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ORIGINAL ARTICLE

Prevalence and Worm Load of Enteric Helminthiasis in Stray Dogs of Chittagong Metropolitan, Bangladesh

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SUMMARY

An epidemiological study was conducted on enteric helminth infections in stray dogs of four different thanas of Chittagong Metropolitan, Bangladesh. A total of 60 stray dogs were captured from the representative thanas in two consecutive seasons starting from May'2010 to February' 2011. The animals were captured, euthanized and necropsized for enteric parasites. The effects of season, age, sex and body conditions were also observed. Results revealed that 57 (95%) dogs were infected with one or more enteric helminths. The highest prevalence (45%) and worm burden (42.18 ± 7.99) was recorded in *Trichuris vulpis* infection whereas *Taenia* spp were found the lowest. Considerably higher prevalence (25%) was recorded in *Diphyllobothrium latum* and *Ancylostoma caninum* infection. However, occurrence of enteric helminths was more common in summer season. The highest (35.71%) seasonal prevalence was found in *Toxocara canis* infection in summer whereas the highest intensity of worms was found in *Trichuris vulpis* infections in both summer (37.18±9.37) and winter season (47.33±12.73). Age specific prevalence indicated that stray dogs of younger age showed higher susceptibility to enteric helminthiasis compared to adults; particularly *Dipylidium caninum*, *A. caninum, T. canis* and *T. vulpis*. Sex group variation showed that the frequency of *D. latum, D. caninum* and *A. caninum* was higher in female dogs. Statistically significant association was not observed in the occurrence of enteric helminthiasis based on the body condition of the stray dogs. In conclusion, it could be stated that the presence of these parasites in dogs also indicates a potential public health problem in study area. Hence, appropriate control measures should be taken to prevent such parasitic diseases.

Key Words *Enteric helminths, Prevalence, Stray dogs, Worm load*

Bangladeş'in Chittagong şehrinde sokak köpeklerinde enterik helminthiasis hastalığının prevalansı ve solucan yükü

ÖZET

Bangladeş'in Chittagong şehrinin dört farklı bölgesinde sahipsiz sokak köpeklerinde enterik helmint enfeksiyonlarının varlığı yönünden epidemiyolojik bir çalışma yürütülmüştür. Temsilen iki ardışık mevsim seçilerek Mayıs 2010'dan Şubat 2011'e kadar toplam 60 sokak köpeği yakalandı. Yakalanan hayvanlar ötenazi edildi ve enterik parazitlerin incelenmesi amacıyla nekropsileri yapıldı. Mevsim, yaş, cinsiyet ve vücut koşullarının etkileri de gözlendi. Sonuçlar 57 (%95), köpeğin bir veya daha fazla enterik helmint ile enfekte olduğunu ortaya koydu. Taenia spp düşük bulunmasına rağmen en yüksek prevalans (%45) ve solucan yükü (42.18 ± 7.99) Trichuris vulpis enfeksiyonunda belirlendi. Kayda değer daha yüksek prevalans (%25) Difillobotrium latum ve Ncylostoma caninum enfeksiyonlarında gözlendi. Bununla birlikte, enterik helmintlerin yaz sezonunda daha sık olduğu görüldü. En yüksek (%35.71) mevsimsel yoğunluğun yaz aylarında Toxocara canis enfeksiyonu olduğu ancak en yüksek solucan yoğunluğunun Trichuris vulpis ile yaz (37.18±9.37) ve kış (47.33±12.73) sezonlarında olduğu tespit edildi. Yaşa özel prevalans değerlendirildiğinde, genç yaştaki köpeklerin yetişkinlere göre enterik helminthiasise özellikle Dipylidium caninum, A. caninum, T. canis ve T. vulpis'e daha duyarlı oldukları tespit edildi. Cinsiyet grup varyasyonu D. latum, D. caninum ve A. caninum sıklığının dişi köpeklerde daha yüksek olduğunu gösterdi. Istatistiksel olarak başıboş köpeklerin vücut durumuna göre enterik helminthiasis oluşumu arasında anlamlı ilişki gözlenmedi. Sonuç olarak, köpeklerde bu parazitlerin varlığının aynı zamanda çalışma alanı içinde bir potansiyel sağlık sorunu oluşturacağı söylenebilir. Bu nedenle, paraziter hastalıkları önlemek için gerekli kontrol önlemleri alınmalıdır.

Anahtar Kelimeler *Enterik helmint, Prevalans, Sokak köpekleri, Solucan yükü*

INTRODUCTION

Stray dogs are ownerless native dogs (*Canis familiaris*) of mostly non descriptive nature which roam freely without human supervision. Several studies have proven that

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parasitism; particularly gastro-intestinal helminthiasis is the most commonly encountered disease and the major impediment to dog health all over the world (Traub 2003). Most of the gastrointestinal parasites affect the dogs 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). Besides these, dogs may harbor a wide range of zoonotic parasites causing significant health risk to humans (Craig and MacPherson, 2000). They act as the usual connectors between people and nature as they thrive on food wastage around the tales (dustbins) in densely populated urban and peri-urban areas contributing high risk of parasitic zoonoses (Khante et al. 2009). Developing countries like Bangladesh, the number of stray dogs that coexist with human being is high in most cities and villages 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 (Robertson et al. 2000). Furthermore, the level of hygienic conditions, lack of veterinary supervision and less awareness concerning zoonotic diseases exacerbate the transmission of these diseases (Traub et al. 2002). Epidemiological pattern of the parasitic diseases in the different agro-climatic zones of the country usually provides a basis for developing strategic and tactical control systems against them. Several studies have been carried out on gastrointestinal parasitism of stray dogs throughout the world but surprisingly in Bangladesh only few published data available in this regard (Rahman 1973, Basu et al. 2010). Currently, there are no data available on the distribution, prevalence, parasitic burden and risk factors associated with intestinal helminthiasis of stray dogs in Chittagong. Therefore, the current study was undertaken to determine the prevalence and intensity of enteric helminth of stray dogs. The study also assists the policy maker to take effective preventive and control measures against different zoonotic diseases.

MATERIALS and METHODS

Study area and duration

The investigation was carried at four randomly selected metropolitan thanas (Chandgaon, Halishohor, Pahartali and Khulshi) of Chittagong city; the second largest port city of Bangladesh. The study was taken for a period of 10 months starting from May'2010 to February' 2011 where two consecutive seasons; summer (May to September) and winter (October to February) were considered.

Selection of animal and Survey Design

Stray dogs were selected as target animals. The sample size constituted 10% of the estimated 600 stray dog population that were killed annually for Rabies control program in Chittagong Metropolitan Area (CMA). A total of 60 (sixty) stray dogs were randomly captured and euthanized by intravenous injection with saturated Magnesium Sulphate ($MgSO_4$) solution. The capture was conducted under the permission of Chittagong City Corporation and ethical committee of Chittagong Veterinary and Animal Sciences University (CVASU). Demographic information like approximate age, sex, and body condition were carefully recorded in a data sheet. The dogs were categorized into young (≤1year) and adult (>1year) based on their approximate age which was estimated by examining the teeth described by Cynthia et al. (2011). The body conditions of the dogs were documented according to the guideline of Laflamme (1997). Immediately after euthanasia, carcasses were brought to the Pathology and Parasitology laboratory of CVASU and the necropsy was conducted as per standard method described in Coles (1986).

Examination of intestine and preservation of parasites

The entire alimentary tract was removed and the different parts (esophagus, stomach, small and large intestine) were tightly ligated with gauze. Subsequently, the whole intestinal tract was removed from other parts of gastrointestinal tract and separated into small and large intestines. The intestine was then exposed; contents of small and large intestine were taken in separate buckets and were passed through a series of graded screens (sieves) to remove fecal debris (Endrias Zewdu et al. 2010). The attachment of tapeworm's heads was separated carefully (Reid, 1962) for their proper identification. In large intestine especially in the caecum, whip worms were found to be anchored firmly to the wall. They were separated out smoothly and gently with the help of a needle. Before preservation, the parasites were washed several times in normal saline and then preserved in luke-worm glycerin alcohol (glycerin 5 parts and 70% alcohol 95 parts) in individual vials (Soulby, 1982).

Identification of enteric parasites

Nematodes were examined in fresh condition under light microscope after preparing temporary slide. Permanent mounts of cestodes were made from fresh samples following the routine procedure described by Cable (1957). Parasites were identified and classified by Bowman (2009) and Soulby (1982).

Statistical Analysis

The obtained information was imported, stored and coded accordingly using Microsoft Excel-2007 to STATA/IC-11.0 (Stata Corporation College Station) for analysis. Descriptive statistics was expressed as proportion with Confidence Interval. The results were expressed in percentage and the associations with different risk factors were determined by one way ANOVA. Level of Significance was determined when $P<0.05$.

RESULTS

During this investigation, it was observed that polyparasitism was very common 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. Considerably higher prevalence was found in *Diphyllobothrium latum* and *Ancylostoma caninum* compare to *Taenia* spp infection (Table 1).

Table 1. Overall prevalence of enteric helminthes in stray dogs

Enteric parasites	Frequency % (N)	95% CI	Mean Intensity	Range
Diphyllobothrium latum	25 (15)	13.71-36.28	10.2 ±2.17	1-28
Dipylidium caninum	15 (9)	5.69-24.30	12.22 ± 3.69	1-34
Taenia spp.	5 (3)	-0.67-10.67	5.0±0.57	4-6
Ancylostoma caninum	25 (15)	13.71-36.28	39.53±8.99	12-152
Toxocara canis	23.33 (14)	10.93-32.39	15.07±3.62	3-56
Trichuris vulpis	45 (27)	32.03-57.96	42.18 ± 7.99	6-211

N: number

Table 2. Prevalence and worm load of enteric helminths based on season and age

			Species					
			Diphyllobothrium latum	***Dipylidium caninum***	***Taenia spp.***	***Ancylostoma caninum***	***Toxocara canis***	***Trichuris vulpis***
Season	**Summer (28)**	**Infected animal rate (N)**	28.57 (8)	21.42 (6)	7.14 (2)	28.57 (8)	35.71 (10)	10.71 (3)
		Mean worm load (Range)	11.0±3.48 (1-28)	9.0±3.51 (1-25)	5.5±0.50 (5-6)	34.57±7.16 (13-63)	16.42±6.72 (6-56)	37.18±9.37 (11-121)
	Winter (32)	**Infected animal rate (N)**	21.87 (7)	9.37 (3)	3.12 (1)	43.75 (14)	12.50 (4)	34.37 (11)
		Mean worm load (Range)	9.28±2.67 (1-28)	18.66±8.41 (17-34)	4.0±.00 (0)	43.87±16.10 (12-152)	13.71±3.34 (5-56)	47.33±12.73 (11-122)
	P value		0.401	0.633	0.545	0.298	0.913	0.372
Age	**Adult (48)**	**Infected animal rate (N)**	29.16 (14)	10.41 (5)	6.25 (3)	29.16 (14)	8.33 (4)	6.25 (3)
		Mean worm load (Range)	9.42±2.18 (1-28)	12.00±4.19 (1-25)	5.0±0.57 (4-6)	43.00±11.61 (13-152)	17.2±4.94 (3-56)	43.65±9.19 (11-121)
	Young (12)	**Infected animal rate (N)**	8.33 (1)	33.3 (4)	0	33.30 (4)	33.30 (4)	91.67 (11)
		Mean worm load (Range)	21.00±.00 (1-21)	12.50±7.23 (3-34)	0	30.0±11.79 (12-63)	9.75±1.65 (6-13)	38.33±16.18 (6-56)
	P value		0.349	0.015	0.170	0.240	0.501	0.114

Table 3. Prevalence and worm load of enteric helminthes based on sex and body condition

			Species					
			Diphyllobothrium latum	***Dipylidium caninum***	***Taenia spp.***	***Ancylostoma caninum***	***Toxocara canis***	***Trichuris vulpis***
Season	**Male (32)**	**Infected animal rate (N)**	18.75 (6)	12.5 (4)	9.37 (3)	21.87 (7)	25.00 (8)	50.00 (16)
		Mean worm load (Range)	7.5±2.92 (1-21)	14.00±6.86 (3-34)	5.00±0.57 (4-6)	38.85±7.22 (14-63)	12.37±3.06 (3-26)	39.56±7.15 (6-122)
	Female (28)	**Infected animal rate (N)**	32.14 (9)	17.85 (5)	0	28.57 (8)	21.42 (6)	39.28 (11)
		Mean worm load (Range)	12.0±3.02 (2-28)	10.8±4.43 (1-25)	0	38.85±7.22 (12-152)	18.66±7.59 (6-56)	48.60±18.73 (11-121)
	P value		0.401	0.495	0.232	0.046	0.721	0.922
Age	**Good (21)**	**Infected animal rate (N)**	23.80 (5)	14.28 (3)	9.50 (2)	14.28 (3)	19.04 (4)	52.38 (11)
		Mean worm load (Range)	7.00±3.02 (1-15)	9.5±1.5 (8-11)	5.0±1.00 (4-6)	33.66±11.25 (14-53)	14.25±3.70 (6-24)	30.3±4.93 (12-56)
	Fair (20)	**Infected animal rate (N)**	30.00 (6)	15.00 (3)	0	30.00 (6)	25.00 (5)	45.00 (9)
		Mean worm load (Range)	9.83±2.95 (2-21)	25.33±4.91 (17-34)	0	27.33±6.20 (12-53)	5.00±3.03 (8-26)	58.12±23.26 (6-121)
	Poor (19)	**Infected animal rate (N)**	21.05 (4)	15.78 (3)	5.26 (1)	31.57 (6)	26.31 (5)	36.84 (7)
		Mean worm load (Range)	13.2±5.15 (3-28)	3.75±1.10 (1-6)	5±0.00 (4-6)	54.66±20.58 (16-152)	15.80±10.09 (3-56)	43.87±2.28 (11-122)
	P value		0.349	0.956	0.792	0.317	0.262	0.676

On the other hand, the prevalence of enteric helminths infection also varied with different variables like sampling season, age, sex and body condition of the stray dogs. Most of the intestinal parasitic infections apparently occurred more in summer season (Table 2).

The highest seasonal prevalence was found in *Toxocara cains* infection (35.71%) in summer and *Ancylostoma caninum* (43.75%) in winter season. Prevalence also varied with the age of stray dogs where youngs were more susceptible than adults (Table 2). Sex specific prevalence showed that *Diphyllobothrium latum, Dipylidium caninum,* and *Ancylostoma caninum* was higher in female dogs. However, enteric helminths did not attribute any significant effect on the body condition of the study population (Table 3).

DISCUSSION and CONCLUSION

The overall prevalence (95%) of the enteric helminth infection of this study were in close consistency with the report of Rahman (1973) who found 100% prevalence of such infection in necropsized stray dogs from six different districts of Bangladesh. Basu et al. (2010) reported 78.5% helminth infection through coproscopy in domestic dogs of Chittagong, Bangladesh. The earlier reports of Komatangi (2005) and Minnaar et al. (2002) were also documented similar type of prevalence in different corners of the world. Non descriptive stray dogs are more prone to various helminth infections as they feed on rubbish bins, hardly dewormed (Umar, 2009) along with geographical or environmental factors might be accounted for higher frequency. Higher prevalence of enteric parasites indicated a continuous trend of such infection in the study area. The recorded species also have the zoonotic significance which constituted a great public health risk due to frequent contact between human and pets (Ramirez-Barrios et al. 2004). However, the current investigation also revealed concurrent infection with more than one enteric helminth which is a usual scenario in stray dogs all over the world (Shimelis 1994).

Species-specific overall prevalence of enteric helminths revealed that Trichuriasis was the highest among other enteric helminths infections. Prevalence of Trichuriasis of this study was much higher than the findings of Rahman (1973) who reported only 13.5% infection in stray dogs from different regions of Bangladesh. In a recent survey, Basu et al. (2010) observed 18.8% prevalence of *T. vulpis* infection in the domestic dogs in Chittagong city by coproscopy. The observed frequency also showed a discrepancy with the report of Papazahariadou et al. (2007) who reported lower frequency of such infection in Northern Greece. Higher frequency of such infection might be due the thick resistant wall of the egg allows them to persist in the soil for longer period (Kirkova et al. 2005).

The prevalence recorded for *A. caninum* was found inconsistent with the reports of Basu (2010) and Rahman (1973) in Bangladesh but found in close accordance with the report of Khante et al. (2009). Lower prevalence of such infection might be due to examination of fewer dogs along with acquire adaptive immunity of older dogs reduced the possibility of clinical infection (Soulsby 1982).

Prevalence of Toxocariasis was comparatively lower than the reports of Traub et al. (2002) and Minnaar et al. (2002) but almost similar to the findings of Rahman (1973) in Bangladesh. Lower frequency of Toxocariasis might have resulted due to smaller number of young dogs examined; as these ascarids mostly infected younger dogs below one year of age (Martinez-Moreno et al. 2006).

The prevalence of *D. latum* was higher than earlier reports of Khante et al. (2009); Umar (2009) and Rahman (1973) who recorded 1.1% in India, 6.3% in Nigeria and 13.8% in Bangladesh, respectively. Chittagong Metropolitan is a port city and all the studied stray dogs were captured form the densely populated urban areas in close vicinity to the fish markets and rubbish bins. The dogs were infected by eating fish and fish wastage containing infective plerocercoid larvae (Umar 2009) which might be accounted for higher prevalence of such infection.

In the present study, the prevalence of *D. caninum* was lower than that report of Minnaar et al. (2002) in South Africa but showed similarity with the reported of Rahman (1973) from Bangladesh. The difference might be the outcome of geographical variation as well as flea and lice infestation which act as the intermediate hosts for this cestode (Bowman, 2009). Variation in the frequency of different helminths infection with some previous reports might be due to the geographical, seasonal, social or ecological variations of the study areas and employed diagnostic techniques (Robertson et al. 2000).

Most of the intestinal parasitic infections apparently occurred more in summer season. Similar findings have been documented by Oliveira-Sequeira et al. (2002) from Brazil and Minnaar et al. (2002) from South-Africa. Higher atmospheric temperature is an important factor for the release of larvae from the parasitic eggs. Moreover, heavy or early rainfall in summer season also influences the higher parasitic infections by water logging and spreading of infective eggs and larvae (Oliveira-Sequeira et al. 2002). Among the enteric helminths, only *T. vulpis* infection were found comparatively higher in winter season which was supported by the earlier reports of Andresiuki et al. (2007) and Oliveira-Sequeira (2002). It might be due to the high resistance and adaptive capability of *T. vulpis* in colder climates (Andresiuki et al. 2007).

In the present study, stray dogs of younger age apparently showed higher susceptibility to enteric helminths infections compared to adults; particularly *D. caninum*, *A. caninum, T. canis* and *T. vulpis* infection. This result was in agreement with the findings of Endrias *et al*. (2010); Swai et al. (2010) and Andresiuki et al. (2007). Oliveira-Sequeira et al. (2002) and Muradian *et al*. (2005) also demonstrated higher infection rate of Ancylostomiasis and Toxocariasis in dogs below one year age which also supported the findings of this study. Higher rate 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 significantly ($p<0.05$) susceptible to *D. caninum* infection than adult which might be due to lower immunity whereas older dogs are comparatively resistant to such infection as they have higher adaptive immunity particularly in endemic areas (Borecka 2005).

Sex group variation did not exert any significant association with the occurrence of enteric parasitism which was similar to the reports of Endrias et al. (2010) and Razmi et al. (2006). But, apparently the frequency of *D. latum, D. caninum,* and *A. caninum* was higher in female dogs. This might be due to the physiological peculiarities of the female dogs which usually constitute stress factors thus reducing their immunity to infections (Wakelin 1984). *T. canis* and T. *vulpis* was more in male dogs where *Taenia* spp occurred significantly more in male dogs. Higher frequency of enteric helminthiasis in male dog has been reported by Swai et al. (2010), Umar (2009) and Oliveira-Sequeira et al. (2002) in different countries of the

world. On the other hand, enteric helminths did not attribute any significant effect on the body condition of the study population. Similar reports have been documented by Rodrı´guez et al. (2011) and Swai et al. (2010) and which possibly indicated the subclinical infection.

Conclusion

The high overall prevalence of enteric parasites of stray dogs observed in this investigation is considered to be critical from public health aspect. The high abundance of enteric helminths is probably directly related to high density of stray dogs in the CMA which act as the potential source of infection for other domestic dogs and human beings. Age and season was the most important predictor of enteric helminthiasis in stray dogs. Young dogs were more susceptible to different enteric parasitic infection particularly *D. caninum*, *A. caninum, T. canis* and *T. vulpis*. Most of the recorded helminths are responsible for causing several zoonotic diseases. Therefore, it is essential to take integrated control campaigns by the public health authorities and veterinarians for increasing the awareness against zoonotic diseases among the inhabitants/pet lovers/dog keepers which will assist to prevent or minimize such infections.

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