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Gastrointestinal Helminthes in Dogs and Community Perception on Parasite Zoonosis at Hawassa City, Ethiopia

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Abstract: A cross sectional study was conducted from November 2011 to April 2012 in Hawassa city to estimate prevalence of helminthes, associate with the assumed risk factors and assess community perception on dog helminthes zoonosis. Fecal samples of 448 dogs regardless of their sex, age, breed and management system were randomly sampled and were diagnosed for the occurrence of gastrointestinal helminthes using Mac master egg count and sedimentation techniques. Out of sampled dogs, 84.6 %(379/448) were found to be positive. Six elminthes species recovered, *Anclyostoma caninum* egg *(*54.5%) was the most prevalent parasite, whereas *Echnococcus granulossos* egg (3.6%) was the least prevalent one. Among the assumed risk factors stray dogs had high prevalence (97.34%) as compared to that of semi-confined (79.72%) and confined (69.64%) dogs. There was significant variation ($p<0.05$) among age groups; prevalence of *Anclyostoma caninum* (73.17%) and *Toxocara canis* (32.03%) were higher in puppies, whereas *Strongloides stercoralis* (34.95%) and *Dipylidium. caninum* (34.3%) were high in adult dogs. The proportion of mixed infections of two, three and four parasite species in same host were found to be 42.4%, 15.2% and 2.2%, respectively. Community response has indicated that all individuals were not aware of treating their dogs against parasites, provision of good house and appropriate waste disposal. Furthermore, all respondents had no idea about zoonotic parasites. Therefore, the current high prevalence of dog gastrointestinal helminthes and zoonotic importance warns to conduct appropriate awareness creation, control and prevention has to be implemented to mitigate its further spread.

Key words: Dogs · Hawassa City · Gastrointestinal-Helminthes · Fecal Sample · Prevalence

INTRODUCTION

Dogs perform a range of cultural, social and economic functions in the society. They are kept as pets and companions, for hunting, as guards, draught animals, for food, or for commercial purposes [1]. Besides, some studies also suggest that keeping pets is associated with a higher level of self-esteem in children [2].

Parasitism is the most commonly encountered disease in dogs all over the world. Regardless of the availability of medications to treat parasites, most parasites of dogs have highly evolved life cycle that make their elimination impossible. In addition, dogs are routinely affected without noticeable infestation. A dog can have internal parasites even though the fecal sample test is negative [3].

Pervious study has indicated that parasitic diseases in general and gastro-intestinal helminthes and protozoan in particular have been identified as the major impediment to dog health worldwide owing to the direct and indirect losses they cause [4]. Most of the parasites affect the dogs sub-clinically. Consequently, dogs may harbor a wide range of parasites with zoonotic potential causing health risks to human beings [5]. Some of the parasites like *E. granulosus involve* food animals as an intermediate host and cause great economic loss through organ condemnation at the level of slaughterhouse [6].

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Gastrointestinal helminthes of dogs pose serious impact both on the host and human beings. It 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. Parasitized animals show a variety of signs depending on the parasite species [7]. These signs are attributed to intestinal obstruction, irritation, mal-digestion, mal-absorption and protein losing induced by the parasites [8].

In areas of high population such as urban and peri-urban, dog keeping could be a risk to the transmission of zoonoses, some of which could be of parasitic origin [9].

The prevalence of dog helminthes considerably varies [10] from one region to another and among the different diagnostic techniques employed. In Ethiopia, however, very little attention was given for parasites of dogs. As a result, the works done on the prevalence of the different gastrointestinal parasites of dogs so far are scanty [11-14].

Consequently, detailed study is not available on the distribution of parasite species, prevalence, risk factors for the prevalence of dog gastrointestinal helminthes and owner's awareness on zoonotic canine parasites in Hawassa city. Therefore, the objectives of this study were to:

- Estimate the prevalence of GIT helminthes of dog in Hawassa city.
- Identify the different species of gastro intestinal helminthes of dogs.
- Detect the effects of assumed risk factors for the prevalence of gastrointestinal helminthes.
- Assess community perception about zoonotic canine parasites in the area.

MATERIALS AND METHODS

Study Area Description: The study was conducted in Hawassa city. Hawassa is the capital city of SNNP region, which is located at 275 Km from Addis Ababa in southern direction, which lies between 4°27' and 8°30' N latitude and 34°21' and 39°1'E longitude at an attitude of 1790 m.a.s.l. It covers 50km^2 area. The average annual rain fall ranges from 800-1000mm. There are two rainy seasons and one long dry season. The long rainy season extends from June to September; whereas short rainy season extends from February up to April; the remaining months October to February known by their dry period. The mean minimum and maximum, temperature of the area was 20.1°C and 30°C, respectively and mean relative humidity was 51.8% [15].

Study Population: All household those were found in Hawassa city considered as study population. Since the exact number of household were not identified systematic simple random sampling method used to collect the designed sample size.

The study animals were dogs of all age group (puppy, young and adult), all breeds (local, cross and exotic) and both sex (female and male) that found in the study area that were from different management/ housing system (confined, semi-confined and stray). For simplicity, dogs up to 6 months of age were classified as puppies; from 6 months through one year of age were referred to young dogs while adults were dogs above 1 year of age [16].

Study Design and Sampling Methodology: A cross sectional study was carried out from November 2011 to April 2012 in Hawassa city to estimate the prevalence of gastrointestinal helminthes of dogs. Sample was taken systematically, after every five household. The first sample started by simple random sampling technique. Approximately 4-5 gm of fresh fecal samples were collected, either immediately after voided from target animal or directly from rectum. The samples were labeled and stored at 4°C for a maximum of one day before processing. Then, examined using Mc master egg counting chamber and sedimentation techniques as [17, 18] and the result was considered as positive when at least one parasite egg present [19]. The eggs were identified using ova identification keys under 10x magnification of compound microscope to the level of genera or species [7, 20].

Sample Size and Sampling Method: Sample size required for the study was calculated according to the formula given for simple random sampling method. Accordingly, 50% previous prevalence was considered for this study. 95% confidence interval (CL), 5% level of desired absolute precision and 50% previous prevalence [21]. Based on the above assumption the minimum sample size was about 384. However, 448 dogs were sampled to get adequate information.

Data Management and Analysis: The raw data collected were entered into Microsoft excel spreadsheet and summarized by descriptive statistics. Stata 9.0 software was used to analyze the effects of assumed risk factors on the prevalence of different GIT parasites of dogs. Level of significance considered when $p<0.05$.

RESULTS

General Prevalence of Helminthes: Out of the total 448 dogs examined, 84.6% (n=379) were diagnosed as harboring nematodes and cestodes eggs at varying levels. The proportion of the dogs harboring *Ancylostoma* was found to be the highest (54.5%) followed by *T. canis* (38.8%), *S. stercoralis* (30.6%), *D. caninum*(29.9%), *T. vulpis* (7.8%) and *E. granulosus* (3.6%) as shown in (Table 1).

The prevalence of parasite infection in dogs in the study area was observed as compared to assumed risk factors as shown in Table 2. All the assumed risk factors, except management system, did not show significance ($p>0.05$) difference between the prevalence of helminthes and age groups, sex and breeds. However, among different management systems, stray dogs had prevalence of 97.3% with $p=0.000$; as compared to semi-confined dogs with prevalence 79.7% and followed by confined dogs 69.6%. The difference was highly significant statistically ($p<0.05$).

Analysis of Variance of Mean Epg Count as Compared to Different Assumed Risk Factors Breed: There was no significant difference ($p>0.05$) in mean epg among the breed category observed.

Sex: Similarly ANOVA was used to see significant difference of mean epg between sexes. All parasites did not show significant difference ($p>0.05$);

Age Group: On the other hand, age group showed significant difference in different parasites observed. Of which *A. caninum* was significantly differs among age groups as shown in Table 3. Where puppies and young age group had significantly ($p<0.05$) high mean epg as compared to adult age groups; where as in case of *S. stercoralis* there was significantly high mean epg in adult age group as compared to puppies. There was no difference in egg count in case of *T. vulpis.* Meanwhile, *T.canis* had significantly($p<0.05$) high mean epg in puppies and young dogs than adult age group and *D. caninum* parasite mean egg count was observed

Table 1:Species of parasite eggs identified and their respective prevalence in dogs at Hawassa city

Species of parasite egg identified	No of sample	No of +ve	Prevalence %	95% CI
Ancylostoma caninum	448	244	54.5	[49.8,9.2]
Strongyloides stercoralis	448	137	30.6	[26.4,35.1]
Trichuris vulpis	448	35	7.8	[5.6,10.8]
Toxocara canis	448	174	38.8	[34.3,43.5]
Dipylidium caninum	448	134	29.9	[25.7,34.4]
Echinococcus Granulosus	448	16	3.6	[2.2,5.9]

Table 2: Logistic regression analysis of prevalence of gastrointestinal helminthes in dogs at Hawassa city in relation to different risk factors

Risk factor		No of Sample	No of +ve sample	Prevalence	95%CI	p-value
Breed	Local	350	301	84.81	[80.2,88.6]	1
	Cross	29	23	84.13	[65.1,95.0]	0.330
	Exotic	69	55	86.0	[75.1,92.8]	0.184
Sex	Female	145	122	79.31	[71.3, 85.4]	1
	Male	303	257	79.71	[74.0, 83.4]	0.852
Age group	Puppy	41	37	90.24	[76.4, 96.9]	1
	Young	98	92	93.87	[86.6, 97.5]	0.453
	Adult	309	250	80.90	[75.9, 85.0]	0.153
Management	Confined	112	78	69.64	[60.1,77.8]	1
	Semi-confined	148	118	79.72	[72.1,85.7]	0.000
	Stray	188	183	97.34	[93.5,98.9]	0.000

Table 3: Analysis of variance of mean epg of helminthes recovered as compared to age group of dogs sampled

Species of parasite egg	No of +ve	Mean epg within age group			F value	p-value	Bonferroni p-value		
		Puppy(n=41)	Young(n=98)	Adult(n=309)			puppy vs young	young vs Adult	Adult vs Puppy
Ancylostoma caninum	244	691.5	783.7	428.0	12.4	0.00***	1	0.00***	0.05*
Strongyloides stercoralis	137	50	136.7	193.2	4.99	0.01**	0.34	0.29	0.01**
Trichuris vulpis	35	0	15.1	14.1	1.04	0.35	0.55	1.00	0.49
Toxocara canis	174	240.2	285.7	130.6	13.51	0.00***	1.00	0.00***	0.05*
Dipylidium caninum	134	15.9	100.5	176.8	8.03	0.00***	0.28	0.05*	0.001***
Echinococcus Granulosus	16	8.5	11.7	16.3	0.20	0.81	1.00	1.00	1.00

Table 4: Analysis of variance of mean epg of helminthes recovered in dogs as compared to management system

Species of parasite egg	No of +ve	Mean epg within management system			F value	p-value	Bonferroni p-value		
		Stray (n=188)	Semi confined (n=148)	Confined(n=112)			Stray vs semi confined	Semi-confined vs confined	Confined vs stray
Ancylostoma caninum	244	632.4	495.9	402.7	4.5	0.01**	0.18	0.79	0.01**
Strongyloides stercoralis	137	222.6	144.6	106.7	6.2	0.00***	0.05*	0.91	0.00***
Trichuris vulpis	35	21.7	6.5	6.8	3.3	0.04*	0.07	1	0.78
Toxocara canis	174	197.6	145.9	173.7	1.43	0.24	0.27	1	1
Dipylidium caninum	134	164.1	147.9	110.4	1.33	0.26	1	0.84	0.31
Echinococcus Granulosus	16	28.7	4.7	4.0	4.05	0.018**	0.04*	1.00	0.06

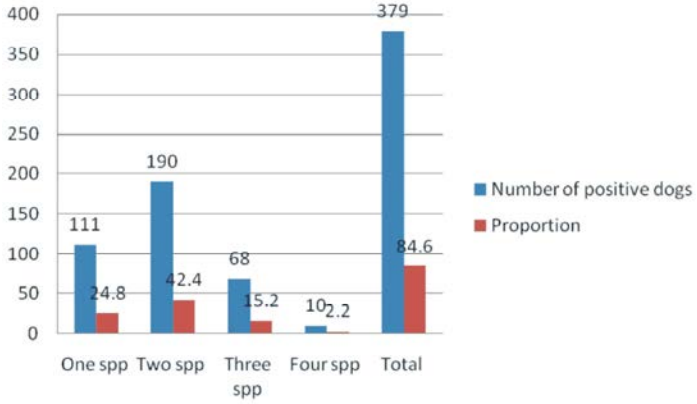

Fig. 1: Proportion of mixed helminthes in positive dogs sampled in the study area

significantly ($p<0.05$) high in adult age group than puppies and young. There was no significant difference in mean egg count observed among age groups in case of *E.granulosus*.

Management System: Management of dogs were considered to analyze mean epg of parasite recovered; where it was categorized as free ranging dogs those fully released day and night but they do have owners; semi confined ones they are released at night and confined at home in day time whereas those confined group were remain in house day and night. According to, parasitic burden based on mean egg count was observed during study period. *A. caninum* and *S. stercoralis* had significantly ($p<0.05$) high mean epg in stray than confined dogs. Other parasite species mean epg was higher in stray dogs than semi confined and confined ones as shown in Table 4.

Prevalence of Concurrent Infections: Out of 448 sampled dogs, 59.8% (n=268) were found to be with concurrent infections, where more than one helminthes species in single dog observed. In line with this, concurrent infections with two species of helminthes were higher (42.4%) as compared to infection with three 15.2% (n=68) and four 2.2% (n=10) species of helminthes parasites in one dog. Though there was six different species of parasites observed during study period; none of the examined dogs harbored five or six species of parasites. Out of 448 dogs examined, only 69 (15.4%) were found to be free of any of the helminthes parasite, whereas 24.8% (n=111) were found to carry only one helminthes species as shown in (Fig. 1).

Questionnaire Survey: Structured questionnaire survey about community perception revealed various concepts. Among 77 owners interviewed only 9.09% (n=7) of the

owners keep dog as companionship, 33.8% (n=26) keep dog for guarding purpose and 57.5% (n=44) keep both for guardians and companion. The survey indicated that 19.5% (n=15) of the owners had the experience of keeping their dogs in confined (indoor), whereas 36.4% (n=28) and 42.9% (n=33) of the owners have had the experience of keeping dogs outdoor (freely) and semi-confined, respectively.

Among owners with the experience of keeping dogs in house, only 30.0% of the house or kennels of dogs were cleaned every week and 70.0% of them were clean the kennel at an interval of two weeks up to one month interval as the condition favors them. In addition, only 10.0% of the individuals were taking the necessary precautions while cleaning the kennel, whereas 90.0% were not taking the necessary precautions.

Among the respondents, 93.5% (n=72) dispose dog's feces with household garbage out of the compound, 6.5% (n=5) in the toilet and none of them burn dog's feces as means of disposal. The study reveals that most of dog owners dispose their dog wastes with household's garbage, which has easy access for contamination. This survey indicated that dog owners keep dogs with other animals such as cat 7.8% (n=6), ruminant 11.68%(n=9), poultry11.68% (n=9) and equine6.49% (n=5), whereas only 62.3 % (n=48) owners were found to keep dogs separately.

According to the respondents, the feeding practices to the dogs in the area was found in the form of raw animal products, cooked animal product, household leftover and mix of raw animal product and household left over with the proportion of 12.98%(n=10), 2.6% (n=2), 58.4% (n=45) and 25.97% (n=20), respectively. This indicates that the majority of dogs was getting their feed from household leftovers and followed by both raw animal product and leftovers.

Regarding owner's perception about health risk to the human showed that 85.7% (n=66) of them were found to have the awareness. However, their awareness was mainly restricted to rabies disease which accounts 96.96 % and few of them also have awareness about canine zoonotic parasites which only holds 3.0 %.

The present study disclosed that only 2.59 %(n=2) of owners use ant helminthes treatment for their dogs. The main reason mentioned was lack of awareness about the availability of drugs for dogs. In connection to this, the information obtained from the animal health workers in the area assured that dogs were brought to the clinic mostly for infectious diseases, especially rabies and canine distemper. In contrary, dogs never brought to the clinic to treat parasitic infections.

DISCUSSION

The present study revealed that gastrointestinal helminthes were highly prevalent in dogs in the study area. Where, 84.6% (n=379) dogs were harboring one or more species of helminthes parasites. This can be partly due to widespread of the parasites in the study areas, poor management and feeding systems of the dogs. Questionnaire survey supports about level of awareness on health care of their dogs. None of owners had the experience of taking their dogs to clinic for helminthes treatment and most of the dogs were stray. These dogs can easily get access to the contaminated sources including feed, water and other animals' products. On top of these, majority of dogs were feeding household leftovers and both raw animal product and leftovers; such feeds can certainly expose animals to the helminthes infections.

The current overall 84.6% prevalence obtained by coprological examination was in agreement with previous works in Cameroon [22] and South Africa [23], who has reported 88.5% and 76%, respectively. Necropsy examination revealed that 86.5% were positive in Ambo town, Ethiopia [24]. The agreement might be associated because of similar management system. However, the present findings contradict with the works of [25] in Spain, [26] in Venezuela, [27] in USA and [28] in Finland who has reported lower prevalence of 53.6%, 35.5%, 34.8% and 5.9%, respectively. The difference in the prevalence of the helminthes infection between countries could be attributed to the differences in ecological factors required for the biology of the parasites, veterinary facilities and public awareness regarding dog health care, animal disease control and prevention policies/strategies the country has adopted, management and feeding systems of dogs could contributes for the variation. In the current survey, it was noted that a large number of stray dogs were scavenging at abattoirs and butcher shops. On top of this, it was common to observe dogs that have kept under confined and semi-confined feeding uncooked and unhygienic offal. Furthermore, it was also common to find animal cadaver thrown on to street where dogs could get access to feed on, which could be a suitable source of parasites transmission.

The present study has indicated that among the assumed risk factors studied management showed significantly ($p<0.05$) high prevalence in stray dogs than confined ones. Yogoob and Mashaei [29] showed high prevalence of *E. granulosus*. This could be a good indication that freely scavenging dogs exposed more than confined and semi confined ones.

Mean epg of parasite recovered against risk factor showed significant difference. Among breeds and sex there was no significant variation; among age groups puppies and young showed significantly ($p<0.05$) high mean epg of *A.caninum* and *T. canis* than adult. Soulsby [7] stated that intrauterine, skin penetration and lactogenic infection of pups by the passage of larvae through milk to the suckling puppy isn't uncommon; whereas *S. stercoralis* and *D. caninum* had significantly ($p<0.05$) high mean epg in adult age group than puppies. The probable reason might be the adult have more opportunity to contact with other dogs and contaminated environments. Similar observation was reported by Yogoob and Mashaei [29] dogs have high chances of getting the intermediate host (flea and louse) and contaminated food with *Dipylidium* eggs than young and puppies.

High epg of *A. caninum* and *T.canis* in puppies might be associated due to poor cleaning habit of the kennel and route of transmission of the parasites through utero, milk and skin could contributed a lot above ingestion of infective larvae. This idea was in agreement with Bowman *et al*. [30] where large numbers of infective larvae have been associated with carelessly managed kennels and pet shops where faces are allowed to accumulate. Unpaved runs are particularly favorable for the perpetuation of hookworm because the faces can mix with the moist soil. In addition, larvae inter the host either swallowed or by burrowing in to the skin through hair follicles. In the case of pregnant bitches, larvae may enter the fetus and infect prenatally. When it reaches the small intestine of the host, the larvae molts a fourth and final stage and develops to maturity in about five weeks [31]. Ascarid larvae are capable of moving to the mammary glands during lactation and puppies and then become infected through the milk [32]. As the result puppies are usually born with or acquiring infection early in their life through transmammary [20, 33, 34 and 35].

Type of management has also shown significant variation on mean epg value, where stray dogs were highly infected 64.9% (122/188) as compared to that of semi-confined 50.67% (75/148) and confined 41.96% (47/112) management system. This is because stray dogs roam around which expose them to the contaminated food than confined and semi-confined [35]. A statistically significant association ($P<0.05$) was observed *strongloides* in case of management with stray 40.95%, semi-confined 27.70% and confined 16.96%. This difference could be due to route of infection by ingestion of the egg or larvae from the contaminated environment and skin penetration.

Coprological examination revealed 7.8% infection with *Trichuris* previous report shows 3.6%, by Anene *et al*. [36], 0.2 % by. Pullola *et al.* [28] and 3% by Yacob *et al*. [37] were lower than this study. However, the current finding agrees to the 8.4% and 9.6% reported by Eshetu *et al*. [12] and Papazahariadou *et al.* [38], respectively. The mean epg of *Trichuris* in stray dogs significantly different ($P=0.04$) among managements. The prevalence of *Echinococcus* (3.6%) was lower than the prevalence recorded in Ambo 8.6% by. Endrias *et al*. [24] and 14.6% incidence recorded in Addis Ababa [12]. The present study shows that significant difference ($P<0.05$) in the prevalence of *Echinoccocus* observed*;* where those dogs from free scavenging had high mean epg than confined and semi confined ones this may be associated that freely scavenging dogs have more access to be exposed on left over uncooked offal's.

Mixed infections were observed in the study. The infection with two species of helminthes was more widespread 42.4 %(n=190), whereas infection with three and four species of parasites were 15.2% (n=68) and 2.2% (n=10), accordingly. Infection with only one species of parasite was found to be 24.8% (n=111). The dominated infection by two parasites species infection agree with the findings of Traub *et al.* [39] and Kutdang *et al.* [40] who has reported that 32.8% and 56% mixed infections were by two species. The occurrence of mixed infection of parasite in dogs may indicate a compatibility of the parasites has more contribution in addition to poor management system and awareness of the people.

Questionnaire survey of this study showed that almost all individuals surveyed had lack of awareness of canine parasitic zoonoses. Most dog owners in the area did not have separate kennels for their dogs, did not dispose their dogs feces and fed the dogs raw animals offal and/or house hold left over. These, in addition to lack of veterinary attention, could exacerbate risk of transmission of canine parasitic zoonoses to human in the area. In the present study 85.71% of surveyed individuals were aware of the health risk of dogs, of which 96.96% were aware only about risk and transmission of rabies, this contradicts with the previous study only 44.3% respondent were aware of the risk and transmission of rabies by Yohannes and Birhanu [16]. About 3.03% were aware of the potential risk of canine parasitic zooneses. A similar condition was reported in Ambo, Ethiopia [24] and in Northeastern India [39]. However, contradicted finding was recorded [41]. This might be associated with living standard of people and availability of adequate information in developed

countries. There was only 2.6% respondents use anthelminthes. This information also substantiates how the communities are poor in parasite disease management.

CONCULSION

The present study disclosed that gastrointestinal helminthes infection in dog is extensively spread throughout study area and the study showed that almost all individuals in the area were not aware of treating their dogs against gastrointestinal helminthes, providing good housing for the dogs and disposing their wastes in appropriate places. Almost all communities in the study area never had a clue about importance of zoonotic canine parasites. Therefore, the current high prevalence of dog gastrointestinal helminthes and lack of awareness by the community in Hawassa city warn for the appropriate control and prevention methods.

Based on the above conclusion, the following recommendations were forwarded:-

- Periodic deworming of dogs against helminthes should be practiced strategically so as to halt further spread of the parasites.
- Awareness creation campaign should be conducted by all stakeholders regarding parasite zoonosis at Hawassa city in particular and in the country Ethiopia in general.
- The dog owners should be trained to avoid feeding their dogs condemned offal's; at least he has to cook properly.
- Owners should handle their dogs in clean and separate kennels/compartments.
- Dog's wastes should be disposed in inaccessible places both for animals and human beings.
- Further investigations should be conducted in order to render more detail information about gastrointestinal parasites of dogs in the study area, so as to put appropriate control and prevention measures in place.

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