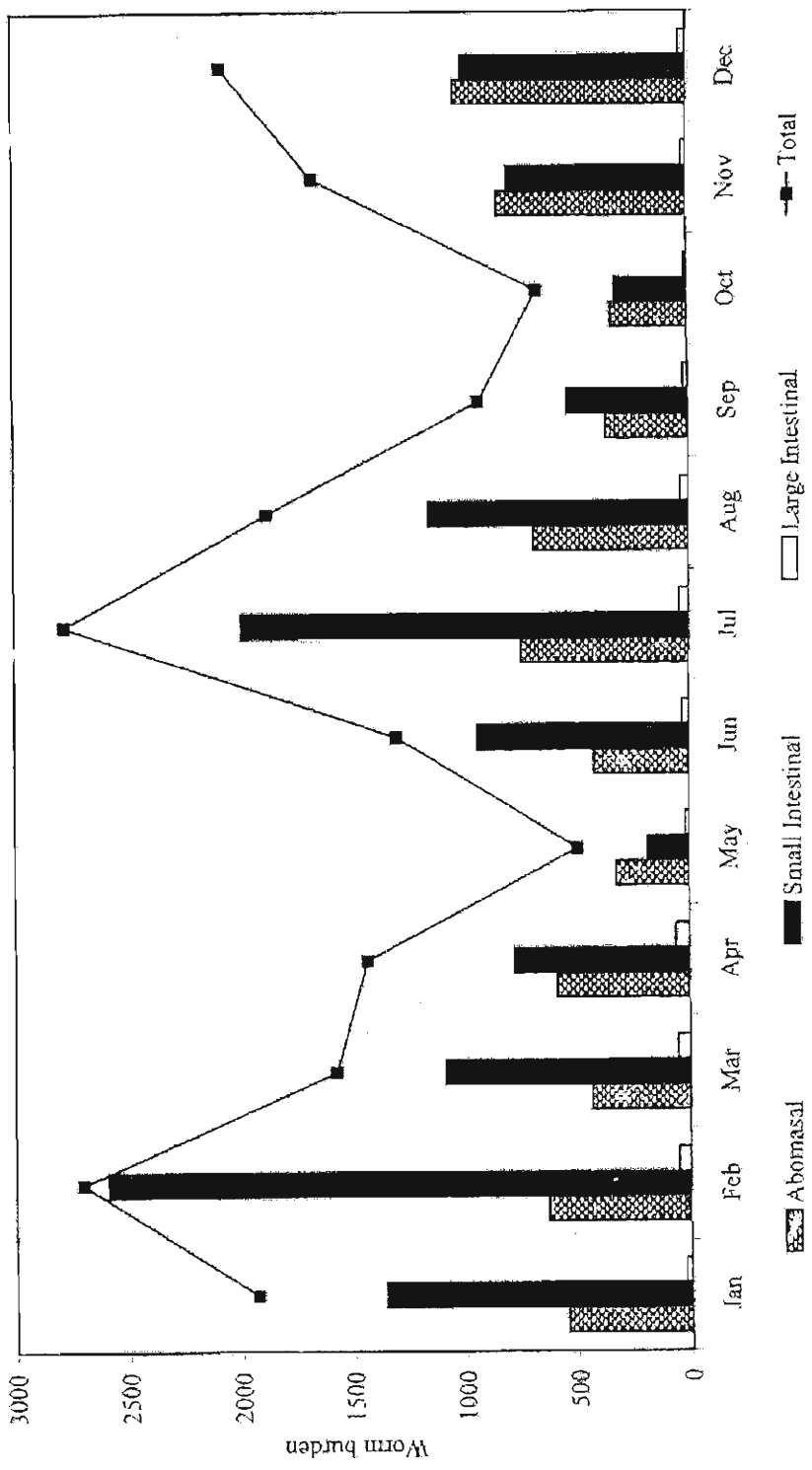


Figure 1 : Monthly variation of total, abomasal, small intestinal and large intestinal worm burdens in 218 adult goats examined in the dry zone of Sri Lanka.

Table 2: Comparison of gastrointestinal nematode prevalence, mean and quantitative range in 218 goats examined during the wet and dry season in the Dry Zone of Sri Lanka.

Site	Worm burden					
	Wet Season (Oct. to Jan, Apr.) n=125			Dry Season (May to Sep, Feb, Mar.) n=93		
	Prevalence (%)	Mean	Range	Prevalence (%)	Mean	Range
Abomasum	90	689	0-5500	83	501	0-3450
Small intestine	74	1195	0-16450	76	1049	0-9600
Large intestine	96	36	0-185	91	32	0-208
Total	100	1920	6-17157	99	1582	0-18317

Table 3 : Frequency distribution of worm burdens of 218 goats examined in the Dry Zone of Sri Lanka.

Worm burden	Site		
	Abomasum	Small intestine	Large intestine
0-100	52	81	199
100-1000	134	79	19
1000-10000	32	55	0
>10000	0	3	0

DISCUSSION

The animals were representative of the Dry Zone and the data from where the animals were brought was obtained from the Colombo municipal abattoir and collected at the time of sample collection. The animals represented many locations of the Dry Zone facilitating the discussion of the data relevant to the Dry Zone.

This is the first study that estimated prevalence and intensity of gastrointestinal nematodes in goats in the Dry Zone of Sri Lanka. In Zimbabwe, the work reported by Pandey et al.¹⁸ observed a high prevalence (88-97%) of gastrointestinal nematodes in goats whereas observations made in Pakistan¹⁷ and Saudi Arabia⁸ indicated a prevalence of 54% and 44%, respectively. The results of the present study indicated that an overwhelming majority (99%) of goats from the Dry Zone was infected with one or more gastrointestinal nematode species. This

observation however cannot be compared with similar studies carried out elsewhere in the tropics since the conditions of feeding, management and other factors, which influence the worm burden may be different.

According to Hansen and Perry¹² an average abomasal worm burden of >500 for sheep is considered an infection of moderate severity. In the present study the average abomasal worm burden was 595, but it is not possible to describe the severity of the infection since the relationship between the worm burden and the degree of the infection in goats has not been defined. The extensive system of management in which large numbers of animals are allowed to browse in limited communal grazing lands and the absence of a planned control programme are likely to be the causes responsible for the high worm burden noted in this study.

In the present study, two abomasal nematodes, one small intestinal nematode and two large intestinal nematodes were recorded. In an earlier study, Weilgama and Perera²⁰ noted *Haemonchus* as the most prevalent genus of nematode affecting goats in a Dry Zone farm. In a later study at the same location, Van Aken et al.,²⁶ recorded both *Haemonchus* and *Oesophogostomum*, to be the most common genera of gastrointestinal nematodes. The findings reported herein confirm the latter observations that these genera were the most prevalent nematodes but differs in that there were other species such as *T. colubriformis*, *T. axei* and *T. ovis* which were not earlier reported. The goats examined in the present study were from a wider geographical area of the Dry Zone and therefore it is not surprising that a greater spectrum of parasites were encountered. Several studies in African^{15,27} and Asian countries^{7,20} have also indicated *Haemonchus* and *Oesophogostomum* to be the most prevalent gastrointestinal nematode species present in goats.

Many workers^{20,27} have reported that the worm burden in domesticated ruminants follow a seasonal pattern where the infection is higher during the wet season compared to the dry period. Although a seasonal rainfall pattern has been described for the Dry Zone with little variation among different locations within this zone, the distribution of the worm burden was only marginally seasonal. Based on the general rainfall pattern described for the area under study, the magnitude and prevalence of gastrointestinal nematodes during the wet season was not significantly higher than that of the dry season. The relatively high worm burden during the dry period may also be attributed to the low nutrition during this period that enhances the build up of the parasitic infection in the gut. Studies in cattle have demonstrated that low pasture availability during the dry period together with an absence of supplementary feeding leads to a lowering of immunity resulting in a comparatively high worm burden.^{4,28} Similar observations have also been supported through experimental *Haemonchus* infection in sheep where animals maintained on a low nutritional plane had a significantly higher worm burden compared to the controls.¹⁶ In a recent study in goats, Blackburn *et al.*⁵,

demonstrated that nutrition plays a significant role in the establishment and persistence of gastrointestinal parasitic infections.

The economic impact of gastrointestinal nematode infection in goats is considerable in view of the recent report by Faizal et al.⁹ in which a weight loss of up to 40% has been recorded in just one rainy season at a goat farm in the Dry Zone. All animals included in this study were goats farmed primarily for meat, hence gastrointestinal nematodes are likely to cause substantial losses in production. Further, the removal of goat intestinal tracts affected by nodular worm infection from the human food chain is a further loss during meat processing. According to Seneviratne²³ around 30% of tracts were removed due to *Oesophogostomum* infection at one of the abattoirs in Sri Lanka.

The results of this study have clearly demonstrated that an overwhelming majority of goats in the Dry Zone of Sri Lanka were affected by a moderate to high gastrointestinal nematode infection, with *Haemonchus* and *Oesophagostomum* spp. being the most common genera. The finding also indicated the need for a closer look at other epidemiological factors such as pasture contamination which may influence the gastrointestinal nematode infection rate of goats in the Dry Zone.

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References

- 1 Ahamed M. & Ansari J.A. (1987). Prevalence of gastrointestinal nematodes of sheep and goats in Aligarh. *Indian Veterinary Journal* 3: 165-170.
- 2 Alwis M.C.L.de (1992). Sri Lanka. Pasteurellosis in production animals; *ACIAR Proceedings* No. 43.
- 3 Amin Babjee S.M., Lee C.C., Sheikh-Omar A.R. & Mohna S.S. (1990). An abattoir study of gastrointestinal parasites of adult indigenous goats. *Journal of Veterinary Malaysia*, 2: 103-108.
- 4 Armour J. (1989). The influence of host immunity on the epidemiology of trichostrongyle infection in cattle. *Veterinary Parasitology* 32: 5-19.

- 5 Blackburn H.D., Rocha J.L., Figueiredo E.P., Berne M.E., Viera L.S., Cavalcante A.R. & Rosa J.S. (1991). Interaction of parasitism and nutrition and their effects on production and clinical parameters in goats. *Veterinary Parasitology* **40**: 99-112
- 6 Devendra C. & Burns M. (1983). *Goat production in the Tropics* (Revised Edition). Commonwealth Agriculture Bureaux, U.K.
- 7 Dorny P., Symoens C., Jalila A., Vercruysse J. & Sani R. (1995). Strongyle infections in sheep and goats under the traditional husbandry system in peninsular Malaysia. *Veterinary Parasitology* **56**: 121-136.
- 8 El-Azazy O.M.E. (1995). Seasonal changes and inhibited development of the abomasal nematodes of sheep and goats in Saudi Arabia. *Veterinary Parasitology* **58**: 91-98.
- 9 Faizal A.C.M., Rajapakse R.P.V.J., Jayasinghe S.R. & Rupasinghe V. (1999). Prevalence of *Eimeria* and gastrointestinal nematodes vs weight gains in treated goats raised in the dry areas of Sri Lanka. *Small Ruminant Research* **34**: 21-25
- 10 Fritsche T., Kaufmann J. & Pfister K. (1993). Parasite spectrum and seasonal epidemiology of gastrointestinal nematodes of small ruminants in the Gambia. *Veterinary Parasitology* **49**: 2-4.
- 11 Gunawardana A. (1998). 1. A preliminary investigation on some reproductive traits of local goats; 2. Some factors affecting local goats under small holder management systems in Matara District; 3. Goat farming in Hambantota: A case study. In: *Proceedings of 54th Annual sessions of Sri Lanka Association for the Advancement of Science*, December, pp. 39-42.
- 12 Hansen J. & Perry B. (1994). The epidemiology, diagnosis and control of helminth parasites of ruminants. Handbook published by the International Laboratory for Research on Animal Diseases, P.O. Box 30709, Nairobi, Kenya.
- 13 Hariharan R. & Ravindran V. (1992). Goat production under traditional management systems in Sri Lanka (Part-11). *Asian Livestock* **9**: 97-99.
- 14 Herlich H. (1956). A digestion method for post-mortem recovery of nematodes from ruminants. *Proceedings of Helminthological Society of Washington* **23**: 102-103.
- 15 Jacquet P., Colas F., Cabaret J., Dia M.L., Cheikh D. & Thiam A. (1995). Dry areas: an example of seasonal evolution of helminth infection of sheep and

- goats in southern Mauritania. *Veterinary Parasitology* **56**: 137-148.
- 16 Kates K.C., Allen R.W. & Wilson G.I. (1962). Effects of two diets on experimental haemonchosis in lambs. *Journal of Parasitology* **48**: 865-870.
 - 17 Khan M.N., Hayat C.S., Chaudrhry A.H., Iqbal Z. & Hayat B. (1989). Prevalence of gastrointestinal helminths in sheep and goats at Faisalabad abattoir. *Pakistan Veterinary Journal* **4**: 159-161.
 - 18 Pandey V.S., Ndao M. & Kumar V. 1994. Seasonal prevalence of gastrointestinal nematodes in communal land goats from the highveld of Zimbabwe. *Veterinary Parasitology* **51**: 241-248.
 - 19 Prichard R. K. & Ranjan S. (1993). Anthelmintics. *Veterinary Parasitology* **46**: 113-120.
 - 20 Rahman W.A. (1992). Seasonal variations in the numbers of trichostrongylid nematode eggs and their larvae in the faeces of farmed goats in Malaysia. *Veterinary Parasitology* **42**: 163-166.
 - 21 Rajaguru A.S.B. (1987). Goat meat production in Sri Lanka. In: *Proceedings of the workshop held in Tandojam, Pakistan*, 13-18 March, pp. 179-187.
 - 22 Ritchie J. S. D., Anderson N., Armour J., Jarrett W. F. H., Jennings F. W. & Urquhart G. M. (1966). Experimental *Ostertagia ostertagi* infection in calves: Parasitology and pathogenesis of a single infection. *American Journal of Veterinary Research* **27**: 659-667.
 - 23 Seneviratna P. (1954). Helminth infestation of some domesticated animals in Ceylon. *C.V.S. Reporter II* pp. 161-166
 - 24 Shanta C.S. (1982). A revised check list of helminths of domestic animals in West Malaysia. *Malaysian Veterinary Journal* **7**: 180-193
 - 25 Smith M.C. & Sherman D.M. (1994). Digestive system. In: *Goat Medicine*. Mavern, PA, Lea and Febiger, USA. pp. 275-358
 - 26 Van Aken D., Bont J.de, Vercruysse J. & Dorny P. (1990). Gastrointestinal nematode infection in a goat breeding farm in Northwestern Sri Lanka. *Tropical Animal Health and Production* **22**: 231-238.
 - 27 Vercruysse J. (1985). The seasonal prevalence of inhibited development of *Haemonchus contortus* in sheep in Senegal. *Veterinary Parasitology* **17**: 159-163.

- 28 Wedderburn J. F. (1970). Ostertagiasis in adult cattle: A clinical report of an outbreak in the field. *New Zealand Veterinary Journal* **18**: 168-170.
- 29 Weilgama D.J. & Gamini Perera P.S. 1981. Efficacy of febantel (Rintal) on gastrointestinal nematodes of goats in Sri Lanka. *Ceylon Veterinary Journal* **29**: 14-15.
- 30 Yadav A.K. & Tandon V. (1989). Gastrointestinal nematode infections of goats in a subtropical and humid zone of India. *Veterinary Parasitology* **33**(2):135-142.