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Full Length Research

Intestinal helminth parasites of *Felis catus* in Syangja, Nepal

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ABSTRACT: Domestic cats can be infested by a huge range of parasite species, leading to a range of diverse clinical signs and symptoms. However, a comprehensive understanding of these endoparasites, particularly in the context of multiparasitism, remains limited. The aim of the study was to determine the prevalence of intestinal helminth parasites on domestic cats in Arjunchaupari Rural Municipality of Syangja District, Nepal. The study was carried out from November 2017 to June 2018. A total of 30 fresh feline fecal samples were collected and examined by using the Saline wet method and sedimentation technique. Overall, 21 (70%) fecal samples were found to be positive for different parasitic infections. Four different helminth parasitic species were encountered as *Toxocara cati* (40%), *Toxascaris leonina* (16.67%), and *Ancylostoma tubaeforme* (10%) belonging to nematodes and a species of cestode: *Hymenolepis diminuta* (6.67%). Nematode infection (66.67%) was found to be comparatively more common than cestode infection (6.67%). Statistically, the relationship between the cestode and nematode parasite is significant (x^2 = 0.232, p>0.05). The high incidence of parasitism of cats was due to the relative influence of behaviour and a contaminated environment since these cats lived in the same environment as other domestic animals. The study recommended that studies on all kinds of gastrointestinal parasites, including protozoan parasites, would be better to get more knowledge about parasites and their risk of transmission.

Keywords: Cat, cestode, nematode, prevalence, intensity.

INTRODUCTION

Gastrointestinal parasites are one of the most common causes of GI disease in cats (Hendrix and Blagburn, 1983). From the veterinary point of view, domestic cats represent potential reservoirs of helminthic parasite, especially in urban areas (Jittapalapong *et al*., 2007). The prevalence of intestinal parasites varies depending on geographical region, availability of veterinary care, local animal population habits, season of the year, and cat population composition (Calvete *et al*., 1998; Khalafalla, 2011). Similarly, depending on the parasite species and its amplitude, the infection may cause different clinical signs in cats, from mild gastrointestinal disorders and failure to thrive, to anemia or anorexia in more severe cases, particularly in kittens with heavy parasitic burdens (Traversa, 2012). The domestic cat (*Felis catus*) is the second most loved companion animal in the world (Sparkes *et al*., 2013). Different environmental factors affect the frequency of a species of parasite in a population (Sowemimo, 2012).

In Nepal, cats are of great importance in agriculture, where they are domesticated for their ability to hunt rodents. Domestic cats can be infected by a wide range of endoparasites. Cats and other felines behave as final hosts for a huge number of intestinal parasites, some of which are responsible for several zoonotic diseases such as toxocariasis. It is caused by the ascarids of dogs and cats: *Toxocara canis* and *Toxocara cati*, respectively (Despommier, 2003). Domestic cats are found near humans in rural and urban areas of the world. In Nepal, they often live freely outside and in human houses. Cats feed on garbage discarded around houses at night, which is important because they release helminths eggs and protozoan cysts into the environment, which are transmissible to humans (Sharif *et al*., 2007). Due to the

close association of cats with humans and the fact that children play outdoors on the soil, cats can be an important potential source of transmission of zoonotic parasites such as *Toxoplama* and *Toxocara. Toxocara cati* is a frequently existing gastrointestinal nematode in cats all over the world, which not only infects young kittens but can also cause human toxocariasis (Dubinsky, 1999).

The cestodes, nematodes, and acanthocephalans have been identified in the intestines of stray and pet cats in various countries (Zibaei *et al*., 2007). Transmission of certain helminth parasites from carnivores to domestic animals and humans causes economic problems and public health hazards (Dalimi and Mobedi, 1992). Therefore, the study of the parasite fauna of carnivores such as stray cats in various areas of the country is necessary for the control of disease. Nematodes are among the most important etiological parasitic agents of the gastrointestinal tract in cats (Taylor *et al*., 2015). Common nematodes infecting domestic cats are *Toxocara cati, Toxascaris leonina* and *Ancylostoma tubaeforme.* Gastrointestinal trematode infection in cats is very rare compared with nematodes and cestodes (Burrows and Lillis, 1965). The common trematode consists of *Alaria* species, and the cestodes are *Spirometra* species, *Taenia taeniaeformis,* and *Dipylidium caninum.* Depending on the parasite species and its abundance, infections may cause varying clinical signs in cats, from mild gastrointestinal disorders and failure to thrive, to anemia in more severe cases, particularly in kittens (Traversa, 2012). In addition, some parasites of cats have a zoonotic potential, either through close contact with parasitized animals or through exposure to contaminated environments (Raether and Hänel, 2003). Owing to the close association and proximity of man with his domestic cat, there exists the possibility of infection by certain helminth parasites of these animals, which may, in some situation, end up with serious problems of public health, e.g., encephalitis and granulomatous lesions caused by toxocariasis (Ashton, 1960; Woodruff *et al*., 1964). The objectives of this study were to determine the prevalence, to identify the different groups of helminth parasites and to study the intensity of intestinal helminth parasites in cats. This study was necessary for the understanding of the intestinal parasites of cats, for the prevention and control of the spread of infectious diseases among cats and to be cautious about the zoonotic diseases that can be transmitted from cats to humans, causing serious problems in human health.

MATERIALS AND METHODS

Study area

The study was conducted in Arjunchaupari rural municipality, situated in the Syangja district of the Gandaki province of central Nepal. It is surrounded by Putalibazar Municipility on the East, Parbat district on the West, Andhukola Rural Municpility on the North, and Bheerkot Municipility on the South. The total population of Arjunchaupari is 16,176, residing in an area of 57.22 km^2. It is located at the coordinates 28.080765°N and 83.761311°E (Figure 1).

Animal selection and sample collection

A multicenter survey was conducted in different areas of Arjunchaupari Rural Municipality of Syangja District from November 2017 to June 2018. A random sample of domestic cats were included weekly, with the aim of 5 to 7 cats per week from the study area. A total of 30 fresh fecal samples (25 adults and five kittens) were collected by the hand-picking method and were preserved in 2.5% potassium dichromate. The samples were fresh, not dried, and kept properly. After collection, the fecal samples were transported to the laboratory of the Central Department of Zoology, Tribhuvan University, Kirtipur, Kathmandu, Nepal, and were stored at 4°C until examined microscopically.

Parasitological procured

The samples were brought and examined under a microscope at the laboratory of the Central Department of Zoology, Tribhuvan University, Kirtipur, Nepal. The fecal samples were examined individually for nematode, cestode, and trematode eggs as well as protozoan cysts, trophozoites, and oocysts. These samples were performed by the saline wet method and the sedimentation technique for the examination of intestinal parasites. The saline wet mount was made by mixing about 2 mg of fecal sample in a drop of saline placed on a clean glass slide. The smear was then examined under a microscope at 10X by 40X. It was mainly used to examine helminthic eggs and larvae (Arora, 2010). Sedimentation techniques use solutions of lower specific gravity than the parasitic organisms, thus concentrating the latter in the sediment. It takes advantage of the high specific gravity of protozoan cysts and helminth eggs compared to water (Parija, 2013). For this, 2 grams of fecal sample was put in a beaker and 28 ml of saline water was added. The sample was ground lightly with the help of a rod and the solution was filtered through a tea strainer. The sediment was separated and mixed with 10% formalin and ethyl acetate and centrifuged for 5 minutes at 1000 rpm. The sediment was examined under an electronic microscope at 10X and 40X. This technique is used for the detection of helminthic eggs (Soulsby, 1982).

Identification

The length and breadth of eggs and larvae were measured using an ocular and stage micrometer. The identification of

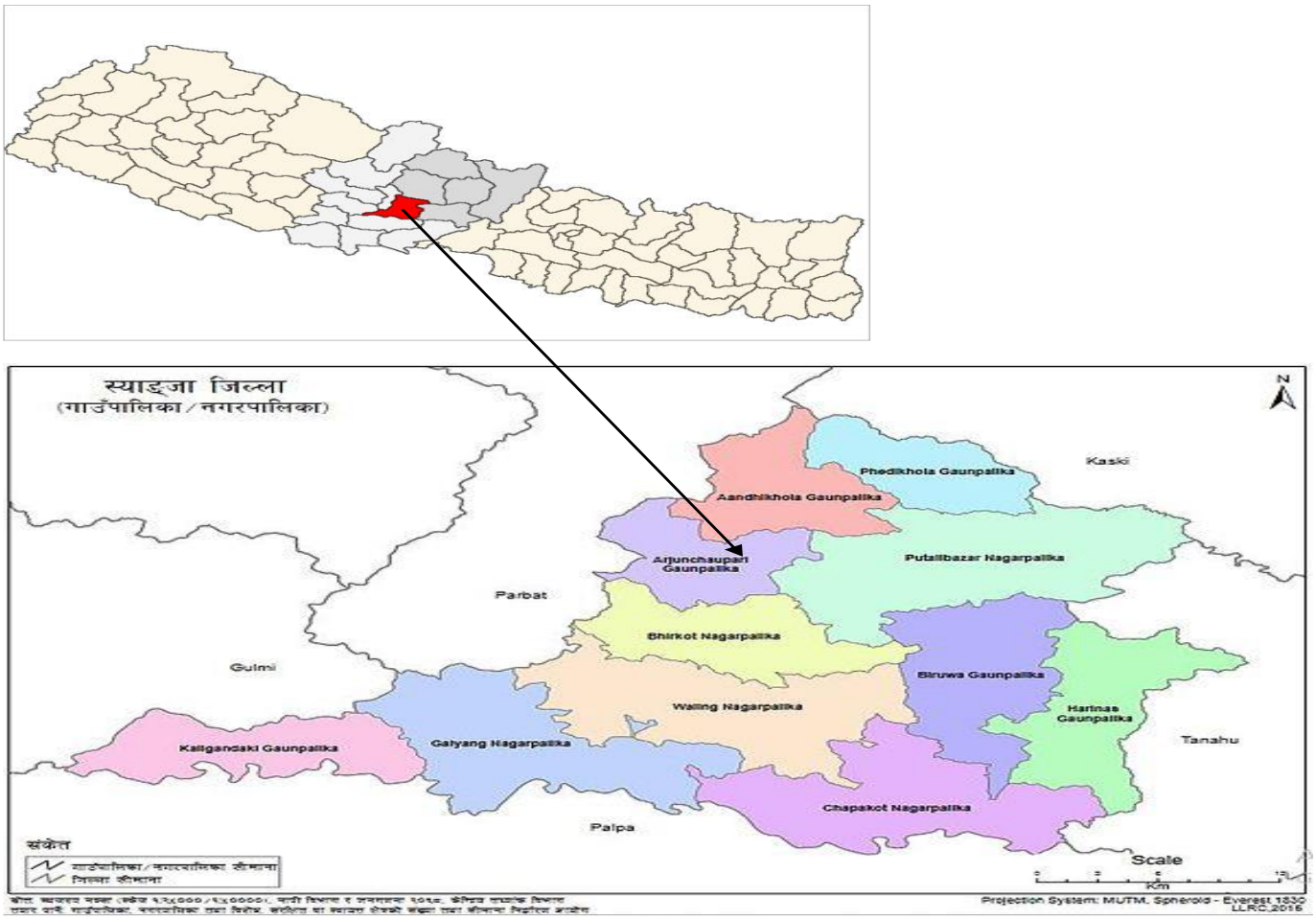

Figure 1. Arjunchaupari rural municipality map.

eggs and larvae was done by comparing their colour, size, and structure (Soulsby, 1982).

Data analysis

SPSS software package was used to perform statistical analysis on the data using Fisher's exact test. Prevalence was calculated using a percentage. In all cases, a 95% confidence interval (CI) and $p<0.05$ were considered for a statistically significant difference.

RESULTS

Prevalence of gastrointestinal parasites revealed that 21 (70%) of the 30 fecal samples investigated were positive for one or more distinct intestinal helminth parasites (Figure 2). Four species of endoparasites including cestode and nematode were detected (Table 1). Nematode parasitic infection was found to be 66.67% whereas cestode parasitic infection was 6.67% (Table 1). Statistically, the relation between cestode and nematode is significant ($x^2 = 0.232$, $p>0.05$). Based on the morphology of eggs, nematode parasites were *Toxocara cati* (40%), *Toxascaris leonina* (16.67%) and *Ancylostoma tubaeforme* (10%). *Hymenolepis diminuta* (6.67%) which is a cestode parasite was found in 2 fecal samples of domestic cats. Out of 70% positive samples, two types of infections were encountered in domestic cats of Arjunchaupari Rural Municipality. The rate of single infection was 66.67% and double infection was 3.33% (Table 2). Statistically, there exists a significant difference between single and double infection ($X^2= 26.46$, $p< 0.05$). Intensity of parasitic infection was evaluated by counting the number of eggs on each microscopic slide. When data were analyzed among the total positive sample (21), *Toxocara cati* (13.33%) and *Toxascaris leonina* (3.33%) showed heavy infection where more than 6 eggs were observed per microscopic field (Table 3). Moderate infection was determined when four to six eggs were observed per field, mild infection when two to four eggs

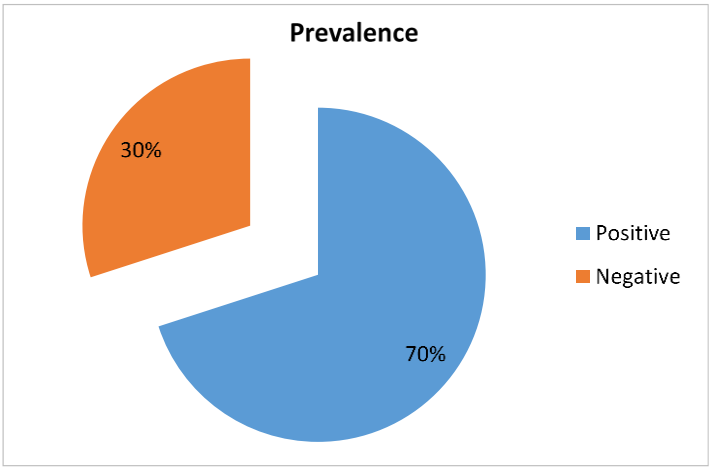

Figure 2. Overall prevalence of intestinal helminth parasites.

Table 1. Prevalence of gastrointestinal helminths parasite in domestic cats.

Parasites	Adult cats (n = 25)	Kittens (n = 5)	Total (n = 30)
Toxocara cati	10 (33.33%)	2 (6.67%)	12 (40%)
Toxascaris leonina	5 (16.67%)	-	5 (16.67%)
Ancylostoma tubaeforme	3 (10%)	-	3 (10%)
Hymenolepis diminuta	2 (6.67%)		2 (6.67%)

Table 2. Types of parasitic infections in domestic cats of Arjunchaupari Rural Municipality.

S.N.	Types of infection	Adult cats (n=25)	Kittens (n=5)	Total (n=30)
1	Single	18 (60%)	2 (40%)	20 (66.67%)
2	Double	1 (3.33%)	(0.00%)	1 (3.33%)

Table 3. Intensity of parasitic infection in domestic cats of Arjunchupari Rural Municipality.

Class	Parasites	Light (+)	Mild (++)	Moderate (+++)	Heavy (++++)
	Toxocara cati	2 (6.67%)	2 (6.67%)	4 (13.33%)	4 (13.33%)
Nematoda	*Toxascaris leonina*	1 (3.33%)	1 (3.33%)	2 (6.67%)	1 (3.33%)
	Ancylostoma tubaeforme	1 (3.33%)	2 (6.67%)	-	-
Cestoda	*Hymenolepis diminuta*	1 (3.33%)	1 (3.33%)	-	-

were observed, and light infection when less than two eggs were observed per field.

DISCUSSION

The most common intestinal nematodes among domestic cats are ascarids (*Toxocara cati* and *Toxascaris leonina*) and hookworms (*Ancylostoma tubaeforme)* (Beugnet *et al*., 2014). The prevalence of intestinal helminth parasites in domestic cats in the present study area was 70%. The parasitic prevalence was reported to be higher than 8.6% and 53.57% in Australia (McGlade *et al*., 2003; Adams *et al*., 2008). Similarly, 31.8% by Villeneuve *et al*. (2015) from Canadian provinces, 51.2% by Moskvina and Zheleznova (2015) from Vladivostok, Russia, 35% by Riggio *et al.* (2013) from Italy, 45% by Canto *et al.* (2013) from central Mexico, and 30.4% by Rembiesa and Richardson (2003) from the United States of America. Poor hygiene and a lack of anthelmintic drugs are the most likely causes of this high prevalence of intestinal helminths. It is likely that infection can occur at any age, either by ingestion of eggs

or tissues containing larvae. It is suggested that 40% of the prevalence of nematode infections among kittens is due to the transmural route of infection. But the present study compared with different localities confirmed that the prevalence was lower than that of Yakhchali *et al*. (2017) from Iran. In addition, a higher prevalence was reported by Ngui *et al.* (2014) from Malaysia. The variation might be due to the difference in sample size, selection of samples, techniques of sample collection, environmental factors, period, and place of study.

The present investigation elucidated that *T. cati* was the most predominant nematode species. *Toxocara cati* is a common nematode found in domestic cats. In the present study, *Toxocara cati* infection was found to be 40% in domestic cats of the present study area, which showed a higher prevalence rate as compared to Labarthe *et al*. (2004) from Brazil (25.2%) and Changizi *et al*. (2007) from Iran (8%). Additionally, the infection rate was higher as compared to Ngui *et al*. (2014) from Malaysia and Riggio *et al.* (2013) from Italy. The higher prevalence of *Toxocara cati* might be due to substandard hygiene and a lack of knowledge regarding anthelmintic drugs used. Cats may become infected with gastrointestinal parasites by inhaling contaminated eggs or by feeding on rats or mice that have parasitic eggs, larvae, or cysts in their muscle tissues. Cats generally defecate their stools at night in soil and bury their faces. Similarly, a few gastrointestinal helminth parasites, for example, Toxocara eggs, resist low temperatures and high humidity. Similarly, *Toxascaris leonina* is a common parasitic roundworm found in cats. The prevalence of *Toxascaris leonina* in the present study was found to be 16.67%, which is higher than the 11.77% reported by Yakhchali *et al*. (2017) from Iran and 5.7% reported by Ngui *et al*. (2014) from Malaysia. Most studies conducted in different countries suggest that the feeding habits of cats might affect the presence of parasites. The higher prevalence in this study may be attributed to the fact that cats are domesticated in rural areas primarily for hunting rodents.

Ancylostoma tubaeforme is a worldwide hookworm known to infect cats, causing anemia, and compromising the immune system. In the present study, the prevalence rate of *Ancylostoma tubaeforme* in domestic cats was found to be 10%, which is higher than the 5.9% reported by Yakhchali *et al*. (2017) from Iran and the 8.9% reported by Labarthe *et al.* (2004) from Brazil, but lower than the 29.3% reported by Calvete *et al*. (1998) from Spain and the 20% reported by Changizi *et al*. (2007) from Iran. This variation in prevalence rates suggests that factors such as sample size, study area selection, and study duration play pivotal roles in parasitism rates. Additional factors contributing to infection in cats include cutaneous penetration of larvae, ingestion of larvae, or ingestion of paratenic hosts.

The study also documented *Hymenolepis diminuta*, a cestode commonly found in rodents and infrequently seen in humans. *Hymenolepis diminuta* eggs are typically excreted in the feces of rodents or humans, ingested by an arthropod intermediate host, and subsequently penetrate the host's intestinal wall, developing into cysticercoid larvae. Mammalian hosts become infected through ingestion of these intermediate hosts carrying cysticercoid larvae. However, the occurrence of *Hymenolepis diminuta* in domestic cats is rare, with very few reported cases in some countries. In the present study, the prevalence rate of *Hymenolepis diminuta* was found to be 6.67%, which is higher than the 1.0% reported by Ngui *et al.* (2014) from Malaysia, the 0.2% reported by Sohn and Chai (2005) from the Republic of Korea, and the 1.9% reported by Moskvina and Zheleznova (2015) from Vladivostok, Russia. The presence of these parasites in fecal samples suggests that the cats get infected either by ingestion of an arthropod intermediate host or by eating rodents that contain cysticercoid larvae inside their bodies. It agreed with the study as the study was conducted in rural areas where cats were domesticated to hunt rodents.

In the current study, it was determined that hookworm and *Toxocara* eggs have zoonotic potential. The findings of this study suggest that the cat may contribute significantly to these agents' environmental burden and remain a regular source of infection to the environment to disseminate zoonotic parasitic diseases. The findings of this study should alert field veterinarians, researchers, and human health workers in the region about the possibility of infections in humans. Further epidemiological studies should be conducted to ascertain the incidence of such zoonotic parasites in cats by a well-defined, sensitive diagnostic test.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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