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PREVALENCE OF GASTRO-INTESTINAL PARASITIC INFECTIONS AND EFFICACY OF ANTIPARASITICS AGAINST THESE INFECTIONS IN DOGS IN MYMENSINGH SADAR

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Gastro-intestinal parasitic infections in dogs represent a major concern in developing countries including Bangladesh. Dogs are important definitive or reservoir hosts for several zoonotic parasites. This study was conducted to determine the prevalence of gastro-intestinal parasites in dogs from different areas of Mymensingh Sadar. The fecal samples were examined by simple sedimentation and stoll's ova counting method for detection of eggs/cysts/oocysts of parasites. The overall prevalence of gastrointestinal parasites was 60.00% (51/85) and the mixed parasitic infection was 16.47% (14/85). A total of six species of gastro-intestinal parasites (ova/oocyst) were identified, of them four species were nematode namely,*Toxocara canis* (24.7%), *Acylostoma caninum* (7.05%), *Acylostoma braziliense* (2.35%), *Uncinaria stenocephala* (2.35%), one species was cestode, *Taenia pisiformis* (3.52%) and one species was protozoa, *Isospora canis* (3.52%). The prevalence of infection was significantly (P<0.02) higher in puppies and young dogs than that in adult dogs. The efficacy of fendnedazole (Bol. Fenvet®), albendazole (Tab. Alben DS®), fenbendazole (Tab. Paraclear®) was 100% effective against single helminth infection. However, the efficacy of mebendazole (Syrup. Mebantrin®) was 25%-50% against mixed helminth infections. The efficacy of metronidazole (Syrup. Amodis®) was 100% against single protozoal infection. So, anthelmintic including albendazole, fenbendazole, mebendazole and metronidazole may be recommended to treat effectively the single infection of helminth and protozoa, respectively, in dogs. Special emphasis should be given to deworm puppies as they are more vulnerable to parasitic diseases. The *T. canis, A. caninum*, *A. braziliense* and *U. stenocephala* prevalent in dogs are zoonotic and have public health impact.

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INTRODUCTION

Dog is very popular as pets in many countries including Bangladesh. It has also an important role in the transmission of important zoonotic parasites to human beings. Environmental contamination with dog feces harboring various infective stages of parasites such as eggs, larvae or oocysts act as a leading source of infection to livestock and human (Bentounsi *et al*., 2009). Hydatidosis and toxocariasis, are considered as serious public health concern (Alvarez-Rojas *et al*., 2014). Being a reservoir host for a large number of parasites dogs share these pathogens between pets and humans (Duscher *et al*., 2015). Human can be infected through the ingestion of eggs, cysts or oocysts via contaminated food-stuffs or water, hands, inhalation of dust, and/or by penetration of larvae through the skin (Lee *et al*., 2010a). Dogs are the definitive or reservoirs hosts of more than 60 zoonotic parasites, such as *Taenia sp., Echinococcus sp., Diphylidium caninum, Toxocara canis, Ancylostoma sp., Giardia sp.,* and *Cryptosporidium sp.* (Satyal *et al.,* 2013; Perera *et al.,* 2013). A high prevalence of gastrointestinal disorders with intestinal parasitic infections in dogs are recognized commonly in most developing countries (David *et al.,* 2015). *T. canis* is one of the most common gastrointestinal parasites of dogs (Lee *et al.,* 2010b; Overgauw and Van Knapen, 2013). Heavy prenatal infection with *T. canis* may lead to the death of all puppies due to migration of larvae into the lung. Dogs especially puppies are also severely affected with *Ancylostoma caninum* and suffered with anaemia resulting death of puppies between 10 and 24 days after a single primary infection. The infection with *Ancylostoma braziliense* and *Uncinaria stenocephala* are not related with anaemia but prompts severe diarrhea (Miller, 1971). Canine hookworms are responsible for zoonotic gastrointestinal parasitic diseases (Bowman *et al*., 2010). Hookworms are commonly associated with cutaneous larva migrans in humans. Dogs are also being infected with various types of tapeworm infections such as *Taenia spp, D. caninum* etc. Dogs are also infected with different types of protozoal diseases. *Isospora canis* or *Isospora wallacei* are common protozoal infection in dogs (Katagiri and Oliveira, 2008). Although a number of pet dogs are increasing rapidly in Bangladesh especially in the big cities, there are scant information on prevalence and the risk factors of intestinal parasitism in pet dogs. To control parasitic infections in dogs and the zoonotic transmission of these parasites to human being, knowledge on prevalence and the risk factors of these parasitic infections is essential.

In developed countries the principles of control of gastro-intestinal parasites are mainly based on proper practices of hygiene, management, biosecurity and protective treatment (Radostits *et al*., 2000). In Bangladesh, these are not always possible and mostly dependent on the anthelmintics to control the parasitic infection of dogs (Rahman, 1997). A good number of anthelmintics and antiprotozoal drugs against a wide range of helminths and protozoa are available in local market of Bangladesh. The commonly available drugs in Bangladesh market are levamisole, albendazole, fenbendazole, mebendazole, triclabendazole, ivermectin, piperzine citrate, pyrantel pamoate, nitroxynil sodium etc. Fenbendazole with praziquantel was reported to be 100% effective for the removal of *Acylostoma sp.*, *Toxocara sp.* and *Taenia* spp (Corwin *et al.*, 1984). The efficacy of albendazole 98.8 to 100% against *Acylostoma* spp (Ramalingam *et al.,* 1983). The efficacy of metronidazole was 90-100% against protozoal infections in both dogs and cats (Garanayak *et al.,* 2017). The comparative efficacy of some anthemintics against common helminths had been investigated mostly in indigenous cattle, sheep, goat etc with varied level of efficacy (Hossain and Ali, 1998; Hanif *et al.,* 2003; Hossain *et al.,* 2004; Khalid *et al.,* 2004; Hossain *et al.,* 2005). However, there is a scant report on the efficacy of antiparasitics (anthelmintic, antiprotozoal drugs) against gastro-intestinal parasitic infections in dogs. Therefore, the objectives of this study were to determine the overall prevalence of parasitic infections, identify the risk factors for parasitic infections and evaluate the efficacy of anthelmintic, antiprotozoal drugs against these parasitic infections.

MATERIALS AND METHODS

Study period and study area

This study was carried out in household dogs in different areas of Mymensingh Sadar from December 2018 to May 2019. A total of 85 fecal samples of dogs were collected purposively irrespective of their age and sex. The selected dogs were categorized into three age groups: puppies of ≤6 months (n = 47), the young dog of > 6 months to 1 year (n = 25) and the adult dog of > 1 year (n = 13). About 10 grams of faeces from each dog was collected from the top of the freshly voided faecal mass with necessary precaution to avoid cross contamination. The age and sex of the dogs were recorded during sample collection.

Faecal examination

The fecal samples were examined by simple sedimentation technique and stoll's ova counting method for detection of the eggs of the gastrointestinal helminthes and cysts/oocysts of the protozoa. The eggs of the helminth parasites and the cysts/oocysts of the protozoa were identified by their characteristic morphological features (Soulsby, 1982; Thienpont *et al*., 1986).

Trial of anthelmintic and antiprotozoal drug

Two groups of dogs infected with single and mixed infections of helminth and protozoa were treated by commercially available anthelmintics (Bol. Fenvet®, Tab. Alben DS®, Tab. Paraclear® and Syrup. Mebantrin) and antiprotozoal drug (Syrup. Amodis®) in Bangladesh.

Data analysis

The data analysis for the determination of prevalence and risk factors analysis of parasitic infection of dogs was done by Epi info software version 7.2.2.16. Odds ratio was calculated according to the formula given by Schlesselman (1982).

RESULTS AND DISCUSSION

Overall prevalence of gastro-intestinal parasites

A total of 85 dogs were examined through fecal sample examination, of which 60.0% (51) were found to be infected with one or more species of gastro-intestinal parasites (Table 1). A total of six species of gastro-intestinal parasites were identified on the basis of the characteristic morphological features of eggs or oocysts. In this study, four species of nematode such as *T. canis, A. caninum*, *U. stenocephala* and *A. braziliense*; one species of cestode such as *T. pisiformis* and one species of protozoa namely *I. canis* were identified *(*(Table 1 and Figure 1). The highest prevalence was observed for *T. canis* (24.7%) followed by *A. caninum* (7.05%), *A. braziliense* (2.35%)*, U. stenocephala* (2.35%)*, T. pisiformis* (2.35%) and *I. canis* (3.52%). Mixed infections with two or more gastrointestinal parasites were detected in 20.00% (14) dogs (Tables 1 and 2).

Table 1. Overall prevalence of gastro-intestinal parasitic infections in dogs

Name of the parasites	Prevalence (n = 85)	
	No. of positive	Prevalence (%)
T. canis	21	24.7
A. caninum	6	7.05
A. braziliense	2	2.35
U. stenocephala	2	2.35
T. pisiformis	3	3.52
I. canis	3	3.52
Mixed infection	14	16.47
Total	51	60

This study describes the prevalence and risk factors of gastrointestinal parasitic diseases in dogs in Mymensingh Sadar. In the present study, 60.00% dogs were found to be infected with one or more species of gastro-intestinal parasites. Lower prevalence than this result were reported bu other authors such as 41.46%, 44.3% and 46.7% from India, Cuba and Kathmandu district in Nepal, respectively (Panigrahi *et al.,* 2014; Puebla *et al.,* 2015; Satyal *et al.,* 2013). However, higher prevalence (78.5%) than our result has also been reported from domestic dogs of Chittagong, Bangladesh (Basu *et al.,* 2010). It was revealed in this study that 24.7% of the dogs were infected with *T. canis*. Sarder *et al.,* (2012) reported higher prevalence (33.30%) of

Toxocara sp in Bangladesh. Some authors reported variable prevalence of *Toxocara canis* which ranged from 2.2% to 16.62% (Hoskins *et al.,* 1982; Savilla, 2009; Katagiri and Oliveira, 2008; Ilic *et al.,* 2017; Little *et al.,* 2009). Higher prevalence of toxocariasis in this study might be due to selection of young dogs; as these ascarids mostly infect younger dogs below one year of age (Soulsby, 1982; Martinez-Moreno *et al.,* 2006; Taylor *et al.,* 2016). The overall prevalence of *Acylostoma sp* was 9.41%. Sarder *et al.,* (2012) observed an overall prevalence of 31% for *Acylostoma sp* in dogs in Dhaka city corporation. The prevalence of *A. caninum* was 7.05% in this study which was inconsistent with the findings of Muhamed and Al-barwary (2016) who reported *2.2% A. caninum* infection in dogs from Iraq. Other authors reported 44.8 to 52% prevalence of *A. canimem* infection in dogs from Hawassa and Bahir Dar town of Ethiopia and in Nepal respectively (Paulos *et al.,* 2012; Getahun *et al*., 2012; Satyal *et al.,* 2013). The variation in findings of the present result and earlier reports might be due to differences in the geographical location, breeds of animals, sample size and sampling technique, methods of faecal examination and endemicity of the area. The prevalence of *I. canis* (3.52%) observed in this study was lower than the findings of Mahmud *et al.,* (2014) who reported 14.75% infection in dogs from Sirajganj, Bangladesh. The prevalence of *I. canis* was reported to be 5.1% in Kerman city, Iran (Mirzaei, 2010). In this study, prevalence of *Taenia pisiformis* was found to be 3.52% which was consistent with other report (5%) in Bangladesh (Das *et al*., 2012). The variations among the findings might be due to the difference in the selection of animal, techniques of sample collection, period and place of study, environmental factors and breed of the animals etc.

Table 2. Prevalence of mixed infections of different parasites in dogs

Name of the parasites	Mixed infection (n=14)	
	No. of positive case	Prevalence (%)
T.canis, A. caninum, A. braziliense	4	28.57
T. canis, T. taeniaeformis, U. stenocephala	2	14.28
A. caninum, A. braziliense, U. stenocephala	2	14.28
A. braziliense, T. taeniaeformis, T. canis	3	21.42
T. canis, A. caninum	2	14.28

Age related prevalence of gastro-intestinal parasites

In this study prevalence of intestinal parasites was found to be higher in puppies (68.08%) compared with young (64.00%) and adult (23.04%) (Table 3). Puppies (≤6 month), were found to be infected with *T. canis* (29.78%), *A. caninum* (8.51%), *A. braziliense* (2.12%), *U. stenocephala* (2.12%), *T. pisiformis* (2.12%*)* and *I. canis* (4.25%). The mixed infections in puppies were recorded as 19.14%. In young animals (>6 month to 1 year) the most prevalent gastro-intestinal parasite was *T. canis* (20.00%) followed by *A. caninum* (8.00%), *A. braziliense* (4.00%), *U. Stenocephala* (4.00%), *T. pisiformis* (4.00%) and *I. canis* (4.00%). In addition,20% young dogs were infected with mixed parasites. Adult dogs (>1 year) were found mostly to be infected with *T. canis* (15.38%) and *T. pisiformis* (7.69%). It was revealed that, age of the dogs had a significant effect on gastro-intestinal parasitic infection. Puppies were found to be more infected with gastro- intestinal parasitic infection than young animals and adults in the current study. This result is in agreement with several other studies (Endrias *et al.,* 2010; Swai *et al.,* 2010; Andresiuki *et al.,* 2007). Oliveira-Sequeira *et al.,* (2002) and Muradian *et al.,* (2005) also demonstrated higher prevalence ancylostomiasis and toxocariasis in dogs below one year of age. *T. canis* was detected more frequently in dogs less than 1 year of age which is consistent with the findings of other authors (Little *et al.,* 2009; Katagiri and Oliveira, 2008; Hoskins *et al.,* 1982). Higher prevalence of *A. caninum* and *T. canis* in younger dogs might be due to the transplacental and transmammary passage of larvae to the puppies (Bowman, 2009; Soulsby, 1982). Young dogs were found to be more susceptible to *I. canis* infection than the adults. Similar result had been recorded by Mirzaei (2010) in Iran. This might be due to lower immunity where older dogs are comparatively resistant to such infection as they have higher adaptive immunity (Souslby, 1982).

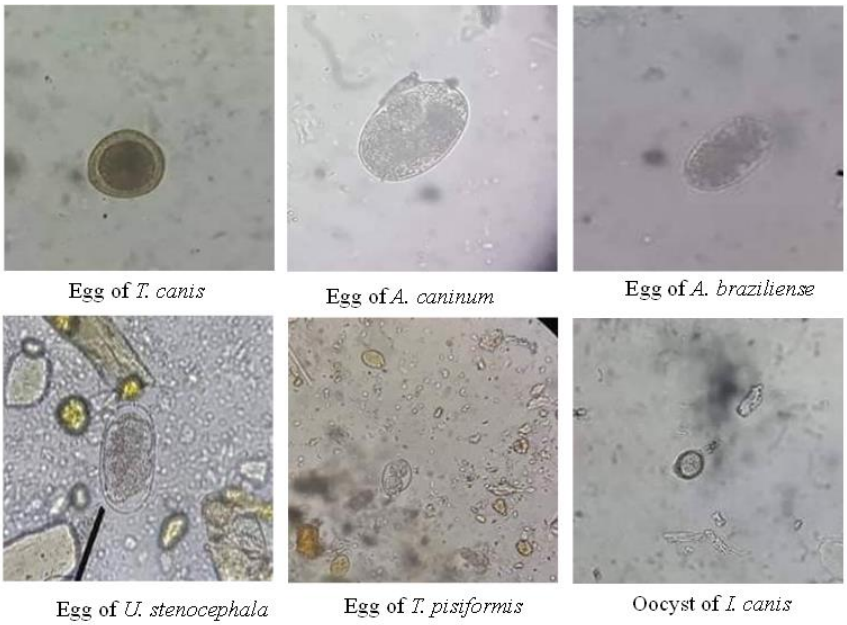

Figure 1. Morphological features of eggs/oocyst of parasites identified in feces from dog under microscope (40x objective)

Table 3. Age related prevalence of gastro-intestinal parasitic infections in dogs

Parameter	Name of parasites	No. of positives	Prevalence (%)
Puppy	*T. canis*	14	29.78
(≤6 month) n=47	*A. caninum*	4	8.51
	A. braziliense	1	2.12
	U. stenocephala	1	2.12
	T. pisiformis	1	2.12
	I. canis	2	4.25
	Mixed infection	9	19.14
	Total	32	68.08
Young	*T. canis*	5	20
(<6 month to 1 Year)	*A. caninum*	2	8
n=25	*A. braziliense*	1	4
	U. stenocephala	1	4
	T. pisiformis	1	4
	I. canis	1	4
	Mixed infection	5	20
	Total	16	64
Adult (>1 year) n=13	*T. canis*	2	15.38
	T. pisiformis	1	7.69
	Total	3	23.07

Sex related prevalence of gastro-intestinal parasites in dogs

Female dogs (70.58%) were found to be more infected with parasitic diseases than male (52.94%) dogs (Table 4). The prevalence of *T. canis* (25.49%) was highest in male dogs followed *by A. caninum* (7.84%), *I. canis* (3.92%) *A. braziliense*, *U. stenocephala* and *T. pisiformis* (1.9%). The mixed infections in male were recorded as (9.8%). Similar to males, the highest level of *T. canis* (23.52%) was noted in the females which was followed *by A. caninurn* (5.88%), *T. pisiformis* (5.88%), *U. stenocephala* (2.94%), *A. braziliense* (2.94%) and *Isospora canis* (2.94%) (Table 3). This result is in accordance to other reports (Getahun *et al.,* 2012; Paulos *et al.,* 2012; Endrias *et al.,* 2010; Katagiri and Oliveira, 2008; Razmi *et al.,* 2006). Higher frequency of enteric helminthiasis in male dog has been reported by other authors in Tanzania, Nigeria and in Brazil also (Swai *et al.,* 2010; Umar, 2009; Oliveira- Sequeira *et al.,* 2002).

Risk factors analysis of gastro-intestinal parasitic infections according to age and sex in dogs

The risk of parasitic infections was 4.8 times higher (P<0.02) in puppies than that in adult (Table 5).

Efficacy of anthelmintics and antiprotozoal drugs against parasitic infections in dogs

The efficacy of anthemintics was 100% against single parasitic infection but the efficacy was 25%, 25%, 50% against mixed parasitic infection (Table 6). The efficacy of antiprotozoal drugs was 100% against single protozoal infection (Table 6). The efficacy of Bol. Fenvet®, Tab. Alben DS®, Tab. Paraclear® against single infection was 100% against roundworm, hookworm, tapeworm, respectively which was similar to the other reports (Corwin *et al.*, 1984; Ramalingam *et al.,* 1983). The efficacy of Syrup Mebantrin® varied from 25% to 50% against mixed helminth infections which was lower than the previous report (Guerrero *et al.,* 1981). The efficacy of antiprotozoal drugs Syrup Amodis® was 100% against single infection of infected dogs which was similar to other report (Garanayak *et al.,* 2017). A lot of factors may be responsible for the difference of drugs efficacy against single and mixed parasitic infection. For example, the efficacy trail was conducted in field conditions and owners were requested to treat their pet dogs with prescribed anthelmintics and antiprotozoal drugs. Again the dose rate was same for the all cases of parasitic infection and for that reason in case of heavy infection it was not recovery properly. During post-treatment fecal sample collection it was also tried to know whether as such the treatment was given or not. But if there are some gap in choice of drugs, dose and timings of the treatment, the efficacy will not reveal the true status of the drugs.

Table 5. Risk factors analysis of gastro-intestinal parasitic infections according to age and sex in dogs

Parameter	Parasitic infection		Odds ratio	P-value
	Yes	No		
≤6 month	32	15	1.42	0.49
>6 month to 1 year	15	10	-	-
≤6 month	32	15	4.8	0.015
>1 year	4	9	-	-
>6 month to 1year	15	10	3.37	0.087
>1 year	4	9	-	-
Female	21	13	0.88	0.786
Male	30	21	-	-

Table 6. Efficacy of anthelmintics and antiprotozoal drug against parasitic infections in dogs

Type of infection	Anthelmintics/anti-protozoal drug	Name of parasite	No. of dog treated	No. of dog recovery (%)	No. of dog unrecovery (%)	EPG before treatment (Mean)	EPG two weeks after treatment (Mean)
Single infection (Helminth)	Bol. Fenvet®)	a	3	3 (100%)	0 (0%)	233.3	0
	Tab. Alben DS®)	b	3	3 (100%)	0 (0%)	111	0
	Tab.Paraclear®)	c	3	3 (100%)	0 (0%)	300	0
Mixed infection (Helminth)	Syrup. Mebantrin®)	a+b	4	1 (25%)	3 (75%)	650	25
		a+b+c	4	1 (25%)	3 (75%)	800	50
		Mixed b	4	2 (50%)	2 (50%)	650	33.3
Single infection (Protozoa)	Syrup.Amodis®)	d	3	3 (100%)	0 (0%)	300	0

a. Round worm, b. Hook worm, c. Tape worm d. *Isospora sp*

CONCLUSION

Gastro-intestinal parasitic infection is highly prevalent in dogs. Albendazole, fenbendazole, and mebendazole containing anthelmintics are highly effective against single helminth infection in dogs. Similarly metronidazole, pyrimetamine+ sulfadoxine are recommended to treat single protozoal infection in dog. Special emphasis should be given to deworm puppies as they are more vulnerable to parasitic diseases. The *T. canis, A. caninum*, *A. braziliense* and *U. stenocephala* prevalent in dogs are zoonotic and have public health impact. Regular deworming and awareness building among dog owners are required to control the disease burden in dogs and also the risk of transmission to humans.

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