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Prevalence of *Cryptosporidium* Infection among Goats in Selected Areas of the Dry Zone of Sri Lanka

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ABSTRACT. *Cryptosporidium species are protozoan parasites capable of infecting mammals including humans, and these parasites are recognised to be of economic significance in young ruminants, causing enteritis resulting in morbidity and mortality. Goat farming is a popular and a relatively high income generating agricultural operation, particularly in the dry zone where more than fifty percent of the country's goat population is present. One of the major drawbacks in this livestock enterprise is the high kid mortality rate especially during the first week of life and this study was conducted to examine prevalence of Cryptosporidium infection among goats in selected areas of the dry zone.*

A total of 200 single faecal samples were collected from December 1998 to June 1999, from goats of different ages. Cryptosporidium oocysts were isolated by using Sheather's sucrose flotation technique and identified by modified Ziehl Neelsen staining method. An approximate quantification was carried out to estimate the oocyst output per gram of faeces. Cryptosporidium oocysts were identified in 55% of the animals examined. Highest prevalence (75%) was observed in 2-5 month old kids. Ten diarrhoeic goat kids, less than one year of age were found to excrete a large number of oocysts (5,000-25,000) however, Cryptosporidia were not attributed as the cause of diarrhoea as the other aetiological agents known to cause diarrhoea were not examined simultaneously.

Present study revealed the prevalence of Cryptosporidium spp in goats of all age groups. A majority of infected adults were asymptomatic. Therefore, they are likely to play an important role in the epidemiology of cryptosporidiosis in goat kids as well as in humans.

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INTRODUCTION

Cryptosporidiosis caused by protozoan parasites of the genus *Cryptosporidium* is a widespread and economically important disease characterised by diarrhoea, and even death in young domestic animals. The disease also affects man where it causes gastrointestinal disorders, particularly in immunocompromised adults and children (O' Donoghue, 1985). The epidemiological evidence of human cryptosporidiosis of zoonotic origin is based on both direct and indirect transmission through infected livestock (Smith and Rose, 1990).

Mason *et al.* (1981) in Tasmania, were the first to describe cryptosporidiosis in goats based on histopathological and electron microscopic evidence obtained from a two week old Angora goat kid which died following a short clinical course characterised by diarrhoea. Subsequently, caprine cryptosporidiosis has been reported from other parts of Australia (Tzipori *et al.*, 1982), as well as from South America (Viera *et al.*, 1997) and Europe (Thamsborg *et al.*, 1990; Molina *et al.*, 1994; Munoz *et al.*, 1996). As in other domestic animals cryptosporidiosis in goats is considered as an economically important disease which is potentially zoonotic.

In Sri Lanka, *Cryptosporidia* were identified in the faeces of calves (Bahirathan *et al.*, 1987), and diarrhoeic children (Perera, 1988; Perera and Lucas, 1990; Mertens *et al.*, 1990). In a more recent preliminary study, Noordeen *et al.* (1999) reported the presence of *Cryptosporidium* oocysts in the faeces of goats. The present study was designed to determine the prevalence of *Cryptosporidium* species among goats in selected areas of the dry zone of Sri Lanka where goat farming is a popular livestock enterprise among rural communities.

MATERIALS AND METHODS

Sample collection

During a six month period (December 1998 to June 1999) a total of 200 single faecal samples were collected from goats (birth to 48 months) in small holder goat farms managed under an extensive system. These goat farms were located in the Puttalam (120) and Anamaduwa (80) areas of the dry zone (average annual rainfall 520-788 mm) of Sri Lanka. Faecal samples were collected directly from the rectum, placed in separate polythene bags and brought to the laboratory in a polystyrene box packed with ice.

Parasitological techniques to detect *Cryptosporidium* oocysts

Faecal samples were concentrated using a sucrose flotation technique in order to provide quantitative estimates of oocyst numbers. Briefly, 2 g of faeces was emulsified with 25 ml of distilled water and sieved through a tea strainer into a 50 ml centrifuge tube. Sheather's sucrose solution (sucrose 2268 g, phenol crystals 29.5 g, distilled water 1452 ml) was added to this tube to make the volume 50 ml and centrifuged for 10 min at 400 G. The top meniscus (5 ml) was carefully aspirated to another 50 ml tube and centrifuged for a further 10 min at 400 G. The supernatant was discarded and the pellet was washed twice by resuspending it in 50 ml distilled water followed by centrifugation for 10 min at 400 G. After second centrifugation the supernatant was aspirated leaving 5 ml of the suspension at the bottom of the tube. A 10 μl aliquot of the suspension was spotted on a glass slide for the preparation of a thin smear. Air dried, methanol fixed smears were stained using the modified Ziehl Neelsen (MZN) technique (Casemore, 1991) and the total number of oocysts in the aliquot smear was counted under a microscope (× 1000). The number of oocysts per gram of faeces was calculated by modifying the method used by Scott *et al.* (1995) for cattle. The modification was that 2 g of faeces was used instead of 5 g as described by the Scott *et al.* (1995).

RESULTS AND DISCUSSION

Cryptosporidium oocysts were identified in 110 out of 200 (55%) animals surveyed (Table 1). The age of the infected animals ranged from 2 weeks to 48 months.

Table 1. Prevalence of *Cryptosporidium* infection in different age groups.

Age (m)	No. examined	No. infected	Prevalence (%)	No. diarrhoeic/ No. infected (%)
0 - 1	25	07	28	02/07 (28%)
2 - 5	86	65	75	08/65 (12%)
6 - 11	37	21	56	0/21 (0)
12 - 35	34	13	38	0/13 (0)
36 - 48	18	04	22	0/04 (0)
Total	200	110	55	10/110 (09%)

Semiquantitative counting of the positive smears showed that majority (91%) of the infected animals excreted a few (250-2,500) or a moderate number of (2,500-5,000) oocysts. Ten diarrhoeic animals (9%) excreted a large number of oocysts (5,000-25,000) (Table 2). The data relevant to excretion of oocysts and diarrhoea revealed that infection was asymptomatic in 91% of the goats infected.

Table 2. Intensity of *Cryptosporidium* oocyst output in diarrhoeic kids.

Age (m)	No. diarrhoeic kids	Average oocyst output/g
0 - 1	02	6,000
2 - 5	08	6,500

The *Cryptosporidium* oocysts appeared as pink to bright red spherical structures (2-6 μm) in a green background (Figure 1).

Results of the present study revealed that *Cryptosporidia* are common parasites among goats with an overall prevalence of 55% in selected areas of the dry zone while studies performed in Australia have revealed a 100% prevalence in a herd where the morbidity was 72% (Smith and Sherman, 1994). The present study was confined to two areas in the dry zone where large concentrations of goats are present (Sri Lanka Livestock Statistics, 1991/92). Moreover, a preliminary study conducted in three agro-ecological zones indicated the dry zone to have highest prevalence (Noordeen *et al.*, 1999). Studies are in progress to increase the number of goats examined within a wider geographical distribution in the dry zone.

In the present study, high prevalence rates of the infection were observed among animals between 2-5 and 6-11 month of age, however other studies where the prevalence of the infection in goats is described (Tzipori *et al.*, 1982) no mention has been made regarding the age of the animals affected, thereby limiting the possibility for comparison. Furthermore, a large proportion of the adults, which were excreting oocyst of *Cryptosporidia,* did not show any clinical evidence of the disease. These asymptomatic carrier animals are likely to have an impact on the epidemiology of the disease. In

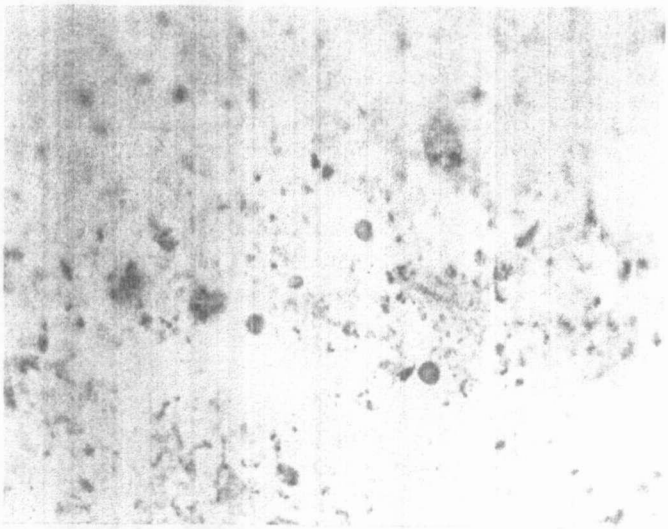

Figure 1. ***Cryptosporidium*** **oocysts in modified Ziehl Neelsen staining technique.**

cattle a similar observation has been reported where more than 70% of the adult animals excreting the oocyst were asymptomatic (Scott *et al.*, 1995 and Lorenzo-Lorenzo *et al.*, 1993).

In contrast to previous studies of cryptosporidiosis in ruminants, in which the infection is generally established during the first two weeks of life (Angus, 1990), the present study revealed a higher prevalence in animals which are 2-5 month old and indeed, 8 out of 10 diarrhoeic cases were in this group. Card *et al.* (1987) also reported the presence of *Cryptosporidia* in 6-month-old diarrhoeic kids in the Netherlands. Although all 10 diarrhoeic goats excreted *Cryptosporidia* in large number, the evidence is insufficient to conclude that this protozoan was the primary cause of diarrhoea since other aetiological agents of diarrhoea, especially bacteria or viruses are not examined.

Studies in humans have indicated that cryptosporidiosis is one of the protozoan zoonosis in Sri Lanka (Dissanaike, 1993) and calves are believed to be the animal reservoir. The findings of the present study, demonstrates a high prevalence of *Cryptosporidium* infection in goats therefore, this species

should also be included as the major animal reservoir for human cryptosporidiosis in the dry zone of Sri Lanka.

CONCLUSIONS

Present study revealed that *Cryptosporidium* infection is prevalent in goats in the dry zone of Sri Lanka. Considering the zoonotic potential of the parasite, goats should be regarded as an important reservoir of *Cryptosporidium* infection with epidemiological implications on human health.

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