

Prevalence of *Toxocara canis* on Private and Stray Dogs and Its Public Health Significance in Addis Ababa City, Ethiopia

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Abstract: To determine the prevalence of *Toxocara canis* on private and stray dogs, the examination of 368 fecal samples and 24 necropsies were conducted from February 2019 to December 2020 in Addis Ababa, Ethiopia. Human toxocarosis is a helmintho-zoonosis due to the migration of *T. canis* larvae which are infected by ingesting either eggs from the soil, dirty hands, raw vegetables, larvae from undercooked giblets. Among 275(70.15%) of the total prevalence of *T. canis*, fecal sample 256(69.56%) and on necropsy, 19(79.16%) of the dogs were found positive for one or more embryonated eggs, larva and adult parasites. The result obtained from fecal and necropsy examination revealed that the prevalence of *T. canis* in puppies, young and adult dogs were 33(58.33%), 164(75%) and 59(62.5%) and 9(90%), 6(71.95%) and 4(66.66%) respectively. Similarly, the prevalence from fecal and necropsy examination in male and female dogs were 175(70.00%) and 81(68.64%) and 11(78.57%) and 8(80.00%) respectively. In all the analyses, the prevalence of toxocarosis showed a statistically significant difference between the numbers of age groups ($P \leq 0.05$). However, all over the results, there was no statistically significant difference noted on both sexes ($P > 0.05$). During fecal sample collection, a semi-structured questionnaire was used to evaluate the different management practices given for dogs and owners' awareness about zoonotic *T. canis* parasites. From 180 households due to lack of awareness, only 55(14.94%) of the owners have awareness about the role of dogs in transmitting diseases to human beings. In conclusion, reducing this human toxocarosis can be addressed through the prevention of recontamination and sanitary education for all private owners' dogs and the community.

Key words: Addis Ababa • Dogs • Prevalence • *Toxocara canis* • Zoonotic

INTRODUCTION

Members of the genus *Toxocara* are zoonotic intestinal nematodes (roundworms) that mature in various mammals, including some domesticated species. Parasitism is the most encountered disease in dogs all over the world [1]. Regardless of the availability of effective medications to treat parasites, most parasites of dogs have highly evolved life cycles that make their elimination impossible. Besides, dogs are routinely infected with internal parasites, sometimes without apparent evidence of the infestation until it is too late. This means that a dog can have internal parasites even though the fecal sample is negative.

Toxocara canis parasite poses a 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 [2]. These signs are attributed to intestinal obstruction, irritation, maldigestion, malabsorption and protein-losing gastro-enteropathy induced by the parasites [3]. Severe cases could be fatal [4].

Moreover, since dogs live in close proximity with humans, there are zoonotic parasites that can be transmitted to humans and cause serious consequences. Human toxocarosis is one of the most common helminth infections in the world; with children living in poverty at the highest risk of infection. Parasitized dogs due to invasions of *Toxocara canis* can shed large numbers of eggs in the feces, the transmission could be through indirect contact with animal secretions and excretions, infected water and food and through direct contact with

the dogs [5], as well as this disease may also be important in adults who eat undercooked animal tissues containing larvae.

The prevalence of parasites especially *T. canis*, considerably varies from one region to another and among the different diagnostic techniques employed [6]. Considering aspects related to public and animal health, the study of the prevalence of parasitic infections in dogs should, therefore, be a continuous task, with the most relevant aim being the establishment of control measures [7]. However, in Ethiopia, very little attention was given to *T. canis* parasites of dogs and the works have been done so far on the prevalence of the *T. canis* and its public health significant [8-11].

Therefore, the present study is contemplated to;

- Estimate the prevalence of *T. canis* parasites on private and stray dogs in Addis Ababa, Ethiopia.
- To assess dog owners' awareness about zoonotic parasites.

MATERIALS AND METHODS

Study Area: Addis Ababa is the capital city and administrative center for the Federal Democratic Republic of Ethiopia (FDRE). Currently, there are 10 "Kifle-Ketemas" in Addis Ababa city administration delineated based on geographical setup, population density, asset and service providers' distribution and convenience for administration. Addis Ababa is situated at a latitude of 9°3'North and 38°43' east. It lies in the central highlands of Ethiopia at an altitude of 2500 m.a.s.l. It has an average rainfall of 1800 mm per annum. The annual average maximum and minimum temperature is 26°C and 11°C, respectively; with an overall average of 18.7°C. The highest temperatures are reached in May. The main rainy season extends from June to September. Addis Ababa has a relative humidity varying from 70% to 80% during the rainy season and 40% to 50% during the dry season. The human population is estimated at 6 million inhabitants.

Study Design and Eligibility Criteria: A cross-sectional study design was conducted from February 2019 to December 2020 to determine the prevalence of Toxocariasis in private owners and stray dogs. The population of studies was that dogs of all age groups were randomly selected for both sexes from confined (volunteer owner's dogs) and loose (stray) housing

systems when dogs were brought to the clinic mainly due to vaccination or treatment, especially for rabies diseases but, dogs never came for anthelmintic treatment. For simplicity, dogs up to 6 months of age were classified as puppies, from 6 months through one year of age were referred to as young dogs while adults were dogs above 1 year of age [12].

Sample Size Determination: The total number of pet dogs required for calculated based on the formula given by Thrusfield [13]. Since there was information about the prevalence of the parasites in Bahir-Dar, Ethiopia, 39.79% [14] expected prevalence was taken to calculate the sample size with a 95% confidence interval and 5% absolute precision. So, the calculated sample size was 368 for pet dogs but only 24 stray dogs were sampled without any calculation.

Sample Collection and Questionnaires Survey: A total of 368 faecal samples were collected directly from the rectum of each pet dog with the help of a finger and 24 faecal samples were collected from the ground immediately after voiding by stray dogs using plastic gloves, stored in the refrigerator and processed within 2-3 hours of collection at Addis Ababa Regional animal disease diagnosis and investigation center. During collection, each sample was labeled with the dog's number corresponding to the owner's name, date, age of dog, sex and place of collection. The samples were processed using direct smear, sedimentation and salt floatation technique as described by Urquhart *et al.* [15]. Identification and counting of parasites and nematode eggs were made according to the morphological characteristics and key as outlined by Soulsby [2].

In the present study, to assess management practices of dog and awareness about zoonotic of *T. canis* parasites, semi-structured questionnaires were administered to 180 dog owners who consented to be interviewed. The questionnaires were included information on reasons for keeping dog(s), the number of dogs kept, knowledge of zoonosis and dog management practices including deworming frequency, housing and feeding mode and veterinary care.

Statistical Analysis: Finally, the data obtained from direct microscopic observation, floatation and sedimentation techniques and pre-tested semi-structured questionnaire were analyzed by using Stata version 7.0 [13]. Prevalence was calculated by dividing the number of dogs harboring roundworms (*Toxocara*) parasites by the total dogs

examined. The chi-square (χ^2) test was used to assess the difference in the frequency of the roundworms (*T. canis*) between the sexes and age groups. In all the analyses, the confidence level was held at 95% and statistical analyses were considered significant at $P \leq 0.05$.

RESULTS

Fecal Examination: This study included 180 households with a total of 368 dogs whose owners were willing to cooperate. Fecal samples were collected per-rectum and using simple random sampling method, from 368 private owner's dogs and examined using gross observation of feces or direct microscopic examination, floatation and sedimentation techniques [17, 18] and the result was considered as positive when at least one parasite egg is present [19]. Maximum effort was made to characterize and classify the different eggs observed under 10X magnification to the level of genera or species [2, 20].

Necropsy Findings: Among stray dogs that were roaming in Addis Ababa especially Arada Sub City purposely killed with strychnine sulphate baits to control rabies randomly 24 dogs were selected and necropsically examined for the presence of adult *T. canis* parasites. The entire alimentary tract was removed and the different compartments (esophagus, stomach, small intestine, cecum and colon) were tightly ligated with gauze. The contents of the different compartments were scraped off, along with parts of the mucosa, using a spatula. The contents, collected in separate buckets, were passed through a series of graded screens (sieves) to remove fecal debris. Then the resulting sediments were placed in a separate universal bottle containing an equal amount of warm 10% formalin solution for further identification and classification [2, 21].

Overall Prevalence: This study included 180 households with a total of 368 dogs whose owners were willing to cooperate and 24 stray dogs (homeless). Using this opportunity, overall, the prevalence of *T. canis* was 70%. Based on the examination, overall, the prevalence of fecal sample 86(68.25%) and on necropsy, 19(79.16%) of the dogs were found positive for one or more embryonated eggs, larva and adult of *Toxocara* parasites. The result obtained from fecal and necropsy examination revealed that the prevalence of *T. canis* in puppies, young and adult dogs were 7(58.33%), 59(75%) and 20(62.5%) and 9(90%), 6(71.95%) and 4(66.66%) respectively (Table 3).

Similarly, the prevalence of *T. canis* from fecal and necropsy examination in male and female were 60(69%) and 26(71.42%) and 11(72.13%) and 8(72.41%) respectively (Table 2). The necropsy and fecal examination further indicated a statistically significant difference ($P \leq 0.05$) in the overall prevalence of *T. canis* observed between three age groups of dogs (Table 3). However, there was no significant difference in the overall and respective prevalence of *T. canis* parasites as observed among sexes of dogs (Table 2).

Management Practice and Awareness of Dog Owners: during fecal sample collection, a semi-structured questionnaire was used to evaluate the different management practices given for dogs and owners' awareness about zoonotic of *T. canis* parasites.

According to respondents (180 households), a total of 368 dogs 79 of them (21.46%) dogs were keeping as companionship with dog owner's indoor system whereas, 120 (32.62%) dogs were kept separately incarcerated with zinc plated steel chain or any ropes outdoor system. For simplicity, indoor and outdoor system dogs were kept without a separate house or kennel (homeless but not stray dogs). Based on respondents, the rest of 169(45.92%) dogs were kept in a separate house or kennel. Among 180 respondents' dogs with a separate house or kennel were found only in 36 households (53.9%) of which only 85.1% of the kennels or dog houses were cleaned before kept the dogs. None of the individuals cleaning the kennels were taking the necessary precautions. Out of 180 households, 51(31%) of the households disposed of dogs' ($n = 41$) feces in their toilets. On the other hand, the remaining dogs ($n = 327$) are confined within their home or compound during the day, the dogs were released during evening time and hence shade their feces everywhere.

Regarding dogs feeding practice of the area, among 180 respondents' 318(86.41 %) of dogs were only feed given a raw animal product whereas, 50(13.59%) there was a tendency of cooking animal products intentionally to feed dogs.

Finally, among 180 respondents only 55(14.94%) of the owners in the area have awareness of the role of dogs in transmitting diseases to human beings. Unfortunately, the awareness was only for rabies; none of them had awareness of *T. canis* (zoonotic) parasites. According to the respondents, the main reason that deters them from using the treatment for dogs was a lack of awareness about the availability of drugs and the possibility of treating dogs with anthelmintics.

Table 1: A total prevalence of *Toxocara canis* parasites by sexes and age groups in dogs

Sex	Age group			Examined	Positive (%)
	Puppies (n=58)	Young (n=235)	Adult (n=99)		
Male (n=264)	29 (50%)	115 (49%)	42 (42.42%)	264	186(70.45)
Female (n=128)	13 (22.41%)	55 (23.40%)	21 (21.21%)	128	89(69.53)
Total (n=392)	42 (72.41%)	170 (72.34%)	63 (63.63%)	392	275(70.15)

Table 2: Prevalence of *Toxocara canis* parasites by sex of dogs based on necropsied and fecal examination

Types of Examination	Sex		P-value	χ^2 -value
	Male (n=264)	Female (n=128)		
Fecal (n=368)	175 (70.00%)	81 (68.64%)	0.89	30.1678
Necropsy (n=24)	11 (78.57%)	8 (80.00%)	0.74	27.7921
Total (n=392)	186 (70.45%)		89 (69.53%)	

Table 3: Prevalence of *Toxocara canis* parasites by age group of dogs based on necropsied and fecal examination

Types of Examination	Age group			P-value	χ^2 -value
	Puppies	Young	Adult		
Fecal (n=368)	33 (58.33%)	164 (75%)	59 (62.5%)	0.043	3.843
Necropsy (n=24)	9 (90.00%)	6 (71.95%)	4 (66.66%)	0.029	1.825
Total (n=392)	42 (72.72%)	170 (72.7%)	63 (63.16%)		

Toxocariasis/larva migrants occur in humans acting as paratenic hosts for migrating larvae. *Toxocara* is generally thought to be incapable of maturing to adult nematodes in humans. Although there are rare reports of intestinal infections with adult *T. canis* and *T. cati*, the accuracy of some of these diagnoses has been questioned. Some cases were later identified as immature *Ascaris* worms rather than *Toxocara* and others may have resulted when young children ingested whole worms that had been expelled by pets.

DISCUSSION

The results of the present study illustrate that the disease Toxocariasis is still prevalent in Addis Ababa on Private owners and stray dogs with a prevalence rate of 70.15% (275/392).

Dissection of 24 stray dogs in the Addis Ababa region showed that 19(79.16%) of them were infected with *T. canis*. The result was approximately agreement studies with Komatangi [22], Minnaar *et al.* [23], Dada *et al.* [24] and Anene *et al.* [25] who reported prevalence of 88.5%, 76%, 97.8% and 68.5%, respectively. Previous studies in homeless dogs conducted in Ethiopia also showed a higher level of infection in homeless dogs, which is 98.36% and 95% with Shimelis [10] and Hailu *et al.* [26] and 100% Reshid [8] and Samuel [9]. The difference in the

prevalence between our study and these authors could be attributed to geographical areas, health care and animal management practices followed.

The prevalence of *T. canis* in the fecal examination was found higher in the present study 69.56% (256/368) compared with similar studies carried out in [10, 23, 25, 27, 28, 29] the higher prevalence observed in the present study which may be partly explained by a large number of dogs sampled, health care and animal management practice.

In the present study, both fecal and necropsy examination was observed that there was a statistically significant difference ($p \leq 0.05$) in the prevalence of Toxocariasis among the three different age groups examined (puppies, young and adult). This result was agreed with Endrias [29] in Ethiopia.

On the other hand, compared to fully indoor kept dogs, the free-roaming nature of dogs in our study might have exposed them to widespread natural infection. Moreover, it is difficult to monitor and implement parasitic disease control measures like regular deworming in such a group of dogs. Although the exact role of the dog in the transmission of parasites to humans in the study area has not been determined [30] they may have serious public health implications by acting as an important source of infection. All of the respondents have not ever come across any *T. canis* parasites in their

dogs and this may be attributed to the loose type of dog keeping practice in the area or due to the lack of awareness on the clinical manifestations and morphology of the common intestinal parasites of dogs. This type of study is varied from one country to another depending on the distribution of veterinary hospitals, the monthly examination of the owner of dogs and dog's treatments.

CONCLUSION

Controlling *Toxocara* infection in dogs will reduce the number of infectious eggs in the environment and reduce the risk of infection for people. Have your veterinarian treat your dogs, especially young animals, regularly for worms. This is especially important if your pets spend time outdoors and may become infected again. Considering the high prevalence of this zoonotic parasite and its hygienic significance in causing human toxocariasis, particularly in children, plus the lack of control of stray dog populations, there is a need to improve personal and food hygiene as well controlling stray dogs in these urban areas.

ACKNOWLEDGEMENT

I would like to extend my gratitude to the City of Addis Ababa, especially Arada Sub City Administration Urban-Agriculture Development Office and Addis Ababa University for the grant release for this project, Addis-Ababa Regional Animal health laboratory Center (Sholla) for the collaboration and diagnosed sample until finished the project and private owners' dogs and community, for willing to cooperate.

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