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ORIGINAL RESEARCH

Gastrointestinal helminth parasites of pet and stray dogs as a potential risk for human health in Bahir Dar town, north-western Ethiopia

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Abstract

Aim: A cross-sectional study was carried out from November 2011 to April 2012 to determine the prevalence and species of gastrointestinal (GI) helminth parasites in pet and stray dogs as a potential risk for human health in Bahir Dar town, north-western Ethiopia.

Materials and Methods: A total of 384 and 46 faecal samples were collected from pet and stray dogs, respectively and examined by using standard coprologic techniques.

Results: The overall prevalence of GI helminth infection in pet and stray dogs was 75.26 and 84.78%, respectively. The detected parasites with their frequencies in pet dogs were *Ancylostoma caninum* (78.89%), *Toxocara canis* (39.79%), *Dipylidium caninum* (29.75%), *Strongyloides stercoralis* (29.06%), *Taeniidae* (23.87%) and *Trichuris vulpis* (7.95%). Stray dogs were found more likely to be polyparasitized and presented higher prevalence of *A. caninum*, *T. canis*, *S. stercoralis*, *Trichuris vulpis* and *Taeniidae* ($P < 0.05$) than domiciled ones. *Diphyllobothrium latum* was detected only in 10.25% of stray dogs. *Toxocara canis* and *A. caninum* ($P < 0.05$) were detected more frequently in dogs with less than 6 months of age ($P < 0.05$) than old age dogs. The sex or breed groups didn't significantly affect the prevalence of parasites. A significant variation was recorded ($P < 0.05$) between different feeding systems where higher prevalence was observed in uncontrolled feeding group (82.18%) compared to controlled feeding (32.08%).

Conclusion: Different gastrointestinal parasites in pet and stray dogs were identified in the study area that can potentially infect humans and cause serious public-health problems. Thus, concerted efforts should therefore be made to educate dog owners to embrace modern dog disease control programs and measures have to be taken on stray dogs.

Keywords: Bahir Dar, dog, Ethiopia, gastrointestinal, helminth, prevalence

Introduction

The domestic dog (*Canis familiaris*) is generally considered as the first domesticated mammal and has co-existed with man as a working partner and house pet in all eras and culture since the days of the cave dwellers [1]. Dogs perform a range of cultural, social and economic functions in society. Dogs are kept as pets and companions, for hunting, as guards or for commercial purposes. Some studies also suggest that keeping pets is associated with a higher level of self-esteem in children [2,3].

The dog population in urban and suburban regions is composed of dogs that roam only with their owners and stray dogs which are ownerless [4]. In both cases, the animals come in close contact with humans and their dwellings and act as reservoirs and transmitters of zoonotic diseases [5,6]. Gastrointestinal helminths of dogs pose serious impact both on the host and human beings. They impede the successful rearing of dogs and result in losses that are manifested by lowered resistance to infectious diseases, retarded growth, reduced work and feed efficiency and general ill health [7]. Uncontrolled population of stray and semi-domesticated dogs in close proximity to increasing densities of human population in urban environments is a common fact in developing countries, in conjunction with the lack of veterinary attention and zoonotic awareness, increases the risks of disease transmission [5]. Thoughtless dog breeding raises the number of stray and free-living dogs. From the aspect of transmission of diseases in urban and rural habitats, they present a high risk factor [8]. Some surveys have been conducted on the prevalence of the helminth parasites of dogs in different parts of the country [9. 10]. However, there is no any information on the literature on the prevalence of gastrointestinal helminth parasites of pet and stray dogs in Bahir dar town, Therefore, the objectives of this study were to identify and determine the prevalence of GI helminth parasites of pet and stray dogs in the town.

Materials and Methods

Study area: A cross-sectional study was conducted from November 2011 to April 2012 in Bahir dar town,

Table- 1. The overall prevalence gastrointestinal helminth infections in pet and stray dogs

Dogs	No. examined	No. positive	Prevalence (%)	Chi-square	*P-Value*
Pet	384	289	75.26	2.056	0.151
Stray	46	39	84.78		
Total	430	328	76.27		

Table-2. Prevalence of gastrointestinal helminth species detected in pet and stray dogs in Bahir Dar town

Type of parasites	Pet dogs (n=289)		Stray dogs (n=39)	
	No. Positive	Prevalence (%)	No. Positive	Prevalence (%)
Ancylostoma caninum	228	78.89	33	84.61
Toxocara canis	115	39.79	21	53.84
Strongyloides stercoralis	84	29.06	18	46.15
Dipylidium caninum	86	29.75	12	30.76
Taeniidae	69	23.87	14	35.89
Trichuris vulpis	23	7.95	8	20.51
Diphyllobothrium latum	0	0.00	4	10.25

north-western Ethiopia. The town is bordered by the biggest lake (Tana) and river (Blue Nile) in Ethiopia. It is located between 12°29'N latitude and 37°29'E longitude. The average annual 0rainfall ranges from 1200-1600 mm and it has mean annual temperature of 26°C [11].

Study animals and sample size determination: The study animals were dogs available in Bahir dar as pet (having owner) and stray (owner less) dogs. There are about 1670 pet and more 100 stray dogs in the town [12]. The total number of pet dog required for sampling was calculated based on the formula given by Thrusfield [13]. Since, there was no information about the prevalence of the parasites in the area, 50% expected prevalence was taken to calculate the sample size with 5% absolute precision. So the calculated sample size was 384 for pet dogs but only 46 stray dogs were sampled without any calculation. Dogs of all age group and both sexes were randomly selected. Pet dogs were categorized as pups (< 6 months of age), juvenile (6 months to 1 year of age) and adult dogs (> 1 years of age) [13].

Sample collection: A total of 384 faecal samples were collected directly from the rectum of each pet dog with the help of finger and 46 faecal samples were collected from the ground immediately after voiding by stray dogs using plastic gloves, stored in refrigerator and processed within 2-3 hours of collection at Bahir dar Regional animal disease diagnosis and investigation center. The samples were processed using direct smear, sedimentation and salt floatation technique as described by Urquhart *et al*. [14]. Identification of characteristic parasite eggs was made according to the morphological characteristics and key as outlined by Soulsby [7].

Statistical analysis: Raw data were entered into a Microsoft Excel spreadsheet and descriptive statistics were used to summarise the data. The prevalence was calculated for all data as the number of infected individuals divided by the number of individuals examined and multiplied by 100 to express in percentage. Chi square was used to assess the association of risk factors on the prevalence of parasites. All statistical analyses were performed using the "SPSS" statistical software and 95% confidence level was used to determine significant difference. For simplicity, only "*P*" values were quoted.

Results

The overall prevalence of parasitism was 75.26 and 84.78% in pet and stray dogs, respectively. There was no statistical significant different (*P>0.05*) between pet and stray dogs (Table-1).

The detected parasites with their frequencies in pet dogs were *Ancylostoma caninum* (78.89%), *Toxocara canis* (39.79%), *Dipylidium caninum* (29.75%), *Strongyloides stercoralis* (29.06%), *Taeniidae* (23.87%) and *Trichuris vulpis* (7.95%). Stray dogs were found more likely to be polyparasitized and presented higher prevalence of *A. caninum, T. canis, S. stercoralis, Trichuris vulpis* and *Taeniidae* (*P*<0.05) than domiciled ones. *Diphyllobothrium latum* was detected only in 10.25% of stray dogs (Table-2). Concurrent infection with two or more helminth parasites was common in 73.7% of the infected pet dogs.

Out of 254 male and 130 female pet dogs, 74.80 and 76.15% were infected with gastrointestinal helminth parasites, respectively. However, there was no significant difference (*P>0.05*) in the prevalence of gastrointestinal helminth infections between male and female dogs. Likewise, there was no significant differences (*P>0.05*) in the prevalence of parasitic infection between local (76.70%), exotic (73.80%) and crossbred (76.19%) pet dogs (Table 3). No significant difference (*P>0.05*) in the prevalence of helminth infection was observed among age groups of pet dogs. The highest prevalence (*P<0.05*) was recorded in young dogs (83.04%) followed by puppies (77.11%) and adults (69.84%). Regarding the feeding systems, the prevalence of helminth parasites in uncontrolled fed dogs was 82.18% whereas 32.08% in controlled feeding (32.08%) with a significant variation (*P< 0.05*) between them (Table-3).

Table-4 shows the distribution of gastrointestinal helminth parasites of pet dogs in Bahir dar town. *Toxocara canis* and *A. caninum* were detected more

Table-3. Overall prevalence of gastrointestinal helminths in pet dogs based different risk factors

Risk factors	Categories	No. examined	No. infected	Prevalence (%)	Chi-square	P-value
Sex	Male	254	190	74.80	0.84	0.772
	Female	130	99	76.15		
Age	Puppies	83	64	77.11	6.770	0.034
	Young	112	93	83.04		
	Adults	189	132	69.84		
Breed of dogs	Local	176	135	76.70	0.422	0.810
	Cross	187	138	73.80		
	Exotic	21	16	76.19		
Feeding system	Controlled (cooked)	53	17	32.08	61.734	0.000
	Uncontrolled (uncooked)	331	272	82.18		

Table-4. Prevalence of parasite species in relation to age in pet dogs in Bahir Dar

Risk factors	Categories	No. examined	No. infected	Prevalence (%)	Chi-square	P-value
A. caninum	Puppies	83	55	66.27	8.743	0.013
	Young	112	75	66.96		
	Adult	189	98	51.85		
T. canis	Puppies	83	45	54.22	35.161	0.000
	Young	112	35	31.25		
	Adult	189	35	18.52		
T. vulpis	Puppies	83	1	1.20	4.314	0.116
	Young	112	8	7.14		
	Adult	189	14	7.41		
S. stercoralis	Puppies	83	16	19.28	0.720	0.658
	Young	112	27	24.11		
	Adult	189	41	21.69		
D. caninum	Puppies	83	19	22.89	0.786	0.675
	Young	112	28	25.00		
	Adult	189	39	20.63		
Taeniidae	Puppies	83	12	14.46	2.272	0.321
	Young	112	25	22.32		
	Adult	189	32	16.93		

frequently ($P<0.05$) in dogs with <6months of age ($P < 0.05$) than adult dogs with a significant difference ($P<0.05$) between them (Table-4).

Discussion

The study showed that 75.26 and 84.78% of pet and stray dogs examined were affected by parasitic diseases, respectively. The result of this study was higher than reports of Yacob *et al*. [15], Endrias *et al*. [9], Degefu *et al*. [10] and Eleni *et al*. [16] in Ethiopia, Katagiri and Oliveria-sequeira [17] in Brazil, Maria *et al*. [18] in Argentina, Fok *et al*. [19] in Hungary, and Anene *et al*. [20] in Nigeria with a prevalence of 51.00, 52.86 and 64.4, 54.33, 52.4 53 and 68.4%, respectively. Higher prevalence than the result of this study was reported by Davoust *et al.* [21] in north-east Gabon (94.1%), Umar [22] in Kaduna State, Nigeria (93.8%) and Lavallen *et al*. [23] in Argentina (89.13%). The difference in the frequency of the helminth parasite infections between places or countries is possibly due to the differences in climatic factors required for the biology of the parasites, veterinary facilities and public awareness to take care of the dogs. During the survey, it was noted that a large number of dogs scavenge at abattoirs and at butcher shops which frequently fed on thrown offal that are not in good hygienic condition. It is also common to find animal cadaver thrown into street where dogs communally feed on, which could be a suitable for transmission of the parasites.

Concurrent infection with two or more different species of helminths was more common than infection with one in both types of dogs. The greatest contributors were *A. caninum* (78.89%, 84.61%) and *Toxocara canis* (39.79%, 53.84%) in pet and stray dogs, respectively. Other worms encountered in this study included *Strongyloides stercoralis, Trichuris vulpis*, and tapeworms. Similar finding was also reported by Traub *et al.* [5], Endrias *et al.* [9] and Degefu *et al*. [10].

A similar prevalence of *A. caninum* was also reported by Jones *et al*. [24] in Southern Ethiopia. A lower prevalence of *A. caninum* was also reported from abroad countries by Umar [22] in Nigeria, Garedaghi and Mashai [25] in Tabriz, Iran, Davoust *et al*. [21] in North-East Gabon and Katagiri and Oliveira-Sequira [17] in Brazil. This difference may be associated with geographic location of the area, a high level awareness about dog parasites and socioeconomic status of pet owners for hygiene and make use of the available veterinary cares for their animals [26].

The overall and specific parasites prevalence recorded in the current study are strongly associated with age. The overall prevalence of helminth parasites was significantly higher in young dogs (< 1 year-old) than adult. This is partially due to parasite specific immunity usually acquired with age or probably as consequence of single or repeated exposures [27].

The result obtained in this study revealed that the difference in prevalence of gastrointestinal helminth parasite in male and female pet dogs was not statistically significant. This agrees with reports of Yacob [15] and Degefu *et al*. [10] conducted in Debre

Zeit and Jimma (Ethiopia), respectively. In contrast, a study in Nigeria indicated that female dogs were more likely to contract intestinal nematodes than male dogs [21].

In this study, concurrent infection with two or more helminth parasites is common in 73.7% of the infected pet dogs. Similar observations have been reported by Degefu *et al*. [10] and Endrias *et al*. [9].

The overall prevalence of *T. canis* (39.79%) recorded in the current study is higher than the previous reports of Yacob *et al*. [15] and Endrias *et al*. [9] and Degefu *et al*. [10] with a reported prevalence of 21, 17.1 and 25.8 % in Debre Zeit, Ambo and Jimma, respectively. In addition, the prevalence of *Toxocara* infection reported here was higher than the earlier reports from Netherland [2]. The present study revealed that the prevalence of *T. canis* was higher in puppies (54.2%) than adults (18.5%). Puppies are at higher risk of infection due to transplacental and transmammary transmission and parasite-specific immunity is usually acquired with age, probably as a consequence of single or repeated exposures [14].

Tricuris vulpis had the least prevalence (7.95%) among other gastrointestinal helminth species. This result agrees with previous reports of Garedaghi and Mashaei [25] in Tabriz, Iran with prevalence of 86.06%. Less prevalence was reported Degefu *et al*. [10] in Jimma, Ethiopia, with prevalence of 4.7%. Higher prevalence studies were found by Katagiri and Oliveira-Sequira [17] in Brazil (7.1%), Davoust *et al*. [21] in North-east Gabon (49.5%).

The prevalence of *Strongyloides stercoralis* revealed a prevalence of 29.06% in pet dogs and 46.15% in stray dogs. Studies conducted by Endrias *et al*. [9] and Eleni *et al*. [16] indicated a lower prevalence of *S. stercoralis* which accounted for 14.29 and 4.29% in Ambo and Gondar towns, respectively.

Dipylidium caninum was found with prevalence of 29.75%. This had less value when compared with 75% reported by Umar [22] in Nigeria, 25.8% by Degefu *et al*. [10] in Jimma, Ethiopia, 25.7 by Endrias *et al*. [9] in Ambo town, Central Ethiopia. Less prevalence were reported in Tabriz Iran (7%) by Garedaghi and Mashahi [25], Brazil 2.4% by Katagiri and Oliveira-Sequira [17]. The result of this parasite reveals the presence of ectoparasites in this town that used as an intermediate host to complete its life cycle.

Prevalence of *Echinococus granulosus* and other *Taeniidae* was 23.87%. This result is higher than the reported prevalence of Degefu *et al*. [10] in Jimma town (18.3%), Endrias *et al*. [9] in Ambo town (8.57%) and Yimer *et al*. [28] in Addis Ababa (4.6%). Improper feeding system and absence of owner awareness about the transmission of this parasite from row meat and offal's may result the occurrence of this parasite in the present study area.

In the present study, the prevalence in local, cross and exotic breeds was not found statistically significant. This report agrees with the previous study by Swai *et al*. [29] in Tanzania. This indicates that all categories have equal chance of acquiring the infection if they are exposed to infected materials.

The current study showed that feeding management had a significant influence in the prevalence of gastrointestinal helminth infections. Dogs which receive a great care by their owners had lower incidence of intestinal helminths than dogs lacking such privileges [30].

In all cases, the overall and specific parasites prevalence recorded in stray dogs in the present study was similar but with different levels with household dogs. The only difference was the presence of *Diphylobothrium latum* in stray dogs. This could be due to the free roaming character of stray dogs which leads them to be exposed to fish offal infected with infective stage of the adult parasite.

Conclusion

This study showed the gastrointestinal helminth parasites in pet and stray dogs in the study area were highly prevalent. In addition, the species of helminth parasites recorded in the present work have potential zoonotic importance. A combination of routinely screening faecal samples for parasites, strategic anthelmintics regimes and improved pet owner education is recommended for the control of gastrointestinal parasites in pet dogs including control of stray dog population in the study area.

Authors' contribution

BB was the project leader and designer in addition to editing and providing valuable comments on the manuscript. TA was responsible for data collection and draft preparation of the manuscript. AM made conceptual and editorial contributions and performed the statistical work. All authors revised and approved the final version of the manuscript.

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Competing interests

Authors declare that they have no competing interest.

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