PREVALENCE OF ENTERIC PARASITES OF DOGS AND CATS IN DHAKA CITY

A Thesis

By

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DEPARTMENT OF MICROBIOLOGY AND PARASITOLOGY

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CERTIFICATE

This is to certify that the thesis entitled "PREVALENCE OF ENTERIC PARASITES OF DOGS AND CATS IN DHAKA CITY" submitted to the Faculty of Animal Science & Veterinary Medicine, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of Master of Science in Microbiology and Parasitology, embodies the result of a piece of bona fide research work carried out by Md. Ismail Hossain Registration No. 14-05846 under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

I further certify that any help or source of information, received during the course of this investigation has been duly acknowledged.

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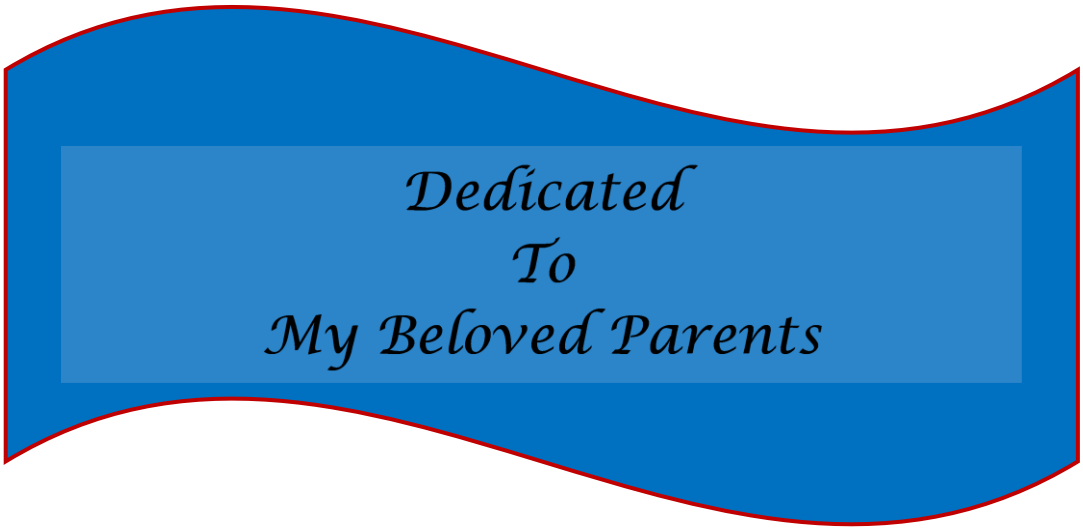
Dedicated
To
My Beloved Parents

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PREVALENCE OF ENTERIC PARASITES OF DOGS AND CATS IN DHAKA CITY

ABSTRACT

Enteric parasitic infection in dogs and cats is a major concern for public health as most of them have zoonotic importance. In Dhaka, surveys of enteric parasites in dogs and cats have been reported sporadically over the past 50 years, mostly focusing on stray and shelter dogs and cats. The present work was performed to determine the current prevalence of various parasites through the examination of fecal samples (both sedimentation and floatation methods) collected from pet and stray dogs (48) and cats (139) in Dhaka city. Overall, 35.42% (17/48) of dogs and 33.09% (46/139) of cats were positive for at least one parasite. *Toxocara canis* and *Toxocara cati* were the most prevalent parasite present in fecal samples followed by *Dipylidium caninum, Diphyllobothrium latum, Taenia* sp., *Toxascaris leonina, Ancylostoma caninum, Trichuris vulpis, Capillaria hepatica, Isospora* sp. and *Eimeria* sp. In dog, enteric helminth and protozoan prevalence were 31.25% (15/48) and 8.33% (4/28), whereas single and mixed infections were 70.59% and 29.41%, respectively. In cats, prevalence of enteric helminth and protozoan were 30.22% and 7.19%, whereas single and mixed infections were 71.74% and 28.26%, respectively. Except the two protozoan species, most recovered parasites have public health significance. Therefore, proper attention needs to be paid to prevent dog and cat borne zoonosis through controling parasites by regular deworming and proper hygiene.

Keywords: Prevalence, Helminth, Protozoa, Dogs, Cats, Dhaka.

CHAPTER 1

INTRODUCTION

Now-a-days dogs and cats are the part of our everyday life. They provide us companionship along with emotional support, reduce our stress levels and sense of loneliness, and help us to increase our social activities and add to a child's self-esteem and positive emotional development (Kornblatt and Schantz, 1980). Pet animals, especially dogs, and cats are crucial elements of life for many people all over the world. They were treated as a whole part of the family and mostly considered to be an extended family (Parvez, 2014). In many countries, parents who have no children nursed pet animals as their child. Dogs and cats help the wellbeing of their owner to get play and exercise, help each other to compete with stress where psychological symbiosis occurs between them. They act as natural ambassadors who help to reduce blood pressure and other cardiovascular diseases of people. Dogs and cats also play different roles, such as guiding, assisting, and especially to the blind, disabled person, and defense section of the country (Hasib *et al.*, 2020). Besides, enteric helminth is the most commonly encountered causal agent causing major impediment to dog health all over the world (Traub, 2003).

Most of the gastrointestinal parasites affect the dogs and cats sub-clinically with or without apparent clinical signs like lowered resistance to infectious diseases, retarded growth rate, reduced working efficiency and general ill health (Taylor *et al.*, 2007). The number of pet cats and dogs that coexist with human being is high in most cities and villages in the developing countries like Bangladesh, which constitute a potential risk of infections for human beings. The distribution and intensity of parasitism in dogs are influenced by geographical, climatic, cultural and economic factors. Pet

animals like cats and dogs are frequently helpless victims of various worms which were found into their gastrointestinal tract. Gastrointestinal helminthes of pet pose serious impact both on the hosts and human beings. It impedes the successful rearing of pets and result in losses that are manifested by lowered resistance to infectious diseases, retarded growth, reduced work and feed efficiency and general ill (Robertson *et al.,* 2000).

Close bonds of pets and humans in combination with inappropriate human practices and behavior remain a major threat to public health as dogs and cats harboring infective stages of parasites transmissible to man and other domestic animals. Dogs and cats are associated with zoonotic disease, among which parasite can pose serious public health concerns worldwide especially in rural areas where dogs and livestock are raised together and, where many inhabitants live under poor sanitation conditions and control of stray dogs is practically not existent (Beyene *et al.*, 2015). At least 36 important zoonotic diseases are acquired from dogs worldwide. Some important zoonotic diseases acquired from dogs have been reported from Bangladesh also (Samad, 2008).

Toxocariosis and Ancylostomosis are reported to remain the most important parasites affecting companion animals worldwide. Some canine helminths are documented to cause significant clinical diseases such as hydatidosis, visceral and cutaneous larva migrans in humans. Dog ownership is considered to be a risk factor for the occurrence of *Ancylostoma caninum*, inducing eosinophilic enteritis, an emerging zoonotic infection. Intestinal helminths are among the most common pathogenic agents encountered in dogs, especially in newly whelped or neonates and they constitute one of the main causes of pathologies of the intestinal tract in dogs. Some of these helminths are responsible for zoonotic diseases such as Toxocariasis or visceral larva

migrans, Ancylostomiosis or cutaneous larva migrans, Tungiasis, Hydatid disease as well as emerging and re-emerging infections such as Cryptosporidiosis and Giardiasis.

There is no current data available on the prevalence of enteric parasitic infections in dogs and cats in Dhaka city. In Dhaka city, a wide study has never been conducted before. Moreover, the findings of previous studies are limited in their value because they generally involved a small number of animals in a particular location, and many were restricted to high risk group. Consequently, it is difficult to compare the prevalence data recording in previous studies due to the differences in demographics of the animals sampled, difference in the sensitivity of diagnostic tests utilities, and certain parasites may have been overlooked. In 21st century, there has also been an increase in the regular prophylactic treatment of pets with anthelmintics, and this is likely to have affected the prevalence of helminthes. Several studies have been carried out on enteric parasitism of pet dog and cat throughout the world but surprisingly in Bangladesh, only few published data are available. Therefore, the current study was undertaken to determine the prevalence and intensity of enteric helminths of dogs and cats. The study will also assist the policy maker to take effective preventive and control measures against different zoonotic diseases.

Objectives of the study:

i. To identify different endoparasites found in gastrointestinal tract of dogs and cats
ii. To investigate the prevalence of endoparasites in dogs and cats in Dhaka city

CHAPTER 2

REVIEW OF LITERATURE

Dogs and cats are associated with more zoonotic disease among which parasite can pose serious public health concerns worldwide especially in rural areas where dogs, cats and livestock are raised together and in developing countries where many inhabitants live under poor sanitation conditions and control of stray dogs and cats is practically not existent (Beyene *et al*., 2015). Dogs and cats are definitive hosts for quite a large number of parasites for which other animals may become intermediate hosts and some of the parasites like *Toxocara canis, Toxascaris leonine, Dipylidium caninum, Diphyllobothrium latum, Taenia solium, Ancylostoma caninum, Trichuris vulpis, Capilaria hepatica, Isospora* sp., *Eimeria* sp.

2.1 Global context

Urgel *et al.* (2019) detected gastrointestinal parasites in both owned and sheltered dogs found in Cebu, Philippines. Of the 200 fecal samples examined, 122 samples were found to be positive with parasites. Samples from shelter dogs (90%) were found to have more parasites compared to those from owned dogs (45.4%). The most common gastrointestinal parasites detected were *Ancylostoma* spp. (38%), *Trichuris* spp. (12.5%), *Toxocara* spp. (11.5%), *Cystoisospora* spp. (8%), *Taenia* spp. (3%), and *Hammondia* spp. (1.5%). Majority of the sampled dogs were 5 years old and below that (79.2%), male (64.6%) and of pure breed (53.1%).

Borthakur and Mukharjee (2011) reported that gastrointestinal helminthes were gathered from 27 necropsied stray felines (Felis catus) in Aizawl, Mizoram, India from January, 2005 to April, 2009. The analyzed felines showed mixed helminthic

diseases, with overall prevalence of 85.2%. Five nematodes, 2 cestodes and 1 trematode was distinguished. The most common helminthes were *Taenia taeniaeformis* (70.4%), *Toxocara cati* (59.3%), *Physaloptera praeputalis* (44.4%), *Dipylidium caninum* (40.7%), *Spirocerca felineus* (18.5%), *Gnathostoma spinigerum* (11.1%), *Ancylostoma tubaeforme* (7.4%) and *Opisthorchis* sp (3.7%). Co-disease with *T. taeniaeformis* and *T. cati* was seen in 48.1% (13/27), showing the chance of these felines were paratenic host for toxocariasis in felines.

Panigrahi *et al.* (2014) determined the overall prevalence of gastrointestinal helminths infection was 41.46%. The highest infection rate was mixed parasitic infection (26.57%) followed by *Ancylostoma caninum* (23.44%), *Toxocara canis* (20.31%) and lowest for *Taenia* spp. (3.13%). In relation to different groups, the prevalence was lower in female than male, lower in older animals and it was shown a increasing trend as age decreased. It was also lower in pure and exotic breeds than non-descriptive breeds. Very few dog owners (10%) were conscious about that canine parasite could be transmitted to humans but maximum of them could provide correct information on the mode of transmission. About 12 % dog owners had maintained deworming schedule.

Suganya (2019) studied that a total of 510 fecal examples were collected from pet canines has a place with different zones of Chennai city, Tamil Nadu, India and were prepared by regular procedures and sub-atomic methods. Out of 510 dog fecal samples, 121 samples were positive for the parasitic eggs, prevalence rate was 23.72%. Species wise prevalence of the parasite was observed. PCR for the species-specific identification of the parasitic eggs was done. The outcomes revealed 38 examples were positive with product size of 540 bp specific for *A. caninum*, 25 examples were positive which resuled a product size of 380 bp which is specific for

Toxocara canis. None of the fecal examples tested were positive for *Echinococcus granulosus* which were positive for the presence of *Taenia spp.* eggs by microscopy.

Borkataki *et al.* (2013) examined a total of 100 stray cats by utilizing standard parasitological methods in Jammu, India. Post mortem examinations of stray cats were also done to determine the presence of any mature parasite. All the cats examined were found to be positive for one or other type of parasitic infection. Eggs identified were those of hookworms found to be predominant (80%) followed by *Taeniid* eggs (40%), *Toxocara* eggs (32%), *Strongyloides* eggs (28%), *Dipylidium canium* eggs (20%) and *Spirometra* eggs (8%). EPG of the positive samples was also recorded. Mean ± SD EPG of hookworm eggs, *Toxocara* eggs and *Strongyloides* eggs were 50, 102.5, 87.57, respectively. Prevalence of *Toxoplasma/Hammondia* oocyst was 88%, *Isospora* oocyst 80% and *Cryptosporidium* oocyst 4% (ZN- staining). Other five cat carcasses which were lying open on the road-side, also collected and brought to the laboratory for post-mortem examination. While opening the carcasses, three different parasites were also found and they were identified as *A. tubaeforme* (80%), *T. taeniaeformis* (60%) and *D. caninum* (40%).

Khan *et al.* (2020) examined one hundred and fifty two stool specimens (stray dogs=90 and household dogs=62) which were collected in suburban areas of Lower Dir district, Pakistan. The helminth eggs were processed by direct smear method and centrifugation techniques and identified by microscopic examination. Of the total examined dogs 26.8% (n=41 /152) were found to be infected with one or more intestinal parasites. The intestinal helminths detected were *Dipylidium caninum* (n =18, 11.8%), followed by *Toxocara canis* (n =16, 10.5%), *Taenia spp*., (n=10, 6.57%) *Ancylostoma caninum* (n=6, 3.94), *Toxascaris spp., Capillaria spp.,* and *Trichuris vulpis* (n=2, 1.31% each) in order of their prevalence. Pattern of infection revealed

that 27 (65.8%) dogs have single, 13(31.7%) double and 1(2.43%) triple infection. The stray dogs were highly infected 34.4% (n=31) than house hold dogs 16.1% (n=10).

Traub *et al.* (2014) collected and examined 411 stray dogs samples from four geographical and climactically distinct locations in India. Hookworms were the most commonly identified parasite in dogs in Sikkim (71.3%), Mumbai (48.8%) and Delhi (39.1%). In Ladakh, which experiences harsh extremes in climate, a competitive advantage was observed for parasites such as *Sarcocystis spp*. (44.2%), *Taenia hydatigena* (30.3%) and *Echinococcus granulosus* (2.3%). PCR identified *Ancylostoma ceylanicum A. caninum* to occur sympatrically, either as single or mixed infections. Accepted Manuscript Sikkim (Northeast) and Mumbai (West). In Delhi, *A. caninum* was the only species identified in dogs, probably owing to its ability to evade unfavourable climatic conditions by undergoing arrested development in host tissue. The expansion of the known distribution of *A. ceylanicum* to the west, as far as Mumbai, justifies the renewed interest in this emerging zoonosis and advocates for its surveillance in future human parasite surveys. Of interest was the absence of *Trichuris vulpis* in dogs, in support of previous canine surveys in India.

Ngui *et al.* (2014) revealed that the overall prevalence of GI parasitic infection was 88.6% (95% CI = 82.5–94.7) in which 88.3% of dogs and 89.3% of cats were infected with at least one parasite in Peninsular Malaysia. There were 14 different GI parasites species (nematodes, cestodes and protozoa) detected, including *Ancylostoma* spp. (62.9%), *Toxocara* spp. (32.4%), *Trichuris vulpis* (21.0%), *Spirometra* spp. (9.5%), *Toxascaris leonina* (5.7%), *Dipylidium caninum* (4.8%), *Ascaris* spp. (2.9%), *Hymenolepis diminuta* (1.0%) and others. General prevalence of GI parasites showed a significant difference between helminth (84.4%) and protozoa (34.3%) infections.

Monoparasitism (38.1%) was less frequent than polyparasitism (46.7%). As several of these GI parasites are recognized as zoonotic agents, the results of this investigation revealed that local populations may be exposed to a broad spectrum of zoonotic agents by means of environmental contamination with dogs and cats faeces and this information should be used to mitigate public health risks While, GI helminths in rural dogs in Argentina found prevalence rates ranging from 37.9% to 52.4% (Soriano *et al.* 2010). Similarly, studies conducted among shepherd and hunting dogs in Greece (Papazahariadou *et al.*, 2007) noted prevalence rates of 35.5% and 26%, respectively

Hajipour *et al.* (2015) examined a total 50 stray cats of which 15 (30 %) were female and 35 (70 %) were male in east Azerbaijan province, Iran. Overall 47 cats (94 %) were identified as infected with at least one of the endoparasites. The prevalence of parasites found were: *Taenia taeniaeformis* (60 %), *Dipylidium caninum* (58 %), *Taenia hydatigera* (24 %), *Mesocestoides lineatus* (78 %), *Ancylostoma tubaeforme* (14 %), *Toxascaris leonina* (30 %), *Toxocara cati* (78 %), *Physaloptera praeputialis* (10 %), *and Syphacia obvelata* (10 %). Contamination rate for zoonotic parasites of cat was greater than expected in AzarShahr region.

Liang and Yang (2015) reported 360 cats feces and intestinal parasites positive feces were 149 (41.39%) from China of which 64 (17.78%) were infected with *Toxocara cati*, 61 (16.94%) with *Isospora felis*, 41 (11.39%) with *Isospora rivolta*, 33 (9.17%) with *Paragonimus*, 23 (6.39%) with hookworms, 11 (3.06%) with *Toxoplasma*-like oocysts, 10 (2.78%) with *Trichuris*, 4 (1.11%) with lungworm, 2 (0.56%) with *Sarcocystis*, and 1 (0.28%) with Trematode.

Rojekittikhun *et al.* (2014) collected 500 dogs and 300 cats fecal samples from an animal refuge in Nakhon Nayok Province, Thailand to test for gastrointestinal

protozoa and helminths. In dog, the overall prevalence of parasites was 36.2% (181/500), where 35.7% (177/500) had helminths and 2.8% (14/500) had protozoa. The helminths were: hookworm (30.6%), *Trichuris vulpis* (16.0%), *Toxocara canis* (6.6%), *Hymenolepis diminuta* (1.2%), *Spirometra mansoni* (0.6%), *and Dipylidium caninum* (0.2%). *Giardia duodenalis* (2.8%) was found in dog feces. In cat, the overall prevalence of parasites was 44.3% (133/300), where 43.3% (130/300) were helminths and 6.0% (18/300) were protozoa. The helminths were hookworm (34.7%), *T. cati* (9.7%), *S. mansoni* (4.0%), *Platynosomum fastosum* (2.7%), *Strongyloides* sp (0.7%), *and Echinostoma* sp (0.3%). Two species of protozoa, *Isospora* sp (5.7%) *and G. duodenalis* (0.3%) were found in cat feces. Two percent of dogs and five percent of cats had mixed protozoan and helminthic infections. Dogs with double, triple, and quadruple helminthic infections were found at rates of 22.0%, 2.8%, and 0.2%, respectively. Cats with double and triple helminthic infections were found at rates of 9.7% and 1.0%, respectively. Quadruple helminthic infections were not found in cats, and double protozoan infections were not found in either dogs or cats.

Yakhchali *et al.* (2017) observed that the overall prevalence of helminths and flea were 44/51 (86.3%) and 31/51 (60.78%), respectively, in Ahar Municipality, Northwestern Iran. The highest percentage of helminth infection belonged to *Toxocara cati* (86.3%), followed by *Taenia taeniaeformis* (64.7%), *Mesocestoides lineatus* (49.02%), *Dipylidium caninum* (29.41%), *Taenia hydatigena* (19.6%), Toxascaris *T. leonina* (11.77%) and *Ancylostoma tubaeforme* (5.9%).

Raza *et al.* (2018) studied that nematodes and protozoa that transmit through ingestion or skin penetration are major enteric parasites of concern in shelter settings. *Ancylostoma* spp., *Uncinaria stenocephala, Toxocara canis, Toxascaris leonina, Trichuris vulpis and Dipylidium caninum* are the major helminths while *Giardia,*

Cryptosporidium, Isospora spp. *and Sarcocstis* spp. are the most prevalent protozoa in shelter dogs. The prevalence of gastrointestinal parasites in shelter dogs was generally higher than in owned dogs.

Tamerat *et al.* (2015) reported that a sum of 384 new fecal examples by utilizing floatation strategy in Eastern Ethiopia. The general predominance of gasterointestinal (GI) helminthes was 83.1% in which 91% of canines and 65.9% of felines were tainted with at least one helminthic parasite. In the two hosts, *Ancylostoma* was the most predominant parasite, explicitly 70.5% in dogs and 37.5% in felines followed by *Toxocara with* 30.3% in canines and 32.5% in felines while *Physaloptera* (1.1%) also, *Dipylidium caninum* (1.7%) were the most un-pervasive parasites in canines and felines, separately.

Torres-Chable *et al.* (2015) observed that fecal examples from 80 (26.5%) canines contained GI parasites. Of these, 58 (19.2%) were positive for helminths and 22 (7.3%) were positive for protozoan parasites. No less than seven parasitic species were recognized. The most well-known parasite was *Ancylostoma caninum* which was distinguished in 48 (15.9%) canines. Different parasites recognized on various events were *Cystoisospora spp*. (n = 19), *Toxocara canis* (n = 7) and *Giardia* spp. (n = 3). Three extra parasites*, Dipylidium caninum, Trichuris vulpis and Uncinaria* spp., were each distinguished in a solitary canine

Ayinmode *et al*. (2016) found that the gastrointestinal parasites of dog were 43.3% (88/203) in Ibadan, Nigeria. Single and multiple parasites were 69 (78.4%) and 19 (21.6%), respectively. The parasites identified were *Ancylostoma* sp. 24.6% (50/88) *Isospora* sp. 14.2% (29/88), *Toxocara* sp. 9.8% (20/88), *Uncinaria* sp. 2.5% (5/88) and *Strongyloides* sp, 3.9% (8/88). *Ancylostoma* sp. (320 x 102 epg) and *Uncinaria*

sp. Parasites epg had the most noteworthy and least force individually. Roads inside neighborhoods having markets had the most noteworthy number of positive examples. Every one of the genera of parasites detected in this examination has zoonotic potential.

Idika *et al.* (2017) identified four helminth parasites namely, hookworm (*Ancylostoma* spp.), *Toxocara* spp., *Dipylidium caninum* and *Trichuris vulpis* in the study with the prevalence rates 33.2%, 5.9%, 4.0% and 0.5% respectively, in Enugu State, South Eastern Nigeria. Mixed infections with more than one helminth parasites species were recorded in 8.6% of the cases, of which 7.0% and 1.6% represent dogs infected with two and three different parasite species respectively. Annual breakdown of the prevalence data as presented in the highest prevalence was recorded in 2009 (82.6%) followed by 2011 (79.4%), 2006 (72.7%) and 2010 (61.8%). The lowest recorded prevalence of 43.2% was in 2013. When the prevalence rates were analyzed by sex, it was observed that male dogs had slightly higher prevalence of infection (56.6%) than the female dogs (54.6%) but the difference was not significant ($P > 0.05$). On breed basis, the local breeds of dog had higher prevalence of infection (62.5%) than their exotic (48.0%) counterpart and the difference was significant ($P = 0.28$). Also, dogs under 12 months old had significantly higher prevalence (62.9%) than dogs over 12 months of age (46.4%). The result in that study showed that prevalence rates of 52.9 and 50.4% were recorded for the rainy and dry season, respectively.

Zanzani *et al.* (2014) were collected a total of 409 fresh fecal samples from household dogs and cats in Northern Italy for copromicroscopic analysis and detection of *Giardia duodenalis* coproantigens. The assemblages of Giardia were also identified. A questionnaire about intestinal parasites biology and zoonotic potential was submitted to 185 pet owners. The overall prevalence of intestinal parasites resulted

higher in cats (47.37%−60.42%) and dogs (57.41%−43.02%) from micropolitan areas than that from the metropolis of Milan (dogs: *P* = 28.16%; cats: *P* = 32.58 %). The zoonotic parasites infecting pets under investigation were *T. canis and T. cati, T. vulpis, A. caninum,* and *G. duodenalis* assemblage A. Only 49.19% of pet owners showed to be aware of the risks for human health from canine and feline intestinal parasites.

Joffe *et al.* (2011) evaluate the prevalence of endoparasites in 619 dogs and 153 cats in the Calgary, Alberta region. Both homed and shelter-sourced pets were evaluated, and prevalence was assessed in various age groups. The overall endoparasite prevalence was 16.5% in canine samples and 7.2% in feline samples. The most common intestinal parasites in dogs were *Giardia* (8.1%) and *ascarids* (4.2%). The most common feline endoparasite was ascarids (6.5%).

Makene *et al.* (1996) identified that out of 235 domestic dogs from Morogoro municipality and Mgeta area in Morogoro region coproscopically screened for gastrointestinal parasitic infections, 174 (74%) were found positive for one or the other parasite. *Ancylostoma caninum* was the most common parasite (72%). Protozoan parasites and other helminths were less prevalent (4%).

Villeneuve *et al.* (2015) reported that 1086 samples from dogs and 636 smples from cats. The overall prevalence of GI parasites in dogs and cats was 33.9% (CI 31.1 – 36.8) and 31.8% (CI 28.2 – 35.5), respectively. Eleven different species of parasites were identified in dogs and eight in cats. Of the dogs that tested positive for any parasite on fecal analysis, 67% were infected with a single species of parasite and 33% with multiple species. Seventy-three percent of positive cats were infected with a single species of parasite and 27% with multiple species. *Toxocara canis* was the

most prevalent parasite in fecal samples from dogs (12.7%, CI 10.8-14.8) followed by *Cystoisospora spp.* (10.4%, CI 8.7 – 12.4). Total prevalence of ascarid infection (*T. canis* and *Toxascaris leonina*) was 14.6% (CI 12.6 – 16.9). The most prevalent parasite in cats was *T. cati* (16.5%, CI 13.7 – 19.6) followed by *Cystoisospora* spp. (14%, CI 11.4 – 16.9). The prevalence of any parasites was higher in dogs ≤ 1 yr of age than in dogs > 1 yr of age (p = < 0.0001). *Toxocara canis (*p = < 0.0001), *T. leonina* (p = 0.0040), *Uncinaria stenocephala* (p = 0.0469), *Giardia* (p = 0.0004), *Cystoisospora* (p = 0.0170) and *Cryptosporidium* (p = 0.0003) were the parasites that contributed most to this result. In cats, differences in parasite prevalence between the age groups produced significant results only for T. cati (p = < 0.0001).

2.2 National Context

Mehedi *et al.* (2020) studied that the prevalence of GI parasites in Mymensingh sadar, Bangladesh was 62.9% (39/62) and the mixed parasitic disease was 20.9% (13/62). The commonness of Toxocara cati and Ancylostoma tubaeforme contaminations were 17.7% and 6.5%, separately. The prevalence of *Taenia pisiformis* contamination was 3.22%. Not with standing, the prevalence of *Isospora felis, Toxoplasma gondii* and *Balantidium coli* contaminations were 4.8%, 3.2% and 6.5%. The prevalence of contamination was significantly (P<0.008) higher in cat than that in grown-up feline. The general prevalence of intestinal parasites were observed to be 76.66% in little cats (≤6 month age) and 60.00% in youthful (>6 month to 1 year) felines. The prevalence of GI parasitic disease was observed to be 33.33% in grown-up (>1 year) felines. In little cats (≤6 months), the most elevated disease was brought about by *T. cati* (23.33%), trailed by *I. felis* (10.00%), *A. tubaeforme* (10.00%), *T. taeniaeformis* (6.66%) *B. coli* (3.33%) and *T. gondii* (3.33%). About 20.00% little cats were observed to be tainted with blended parasites. Parasites were higher in female felines 66.67% than in the male felines 57.69%. In both genders, the most noteworthy predominance was seen in instance of *T. cati* 19.23% in male and 25.00% in female.

Das *et al.* (2012) observed that mixed parasite was very much in Chittagong Metropolitan, Bangladesh where 57 dogs (N=60) were found positive for enteric helminths infections. Six different enteric parasites (3 cestodes and 3 nematodes) were identified. The highest (45%) overall prevalence and worm load (42.18 ± 7.99) was recorded in *Trichuris vulpis* infection. Here higher prevalence was found in *Diphyllobothrium latum* and *Ancylostoma caninum* compared to *Taenia* spp infection. The highest seasonal prevalence was found in *Toxocara cains* infection (35.71%) in summer and *Ancylostoma caninum* (43.75%) in winter. Prevalence was also

difference with the age of stray dogs where youngs were more susceptible than adults. Sex specific prevalence found that *Diphyllobothrium latum, Dipylidium* caninum, and *Ancylostoma caninum* was higher in female dogs.

Mahmud *et al.* (2014) studied that 272 sick pet dogs in the District Veterinary Hospital (DVH), Sirajganj. A total 7 types of protozoan diseases were found in only 61 dogs and their variation in prevalence were seen on the basis of age and sex. The overall prevalence of protozoan diseases of pet dogs in the study area was observed 22.42%. The highest prevalence was found as Giardiasis (42.62%), Amoebiasis (26.23%), Coccidiosis (14.75%), Balantidiasis (9.84%), Toxoplasmosis (3.28%), Babesiosis (1.64%) and Leishmaniasis (1.64%). Age-wise highest cumulative prevalence was identified in age group above 1 year (54.10%), compare to that in less than or equal to 1 year (45.90%) age groups of pet dogs. On the other hand, sex-wise overall cumulative prevalence of dog was noticed in the female (55.74%) than male (44.26%).

Barua *et al.* (2020) identified 17 different parasite species of zoonotic importance in pet market of Dhaka. Among them 8 species were common in both dog and cat (*Taenia* spp., *Hymenolepis diminuta, H. nana, Ancylostoma* spp., *Ascaris lumbricoides, Capillaria* spp., *Toxascaris leonina* and *Trichuris vulpis*). Aside from 8 common species, 2 additional species were only recognized in canines and 7 species in felines. *Capillaria* spp. had the most elevated predominance in the two canines (86.67%) and felines (90%) trailed by *Trichuris vulpis* (83.33% in canines, 90% in felines). Other predominant parasites in canines were *A. lumbricoides* and *Toxocara canis* (Prevalence 76.67% for both); in felines were - *T. leonina, Toxocara cati, Sarcocystis* spp. what's more, *Toxoplasma* spp. (pervalence 76.67%, 73.33%, 60%

and 60%, respectively). In the age group of hosts, both dogs and cats, puppies or kittens and young hosts had higher prevalence of parasites compared to adults.

CHAPTER 3

METHODS AND MATERIALS

3.1 Study Area

Different veterinary hospitals, clinics, foster and owner houses located at Mohammadpur, Dhanmondi, Mirpur, Sher-e-Bangla nagar, and Badda region of Dhaka city were selected as the study area. The city is located in central part Bangladesh at 23°42′N 90°22′E, and on the eastern banks of the Buriganga River. It has a distinct monsoon season, with an annual average temperature of 26 °C (79 °F), and monthly means varying between 19 °C (66 °F) in January and 29 °C (84 °F) in May. The average annual rainfall is 2,123 millimetres and relative humidity is 75% on an average.

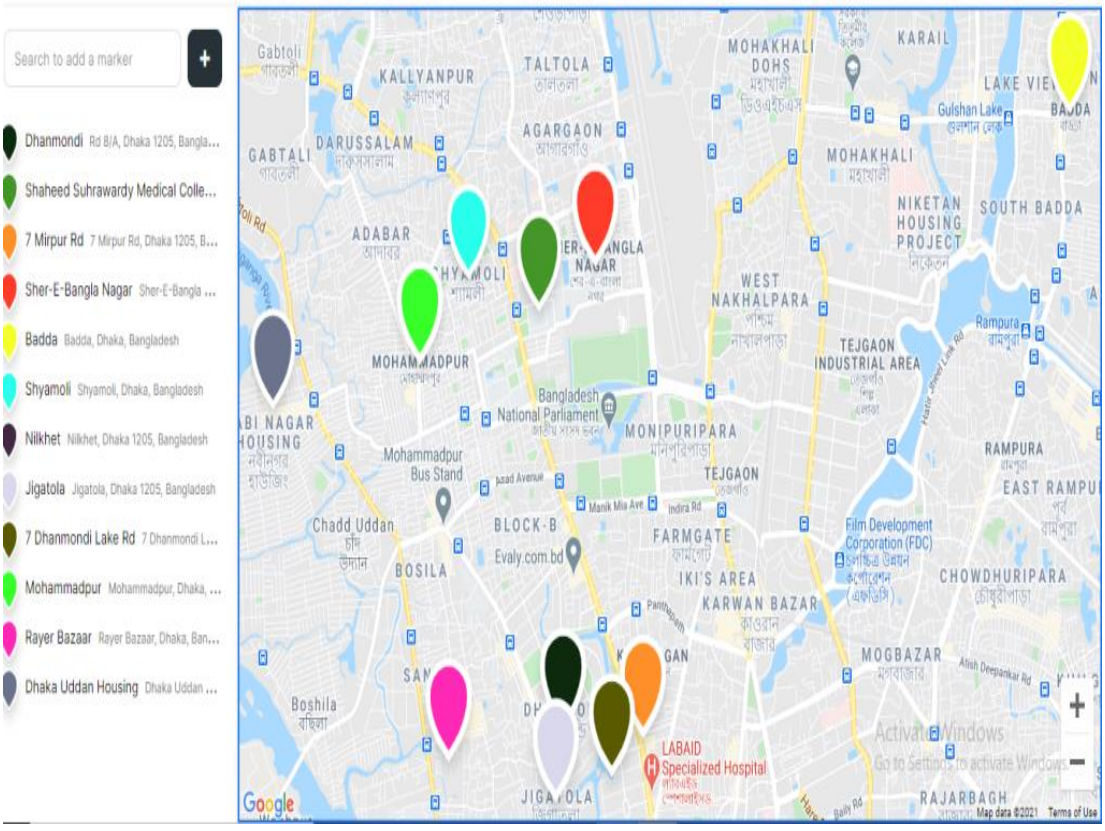


Figure 1: Study area pins in map show the specific location.

3.2 Study Animal

The study animals were pet and stray dogs and cats of both sexes. Dogs and cats up to six months of age were classified as young, and those above six months of age were referred to as adults.

3.3 Sample Collection

Fecal samples were collected with the permission and assistance of the owners. The fecal samples were collected either directly from the rectum or from freshly voided feces of the target animals. The samples were kept in 70% ethanol containing collection vial. Extra care was taken to avoid contamination with soil which might be harmful through the introduction of free-living organisms from the environment. During sampling, data with regard to species, age, sex and date of collection were recorded for each animal. The samples were taken to the Microbiology and Parasitology laboratory, Sher-e-Bangla Agricultural University, Dhaka. Then the samples were stored in refrigerator in 4℃ for future use.

3.4 Sample size

A total of 187 samples (48 dogs and 139 cats) were collected from dogs and cats of different ages and sexes from the study area.

3.5 Fecal sample examination

The fecal samples were examined by qualitative methods where both sedimentation and floatation techniques were performed maintaining proper protocols.

3.5.1 Sedimentation method

Five to ten grams of fecal sample was taken in a beaker containing 100 ml of water. The sample was mixed properly with a stirrer and passed through a sieve to another beaker. Then the beaker was allowed to stand for 30 minutes to form clear sediment. The supernatant fluid was carefully poured off and a small amount of the sediment was taken out with the help of medical dropper and spread on a glass slide. This is then covered with a cover slip and placed under microscope at 4X, 10X and 40X.

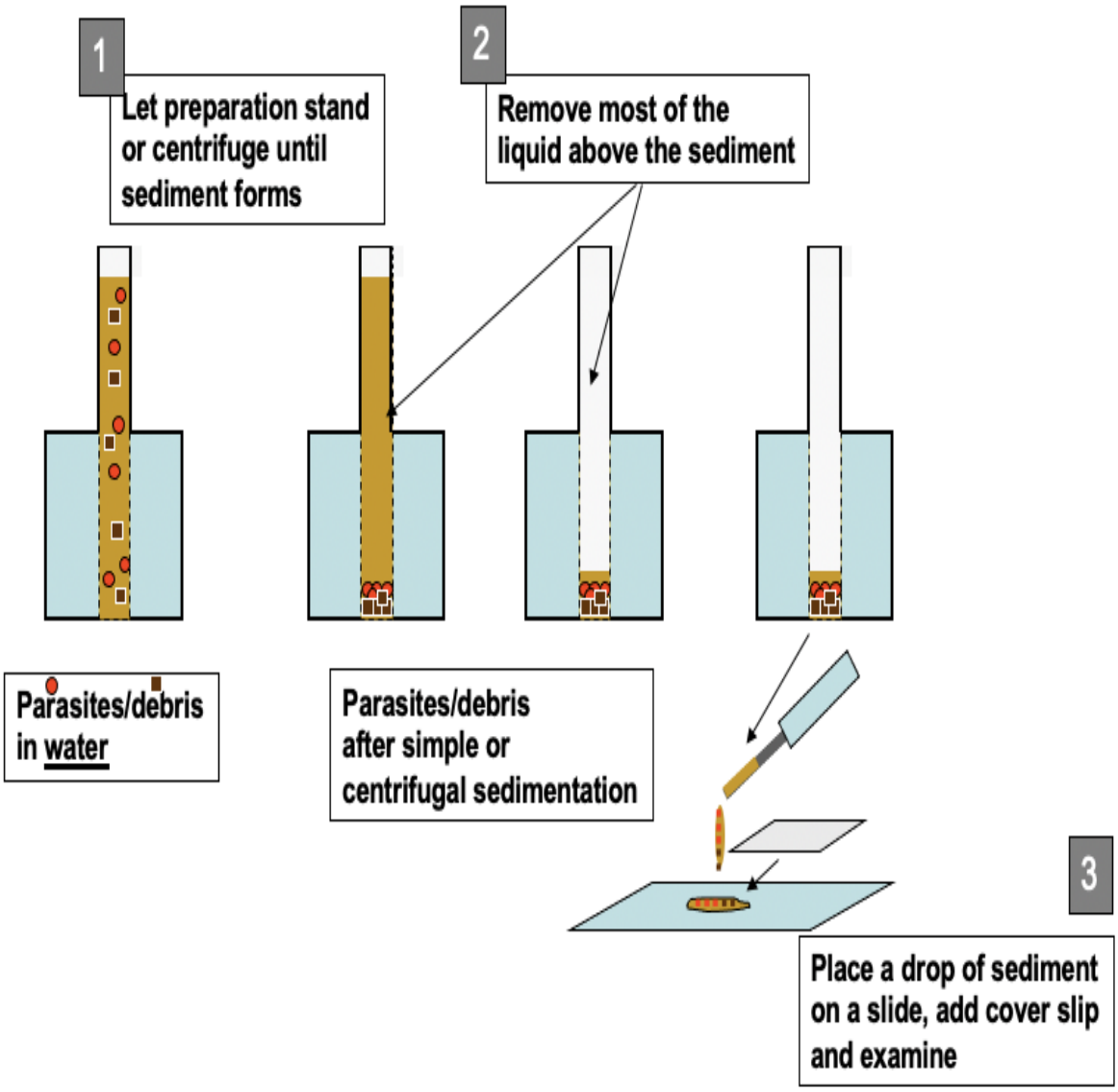


Figure 2: Schematic diagram for simple sedimentation method.

3.5.2 Floatation method

Floatation fluid was made by desolving 400 gm Sodium Chloride Salt into 1000 ml of water. Hence, floatation fluid was made with a specific gravity of 1.28. Two to five grams of feces was taken in 10ml of sugar solution and mixed properly. This solution was then taken into 12-15 ml centrifugal tube and tube was loaded up with sugar solution around 1 inch from the highest point. Centrifugation was done for 5 minutes at 1200 rpm. The test tube was then taken out from the centrifuge machine; top 1 inch of the tube was filled up with sugar solution. A coverslip was put on the top of the tube and it was permitted to stand for 10 minutes. After that, the coverslip was placed on a slide and seen under the microscope at 4X, 10X to 40X.

Figure 3: Floatation technique performed in laboratory

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Results

4.1.1 Parasites recovered in dogs

The study was conducted from September, 2019 to February, 2020. A total of 187 samples were collected, and out of them, 48 were dog samples and 139 were cat samples. Through examination of different breeds of dog, a number of different endoparasites were recovered. The endoparasites included six species of helminths and two species of protozoa in dogs. Among the helminths, two species of cestodes (*Dipylidium caninum* and *Diphyllobothrium latum*) and four species of nematodes (*Toxocara canis*, *Toxascaris leonina*, *Ancylostoma caninum* and *Trichuris vulpis*) were identified. Moreover, two protozoan species, namely, *Isospora* sp. and *Eimeria* sp were recorded from the samples.

4.1.1.1 Overall prevalence of parasitic infection in dogs

In dogs, 17(35.42%) were found positive where the prevalence of enteric helminth and protozoan were 31.25% and 8.33%, respectively. Out of 17 samples, 12 dogs were positive, where 70.59% had a single infection and rest 29.41% dogs had mixed infections.

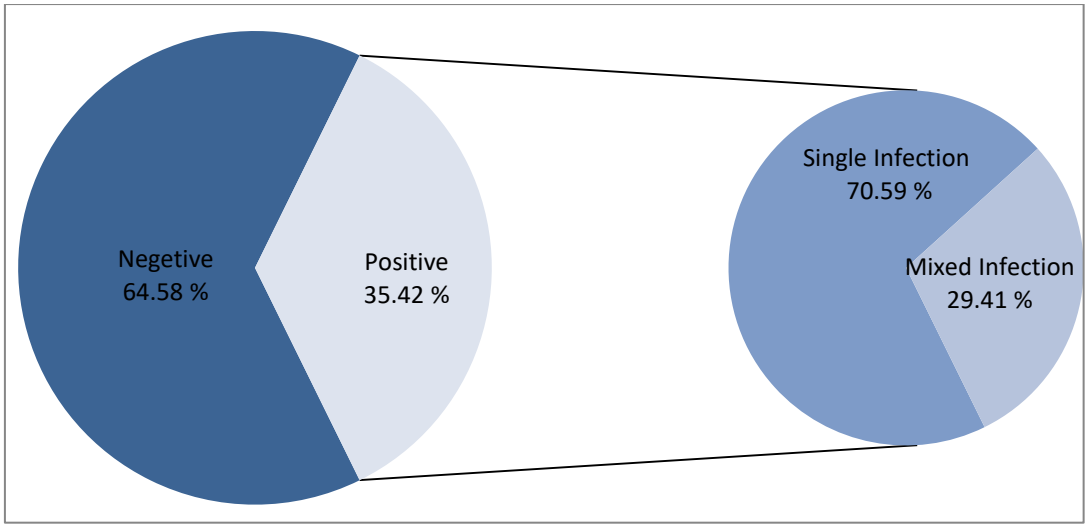


Figure 4: Overall prevalence of parasitic infection in dogs

In this study, *Toxocara canis* was the highest prevalent parasite (8) 16.67%. The other endoparasites prevalent were *Toxascaris leonina* 2.08%, A*ncylostoma caninum* 6.25%, *Trichuris vulpis* 10.42%, *Dipylidium caninum* (4.17%), *Diphyllobothrium latum* (2.08%). Two species of protozoa, *Isospora* sp. and *Eimeria* sp., had a prevalence of 6.25% and 2.08% respectively.

Table 1: Prevalence of individual parasites in dog

Species of Endoparasites	Number of total sample	Prevalence (%)
Toxocara canis	8	16.67
Toxascaris leonina	1	2.08
A*ncylostoma caninum*	3	6.25
Trichuris vulpis	5	10.42
Dipylidium caninum	2	4.17
Diphyllobothrium latum	1	2.08
Isospora canis	3	6.25
Eimeria sp.	1	2.08

4.1.1.2 Age-wise prevalence of parasitic infection in dogs

All 48 dog samples were categorized into 2 groups, older and young. 16 samples were collected from older group (> 6 months) and 32 samples were collected from younger group (≤6 months). In the younger group, 5 samples were positive (31.25%), and in the older group 12 samples were positive (37.50%).

Table 2: Age-wise prevalence of parasitic infection in dogs

Age groups	No of animals	No. of positive cases	Prevalence (%)
Young dog (≤6 months)	32	12	37.50
Adult dog (> 6 months)	16	5	31.25

4.1.1.3 Sex related prevalence of parasitic infection in dogs

The study was carried out in a total of 48 dogs where 23 were male and 25 were female. Among the male dogs, 8 cases were positive with the prevalence of 34.78%; While 9 were positive with the prevalence of 36.00% in female dogs.

Table 3: Sex related prevalence of parasitic infection in dogs

Sex	No of observed	No. of positive cases	Prevalence (%)
Male	23	8	34.78
Female	25	9	36.00

4.1.1.4 Prevalence of parasitic infection according to habitat in dogs

In this study, 48 dogs were classified into two groups according to the habitat; pet and stray. The prevalence of stray and pet dogs was 77.78% and 25.65%, respectively. In this study, endoparasitic infections were more prevalent in stray dog than pet dog.

Table 4: Prevalence of parasitic infection according to habitat in dogs

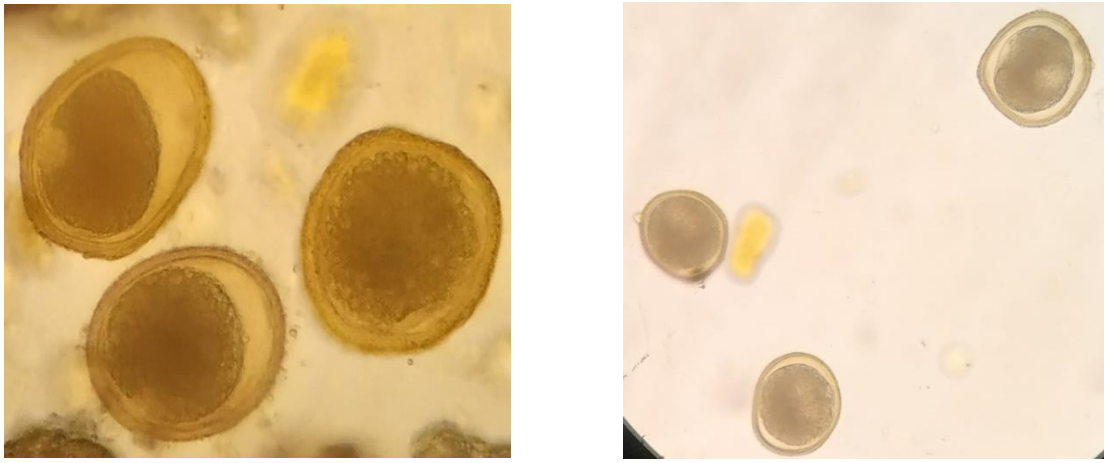
Class	Number of animals	No. of infected dogs	Prevalence (%)
Pet Dog	39	10	25.65
Stray Dog	9	7	77.78

4.1.1.5 Breed wise prevalence of parasitic infection in dogs

In this study, a total of 48 dogs of 3 breeds namely, local breed, cross breed and exotic breed, were examined. Out of them, 10 were local breed originated in Bangladesh, 22 were crossbred and the rest 16 were exotic. Prevalence rate was highest in local breed (40.00%) followed by exotic breed (37.50%) and crossbreed (31.82%).

Table 5: Breed wise prevalence of parasitic infection in dogs

Breed	No of animals	No. of infected dogs	Prevalence (%)
Local breed	10	4	40.00
Cross breed	16	6	37.50
Exotic breed	22	7	32.82



A B

Figure 5: *Toxocara canis*; A (40x magnification), B (10x magnification)

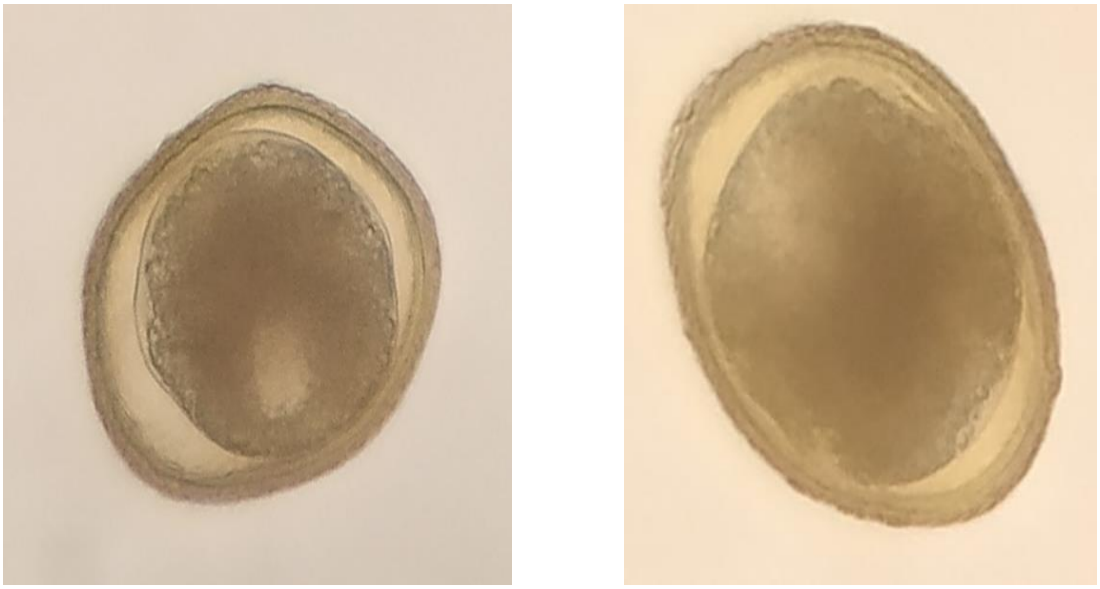


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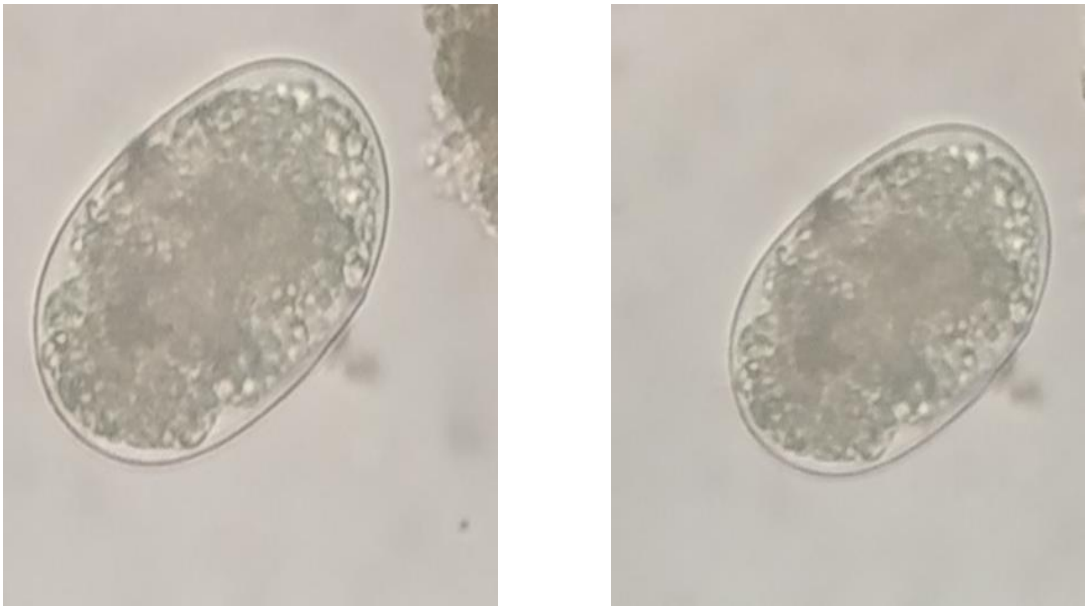
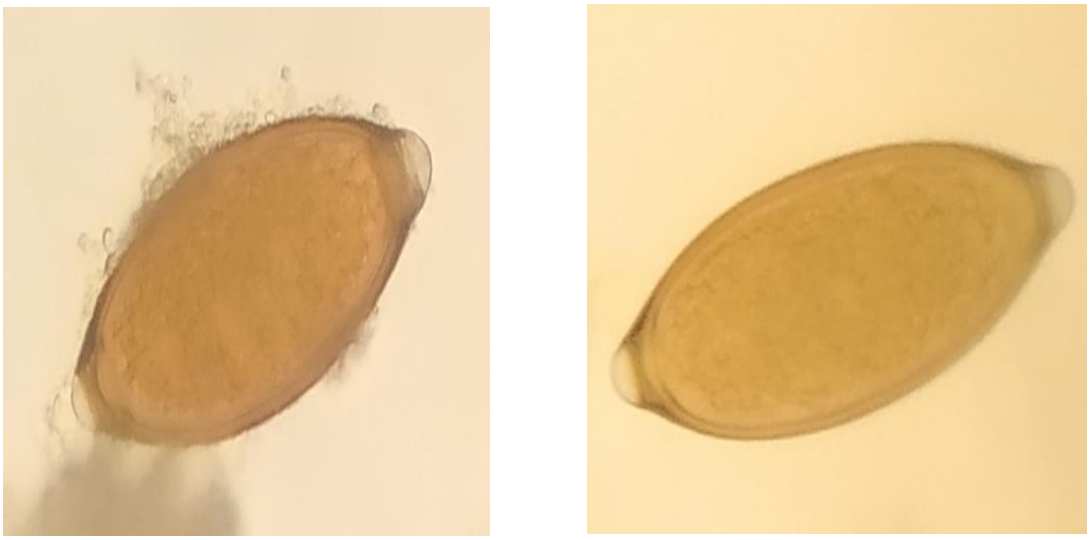
Figure 6: *Toxascaris leonina*; A and B Both (40x Magnification)



A B

Figure 7: *Ancylostoma caninum*; A and B both (40x Magnification)



A B

Figure8: *Trichuris vulpis*; A and B both (40x Magnification)

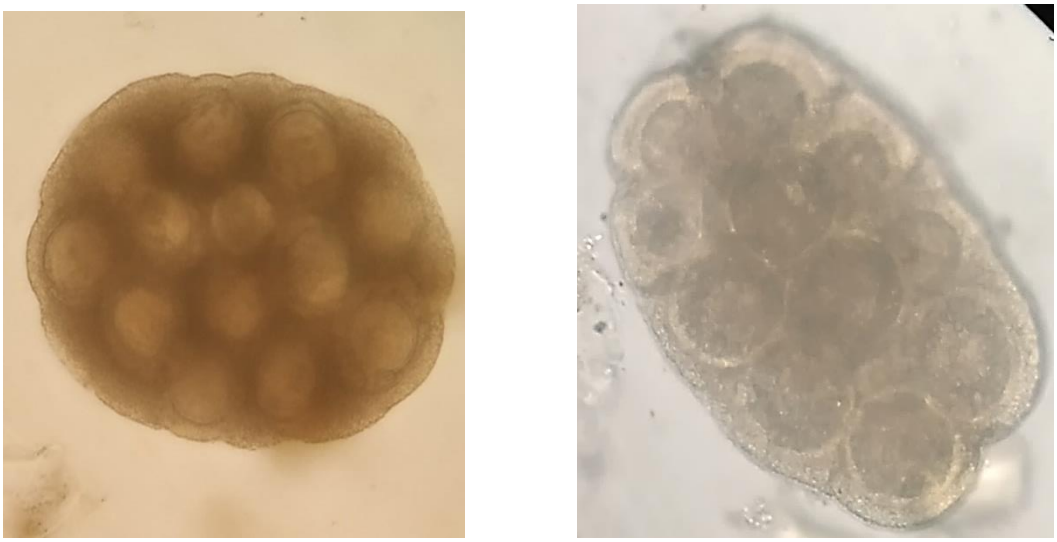


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Figure 9: *Dipylidium caninum*; A and B both (40x Magnification)

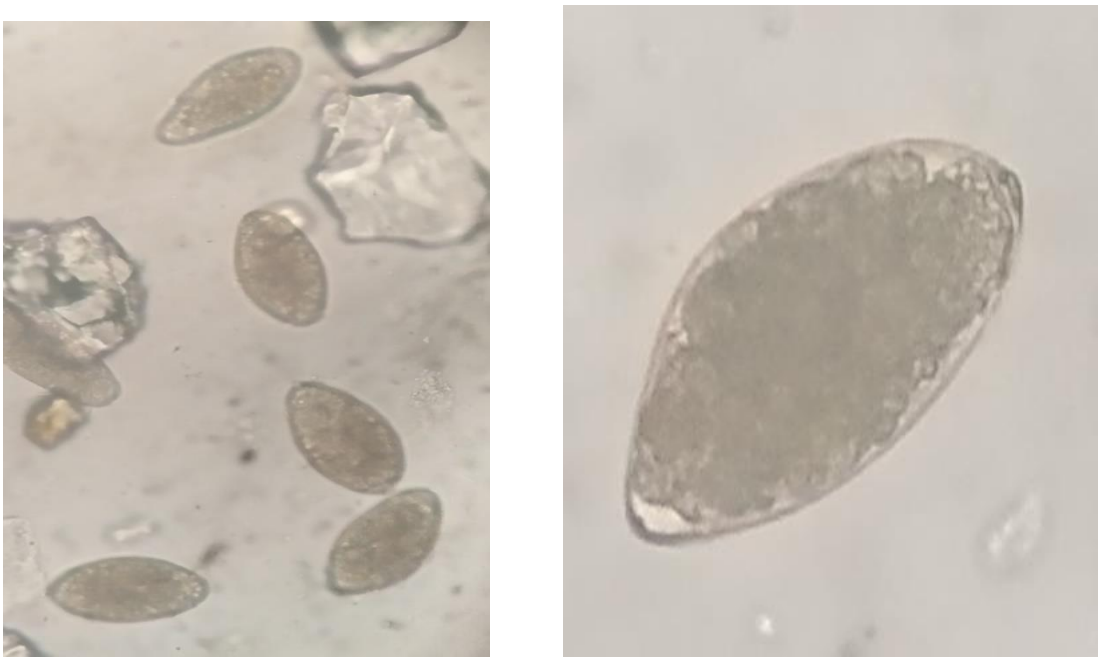

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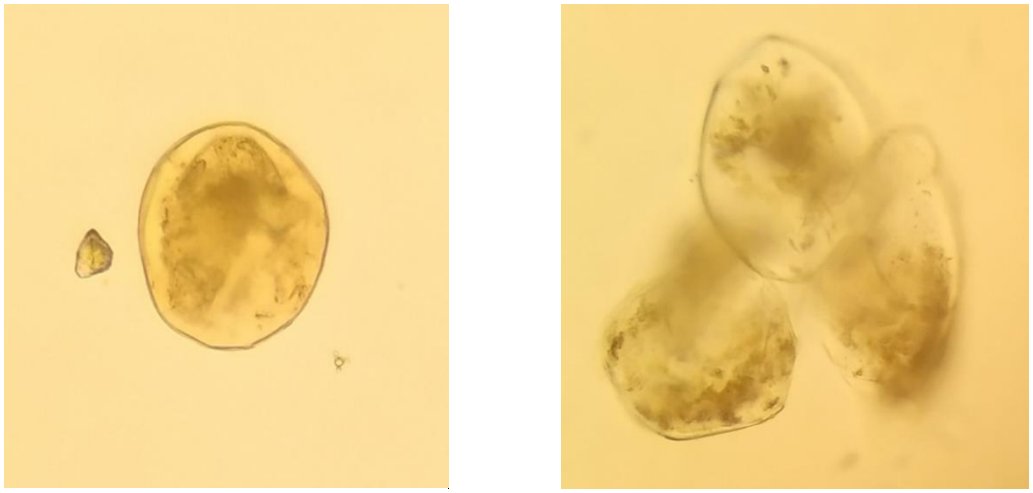
Figure 10*: Diphyllobothrium latum*; A and B both (40x Magnification)



A B

Figoue 11: *Isospora* sp.; A and B both (40x Magnification)

Figure 12: *Eimeria* sp. (40x Magnification)

4.1.2 Parasites recovered in cats

Through examination of 139 different breeds of cats, several endoparasites were identified. Among the endoparasites, seven species were helminths and two species were protozoa in cat. The helminths included three species of cestodes (*Dipylidium caninum, Diphyllobothrium latum* and *Taenia* sp.) and four species of nematodes (*Toxocara cati, Toxascaris leonina, Ancylostoma caninum* and *Capillaria hepatica*). Other hand, there were only two species of protozoa, *Isospora* sp. and *Eimeria* sp.

4.1.2.1 Overall prevalence of parasitic infection in cats

Among 139 cat faeces, 46 cases were found positive, which showed a prevalence of 33.09%. Out of these positive cases, 42 showed positive for helminthes (30.22%) and rest 10 showed positive for protozoa (7.19%). 33 out of 46 positive cat sample had single endoparasitic infection (71.74%), and rest 13 (28.26%) sample had mixed infection in cats.

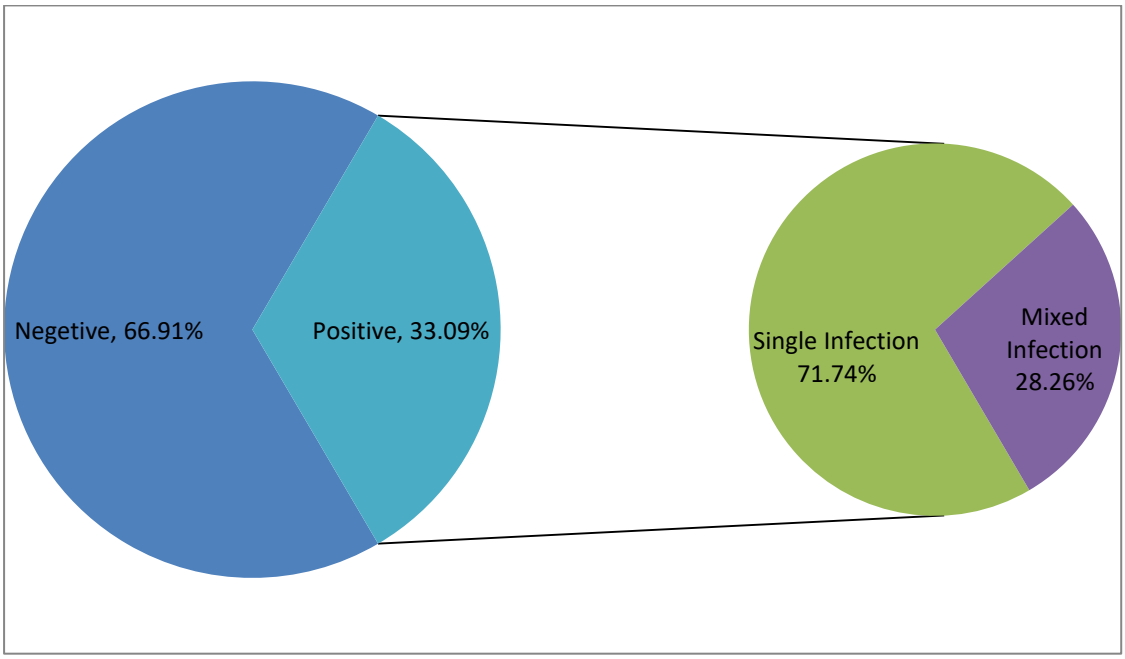


Figure 14: **Overall prevalence of parasitic infection in cats**

In this study, total seven types of helminths were found. Among the helminths, *T. cati* had the highest prevalence (15.83%) followed by *C. hepatica* (7.91%), *A. caninum* (5.04%), *D. caninum* (3.6%), *D. latum* (2.88%), *T. leonina* (2.16%) and *Taenia* sp. (1.44%). On the contrary two species of protozoa were identified with the prevalence of 6.47% and 2.16% for *Isospora* sp. and *Eimeria* sp., respectively.

Table 6: Prevalence of individual species of endoparasites in cat

Species of Endoparasites	No. of positive sample	Prevalence (%)
Toxocara cati	22	15.83
Toxascaris leonina	3	2.16
A*ncylostoma caninum*	7	5.04
Capilaria hepatica	11	7.91
Dipylidium caninum	5	3.6
Diphyllobothrium latum	4	2.88
Taenia sp.	2	1.44
Isospora sp.	9	6.47
Eimeria sp.	3	2.16

4.1.2.2 Age-wise prevalence of endoparasites in cats

A total of 139 cat samples were categorized into 2 groups; older (age > 6 months) and young (age ≤6 months). Among the samples, 46 samples were collected from older group and 93 samples were collected from younger group where younger group (34.41%) were more infected than the older group (30.43%).

Table 7: Age-wise prevalence of endoparasites in cats

Age group	No. of animals	No. of positive cases	Prevalence (%)
Young cat (age≤ 6 months)	93	32	34.41
Adult cat (age > 6 months)	46	14	30.43

4.1.2.3 Sex wise prevalence of parasitic infection in cats

The study was carried out in a total of 139 cats where 52 were male and 87 were female. Among 52 male, 18 cases were positive with the prevalence of 34.62%; Among 87 females, 28 were positive with the prevalence of 32.18%.

Table 8: Sex-wise prevalence of parasitic infection in cats

Sex group	No. of animals	No. of positive cases	Prevalence (%)
Male	52	18	34.62
Female	87	28	32.18

4.1.2.4 Prevalence of parasitic infection according to habit in cats

In this study, 139 cats were classified into two groups, pet and stray, according to the habitat. Among 139 cats, only 21 were stray cats while 118 were pet cats. The prevalence of stray and pet cats was 80.95% and 24.58%, respectively. In this study, endoparasitic infections were more prevalent in stray cat than pet cat.

Table 9: Prevalence of parasitic infection according to habit in cats

Type	No. of animals	No. of infected cats	Prevalence (%)
Pet cat	118	29	24.58
Stray cat	21	17	80.95

4.1.2.5 Breed wise prevalence of parasitic infection in cats

In this study, a total of 139 cats of 3 types, local breed, cross breed and exotic breed, were examined. Out of them, 34 were local breed originated Bangladesh, 52 were crossbred and, the rest 49 were exotic. Prevalence of infection was highest in Local breed (38.24%) followed by exotic breed (31.48%) and crossbred (31.37%).

Table 10: Breed wise prevalence of parasitic infection in cats

Breed	No. of animals	No. of infected cats	Prevalence (%)
Local breed	34	13	38.24
Cross breed	52	17	31.48
Exotic breed	49	16	31.37

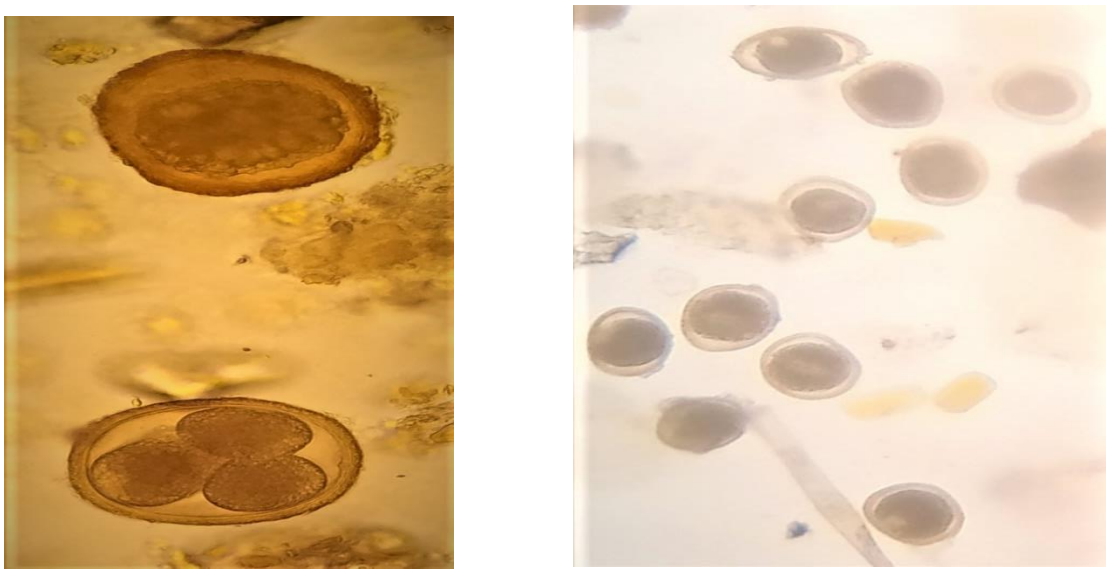


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Figure 14: *T. cati*; A: 10x magnification, B: 4x magnification

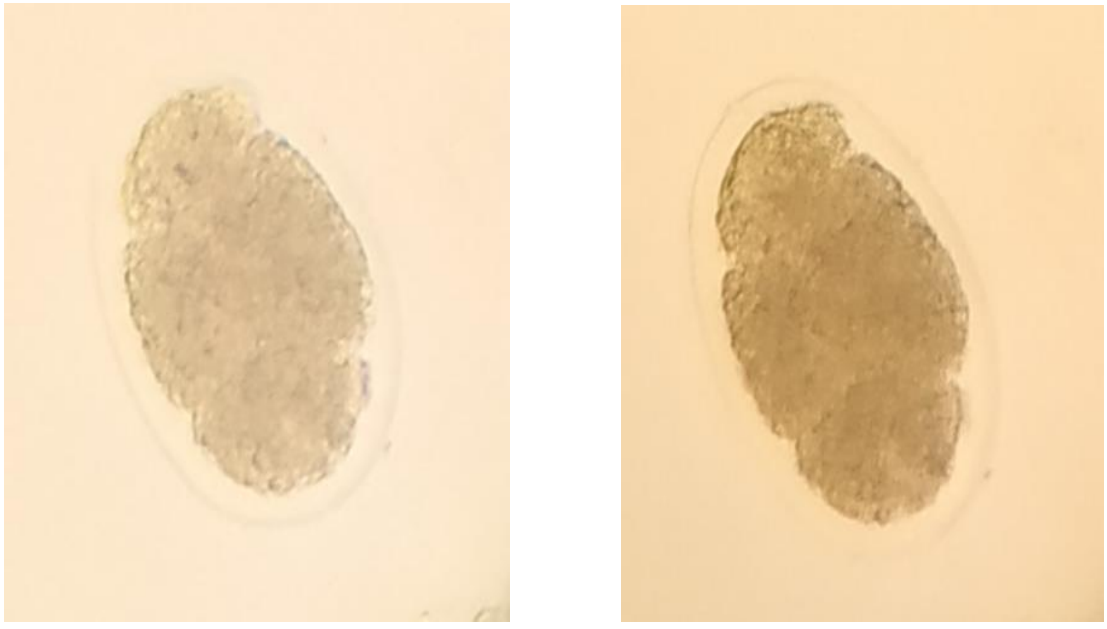

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Figure15: *A. caninum*; A and B Both (40x magnification)

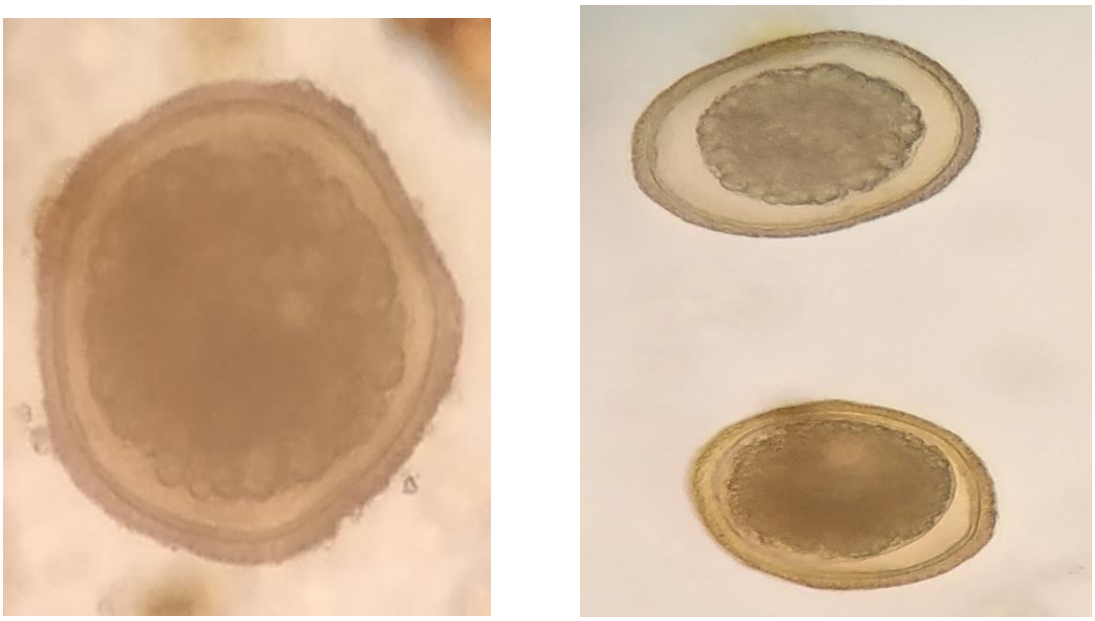

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Figure 16: *T. leonina*; A: 40x magnification, B: 10x magnification

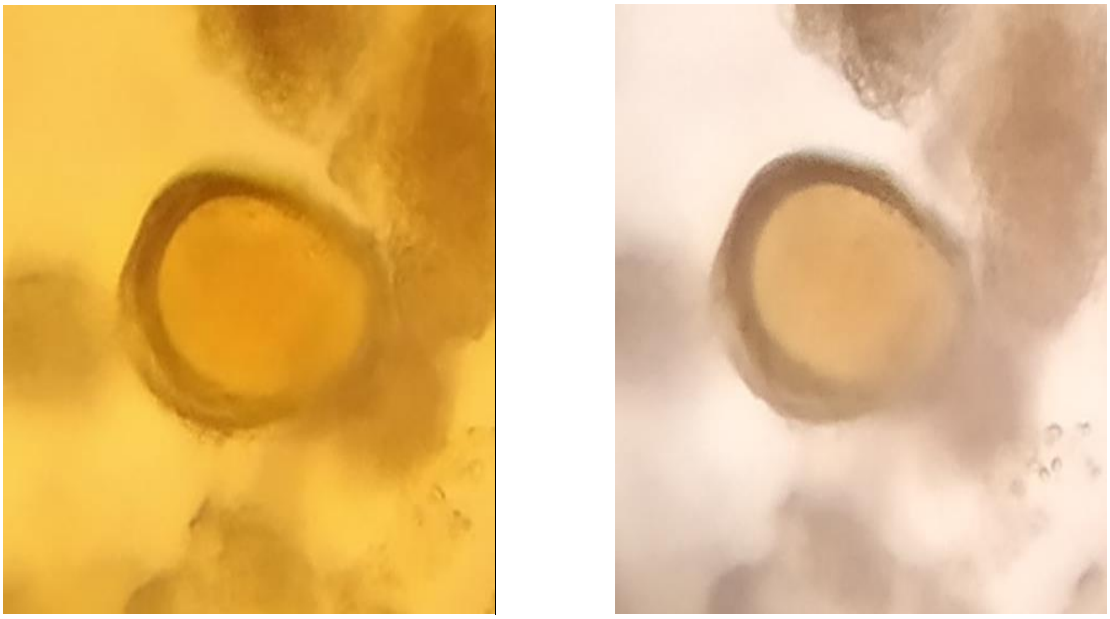

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Figure 27: *Taenia* spp.; A and B Both (40x magnification)

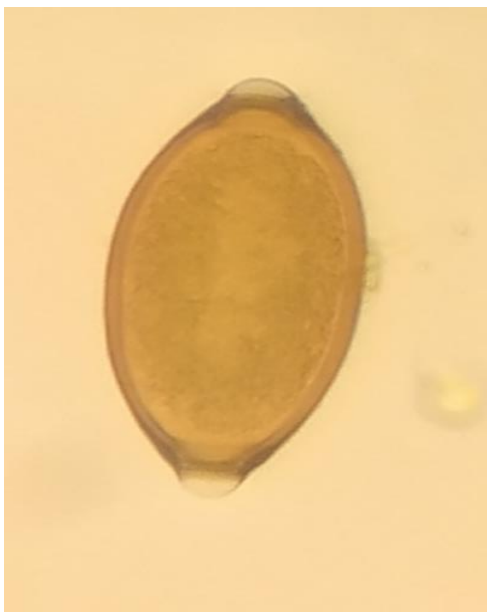

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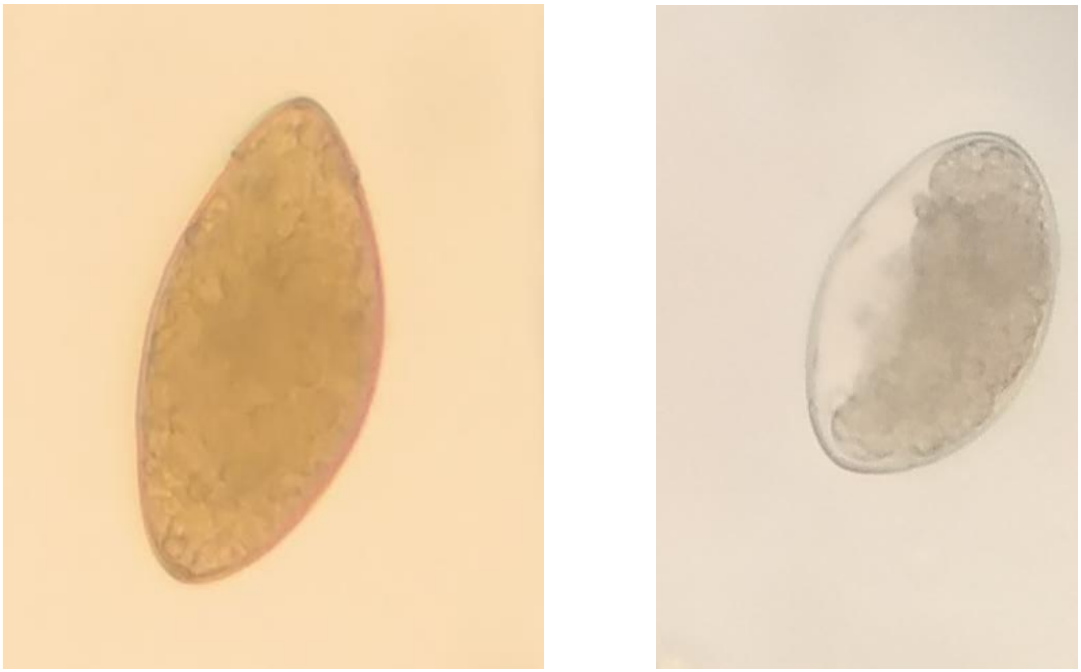
Figure 18: *C. hepatica*; A and B Both (40x magnification)

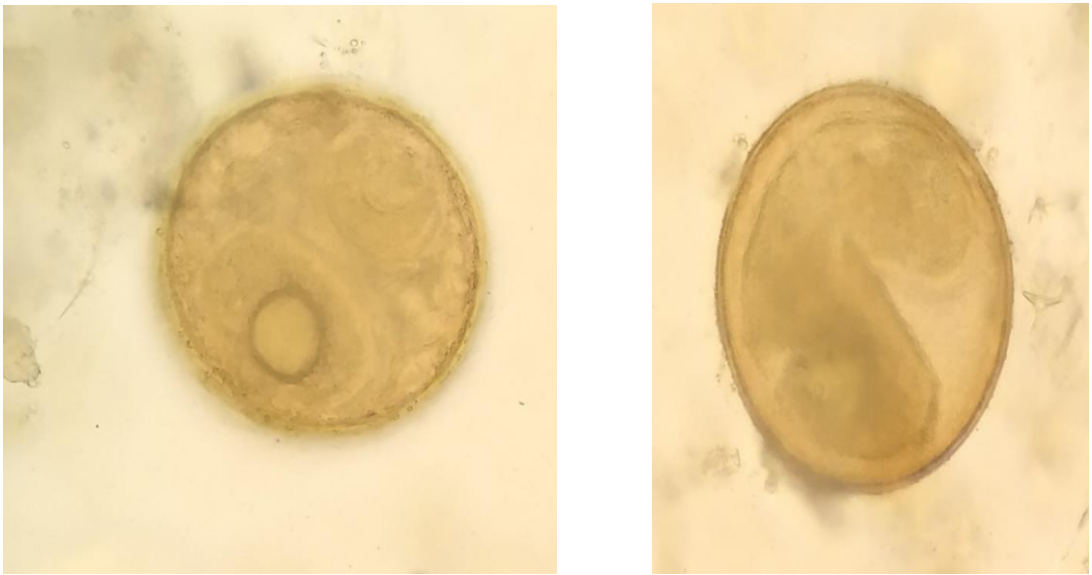
A B

Figure 19: *D. caninum*; A and B Both (40x magnification)



A B

Figure 20: *D. latum*; A and B Both (40x magnification)



A B

Figure 21: *Isospora* sp.; A and B Both (40x magnification)

4.2 Discussion

4.2.1 Prevalence of parasitic infection in Dog

Six species of enteric helminth namely, *T. canis*, *T. leonina, D. caninum, D. latum*, *A. caninum* and *T. vulpis*, and two species protozoa, *Isospora* sp. and *Eimeria* sp. were found during this study in dog. All of the above parasites have been previously reported in dogs from different parts of Bangladesh (Das *et al.*, 2012; Mahmud *et al.*, 2014; Barua *et al.*, 2020) as well as from different parts of world (Collins *et al.*, 1983 in Australisa; Johnston and Gasser, 1993 in Australia; Milstein and Goldmid, 1995 in Australia; Bugg *et al*., 1999 in Australia; Jones *et al.*, 2011 in Ethiopia; Satyal *et al.*' 2013 in Nepal; Panigrahi *et al.*, 2014 in India; Ngui *et al.*, 2014 in Nigeria; Rojekittikhun *et al.*, 2014 in Thailand; Villeneuve *et al.*, 2015 in Canada; Torres-Chable *et al.*, 2015 in Mexico; Ayinmode *et al.*, 2016 in Neigeria; Yadav and Shrestha, 2017 in Nepal; Neigeria; Idika *et al.*, 2017 in Neigeria; Suganya *et al.*, 2018 in India; Khan *et al.*, 2020 in Pakistan).

In this study overall prevalence in was 35.42%, where the prevalence of enteric helminth and protozoa was 31.25% and 8.33%, respectively. This investigation is in agreement with with Satyal *et al.* (2013); Rojekittikhun *et al.* (2014); Panigrahi *et al.* (2014) and Ayinmode *et al.* (2016), where the overall prevalence was 46.7%, 36.2%, 41.46% and 43.3%, respectively. This finding of this study is dissimilar with Suganya *et al.* (2018) and Khan *et al.* (2020), who recorded the overall prevalence of 23.72% and 26.8%, respectively. The variation of overall prevalence might be due to the variation of different geographic locations, sampling size, analytical techniques etc.

The prevalence of enteric protozoa (8.33%) in this study was very close to those of Oliveira-Sequeira *et al.* (2002) in Brazil (12.2%) and Palmer *et al.* (2008) in Australia

(9.4%). Whereas, the prevalence of enteric protozoa in Pakistan is much lower (2.8%) (Khan *et al.*, 2020). This might be due to the fact that they examined the faeces of pet and sheltered dogs only.

In our investigation, the single endoparasitic infection was 70.59%, and mixed infection was 29.41% in dogs. It is quite similar to the findings of Satyal *et al.* (2013) in Nepal who recorded single parasitic infection in dog as 20.4% in their study. This is also supported by the findings of Khan *et al.* (2020) who recorded single parasitic infection as 65.8% and mixed parasitic infection as 34.20% in Pakistan. Ayinmodi *et al.* (2016) in Nigeria documented 69.4% single parasitic and 21.6% mixed infection in Nigeria.

Toxocara canis showed the highest prevalence (16.67) in this study which was nearly similar with Johnston and Gasser, (1993) in Australia; Milstein and Goldmid, (1995) in Australia; Panigrahi *et al.* (2014) in India; Villeneuve *et al.* (2015) in Canada; Ayinmode *et al.* (2016) in Neigeria; Suganya *et al.* (2018) in India; Khan *et al.* (2020) in Pakistan, who recorded the prevalence as 9.5%, 10.9%, 20.31%, 12.7%, 9.8%, 24,79%, 10.5%, respectively. However, our findings varied with Jones *et al.* (2011) in Ethiopia; Ngui *et al.* (2014) in Malaysia; Barua *et al.* (2020) in Dhaka who documented the prevalence of 53.9%, 32.4%, 76.67%, respectively. Moore and O'Callaghan, (1985) in Australia; Rojekittikhun *et al.* (2014) in Thailand; Torres-Chable *et al.* (2015) in Mexico; Idika *et al.* (2017) in Nigeria recorded the prevalence of *T. canis* as 6.4%, 6.6%, 2.3%, 5.9%, respectively.

The prevalence of *T. leonina* was 2.08% which was almost close to the findings of Kelly and Ng, (1975) in Australia; Blake and Overend, (1982) in Australia; Panigrahi *et al.* (2014) in India; Ngui *et al.* (2014) in Nigeria; Villeneuve *et al.* (2015) in

Canada; who recorded 3.2%, 4.0%, 4.68%, 5.7%, 3.0% prevalence, respectively. Moreover, Moore and O'Callaghan, (1985) in Australia; Khan *et al.* (2020) in Pakistan mentioned the prevalence as 1.4%, and 1.31%, respectively.

In case of *A. caninum*, the prevalence was 6.25% which is supported by the finding Moore and O'Callaghan, (1985) in Australia; Johnston and Gasser, (1993) in Australia; Villeneuve *et al.* (2015) in Canada; Torres-Chable *et al.* (2015) in Mexico; Khan *et al.* (2020) in Pakistan, who recorded the prevalence as 3.0%, 6.7%, 3.1%, 15.9% and 3.94%, respectively. However, it varies with Carnack and O'Rourke, (1991) in Australisa; Das *et al.* (2012) Chattogram metropolitan; Panigrahi *et al.* (2014) in India; Rojekittikhun *et al.* (2014) in Thailand; Idika *et al.* (2017) in Neigeria; Suganya *et al.* (2018) in India; by a wide margin like 20.1%, 25%, 23.44%, 30.6%, 33.2%, 37.19%, respectively.

In our investigation, the prevalence of *Trichuris vulpis* was 10.42%. This result was close to Moore and O'Callaghan, (1985) in Australia; Johnston and Gasser, (1993) in Australia; with Satyal *et al.* (2016) in Nepal; Panigrahi *et al.* 2014 in India; Rojekittikhun *et al.* (2014) in Thailand; Villeneuve *et al.* (2015) in Canada; Yadav and Shrestha, (2017) in Nepal; who found the prevalence of 8.8%, 8.1%, 5.1%, 9.37%, 16%, 4.4% 5.73%, respectively. But a huge variation was found with the findings of Milstein and Goldmid, (1995) in Australia; Ngui *et al.* (2014) in Nigeria; Idika *et al.* (2017) in Neigeria; Khan *et al.* (2020) in Pakistan, who recorded the prevalence as 1.8%, 1.0%, 0.5%, 1.31%, respectively.

Prevalence of *D. caninum* was 4.17% in this study, which was almost similar to those of Davies and Nicholas, (1977) in Australia (10.0%), Carnack and O'Rourke, (1991) in Australisa (4.1%), Satyal *et al.* (2013) in Nepal (9.2%); Ngui *et al.* (2014) in

Nigeria (4.8%); Panigrahi *et al.* (2014) in India (12.5%); Idika *et al.* (2017) in Neigeria (4%); Suganya *et al.* (2018) in India (1.65%); Khan *et al.* (2020) in Pakistan (11.8%).

This study showed the prevalence of *D. latum* as 2.08%, which matched with the findings of Yadav and Shrestha, (2017) in Nepal; Suganya *et al.* (2019) in India, who recorded the prevalence as 2.98% and 1.65%, respectively. But it varies from findings of Das *et al.* (2012) who recorded prevalence as 25%.

The prevalence of *Isospora* sp. in this study is 6.25% which is almost similar to Collins *et al.* (1983) in Australisa; Johnston and Gasser, (1993) in Australia; Bugg *et al.* (1999) in Australisa; Villeneuve *et al.* 2015 in Canada; who recorded this as 5.5%, 7.9%, 6.9%, 10.11%, respectively; but varies with Savini *et al.* (1993) in Australisa; Ngui *et al.* (2014) in Nigeria; Ayinmode *et al.* 2016 in Neigeria; Suganya *et al.* (2018) in India, who found the prevalence as 1.5%, 1.3%, 14.2%, 1.65%, respectively. In case of *Eimeria* sp., prevalence was 2.08% which was supported by Ngui *et al.* (2014) in Nigeria; who reported the prevalence of 2.6% but not supported by Mahmud *et al.* (2014) who reported the prevalence of *Eimeria* sp. as 26.23% in Sirajgong. It might be due to the examination of the diseased dogs which were brought to the hospital for treatment.

In our study, adult dogs had higher prevalence (37.5%) than that of the young dogs (31.25%). This result is similar to that of Panigrahi *et al.* (2014), who also recorded a higher prevalence in young group (53.19%) than the adult (36.44%). But this result varied with that of Khan *et al.* (2020), who recorded higher prevalence in adult (28.09%) than the young (25.4%). Higher prevalence of parasitic infection in young dog might be due to ignorance of anthelmintic treatment.

In this study, the prevalence of infection in stray and pet dogs was 77.78% and 25.65%, respectively. Satyal *et al.* (2013) also recorded higher prevalence (56.2%) in stray dog than pet dogs (37.1%). However, the prevalence varied from the findings of Khan *et al.* (2020) who reported 16.1% prevalence in pet dogs and 34.4% prevalence in stray dog. In this study, higher endoparasitic infections in stray dog might be due to their higher exposure to parasite and lack of anthelmintic treatment. In relation to the breed, highest prevalencewas observed in local breed (40%) followed by exotic breed (37.5%) and crossbred (31.82%).

4.2.2 Prevalence of parasitic infection in Cat

In this study, Seven species of helminths namely, *T. cati*, *T. leonina*, *A. caninum, C. hepatica, D. caninum, D. latum*, *Taenia* sp., and two species of protozoa, *Isospora* sp. and *Eimeria* sp. were identified through coprological examination. This parasite have been previously documented in cats from different areas of Bangladesh (Mehedi *et al.* 2020; Barua *et al.* 2020), as well as from different parts of world (Jittapalapong *et al.* 2007 in Thailand; Karatepe *et al.* 2008 in Turkey; Rojekittikhun *et al.* 2014 in Thailand; Villeneuve *et al.* 2015 in Canada; Liang and Yang, 2015 in China; Ito *et al.* 2016 in Japan).

Overall prevalence in cat was 33.09%, while the prevalence of enteric helminth and protozoa was found 30.22% and 7.19%, respectively. This findings are very similar with many authors Rojekittikhun *et al.* 2014; Villeneuve *et al.* 2015; Liang and Yang, 2015, where the overall prevalence was 44.3%, 31.8%, 41.39%, respectively. But the results of this study showed higher prevalence compare to Jittapalapong *et al.* (2007); Palmer *et al.* (2008), Ito *et al.* (2016), who recorded the overall prevalence 11.9%,

18.4%, 20.8%, respectively. However, Karatepe *et al.* (2008); Mehedi *et al.* (2020) recorded higher prevalence, 76.4%, 62.9%, respectively. The dissimilarities in prevalence may be due to different geographic locations, sample size, sampling method, rearing system of cat, deworming practices, etc. Most of the cat population in this study were reared in house as a pet animal. Owners of the cat did not allow them to go outside. As a result, prevalence of parasite in cat was lower than few authors.

In our investigation, the single endoparasitic infection was 71.74% and the rest 28.26% were mixed infections in cats. It is similar to the finding of Villeneuve *et al.* (2015) in Canada who recorded 73% single parasitic infection and 27% mixed parasitic infection and Mehedi *et al.* (2020) where single parasitic infection was 79.04% and mixed parasitic infection was 20.96% in Mymensingh. Single parasitic infection may be due the consumption of ready-made food given by the owners. The cats of this study, eats residual food. That's why they were infected with multiple parasites.

Toxocara cati showed highest prevalence (15.83%) in this study which was nearly similar with Shaw *et al.* (1983); Karatepe *et al.* (2008); Rojekittikhun *et al.* (2014); Villeneuve *et al.* (2015); Liang and Yang, (2015); Mehedi *et al.* (2020) who recorded 9-17.74% prevalence, however our findings varied with Pavlov and Howell, (1977); Wilson-Hanson and Prescott, (1982); Moore and O'Callaghan, (1985); Jittapalapong *et al.* (2007), Who recorded the prevalence of *T. cati* at 24.5%, 25%, 5.3%, 3.5%, respectively.

The prevalence of *T. leonina* was 2.16%, which was almost close to the findings of 3.7% by Moore and O'Callaghan, (1985); 2.2% by McGlade *et al.* (2003) and 7.1% by Ngui *et al.* (2014). However variation with Wilson-Hanson and Prescott, (1982) and Karatepe *et al.* (2008) where observed in the prevalence of *T. leonina.*

In our study, the prevalence of *A. caninum* was 5.04% where many authors (Pavlov and Howell, 1977; Jittapalapong *et al.* 2007; Villeneuve *et al.* 2015; Yang and Liang, 2015; Mehedi *et al.* 2020) found the similar results. But our result showed lower prevalence than Wilson-Hanson and Prescott, (1982) 19% and Meloni *et al.* (1993) 20%.

In case of *D. caninum,* prevalence was 3.6% which was supported by Moore and O'Callaghan, (1985) and Nugi *et al.* (2014) who reported that 1.3% and 7.1%, respectively. But this result was not supported by Wilson-Hanson and Prescott, (1982) and Jittapalapong *et al.* (2007) who recoded 19% and 0.14%, respectively.

The result of this study showed 1.44% prevalence of *Taenia* sp. in Dhaka city. This type of abutting result was shown by Wilson-Hanson and Prescott, (1982), Moore and O'Callaghan, (1985), Villeneuve *et al.* (2015) and Mehedi *et al.* (2020) where the prevalence was 0.3%, 2.7%, 4.4% and 3.2%, respectively. But Kelly and Ng, (1975) found 6.9% of *Taenia* infection which was a disagreement with our result.

Almost identical results in the prevalence of both *Isospora* spp. (6.47%) and *Eimeria* sp. (2.16%) was recorded in the study are (Wilson-Hanson and Prescott, 1982; Shaw *et al.* 1983; Collins *et al.* 1983; McGlade *et al.* 2003; Palmer *et al.* 2008; Rojekittikhun *et al.* 2014; Ngui *et al.* 2014; Mehedi *et al.* 2020 and Karatepe *et al.* 2008). However Sargent, (1997); Jittapalapong *et al.* (2007); Villeneuve *et al.* (2015) and Yang and Liang, (2015) found a degree of variable result in different part of the world. The lower parasitic infection may be attributed due to the feeding habit. The cats in this study had a history of seldom visit to the environment, that's why most of the consumed very scanty amount of oocyst which was infective stage of enteric protozoa.

In our study, young animals (34.41%) were more infected with various parasite than the older (30.43%). Our study matched with Villeneuve *et al.* (2015) who found 39% infection in the young group where infection in older group was 23.9%. More infection in younger group was in accordance with Jittapalapong *et al.* (2007); Mehedi *et al.* (2020). Young cats do not develop a good immune system. Moreover, kitten can be infected with larva through transplacental or transmammary routes. The higher Infection in younger cats may also be due to no anthelmintics and vaccination history, concurrent infection, etc.

In this study, the prevalence of stray and pet cat was 80.95% and 24.58% respectively. In relation 34.62% male and 332.18% female were infected with various parasites which was similar to the results of Jittapalapong *et al.* (2007) and Mehedi *et al.* (2020). The variation in the prevalence in relation to sex can't be explained properly, but it may be associated with hormonal effect, immune-suppression, stress etc. In addition of these factor male cats spent more time in the environment than the female.

CHAPTER 5

SUMMARY AND CONCLUSIONS

This study was performed in the Dhaka city aimed to find out the prevalence and identification of enteric parasites found in dog and cat. A total of 48 dogs and 139 cats fecal sample were collected and the overall, 35.42% of dogs and 33.09% of cats were positive for at least one parasite. The results showed that the overall individual prevalence of the endoparasites in Dhaka where highest prevalence was found in *Toxocara canis* and *Toxocara cati* than the other parasite *Dipylidium caninum, Diphyllobothrium latum, Taenia* sp., *Toxascaris leonina, Ancylostoma caninum, Trichuris vulpis, Capillaria hepatica, Isospora* sp. and *Eimeria* sp. Both Dog and cat about one sample was detected by mixed infection out of every four positive samples and at least one sample found protozoa out of five positive samples.

The parasite prevalence levels reported in this study reinforce the need to monitor pets across Dhaka, for intestinal parasites and to treat infected animals promptly and correctly with effective anthelmintics. Animals adopted from household with untreated, or ineffectively treated, parasite infections pose ongoing risks for animal and human health. This reinforces the importance of strategies for prevention, which depend in part on pet management and owner awareness of the sources and management options for parasites in their pets. This awareness can be greatly enhanced by veterinarians and their staff. Veterinarians are an important source of information for pet owners and play a critical role in the initiation of education programs emphasizing the importance of preventive measures in reducing the risks of environmental contamination and zoonotic transmission. In addition, periodic fecal

monitoring of pets allows determination of the efficacy of the products being used, compliance with the recommended administration schedules and re-assessment of the therapeutic approach based on current patient health status. The animal surveillance data from this study will help in the development of strategies, based on risk per geographic location for the prevention and response to endoparasites in pets and shelter animals in Dhaka.

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