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Prevalence and Worm Burdens of Gastro-Intestinal Parasites in Stray Dogs of Mekelle City, Tigray, Ethiopia

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Abstract: Stray dogs (*Canisfamiliaris*) are ownerless native dogs of mostly non descriptive nature which roam freely without human supervision and gastrointestinal parasites are common pathogens in these dogs and some are reservoirs of parasitic infections of humans. A study on gastrointestinal parasites of free roaming dogs was conducted from November 2009 to April 2010 with the objective of determining the prevalence and intensity of GI parasites of stray dogs and documenting the helminth biodiversity of stray dogs so as to provide baseline information on GIparasites infection of stray dogs on a local scale in Mekelle city. A total of 11 stray dogs were captured and euthanized. Necropsy finding was done and the contents of their alimentary canal were inspected. Statistical tests were performed using SPSS 15.0 windows version. The necropsy finding revealed that 72.72% free roaming dogs were found to be harbor*cestodes*, *nematodes* and mixed infections. Five species of *cestodes a*nd two species of *nematodes* were found to be adult worms in their respective hosts. The highest parasite burdens (72.72%) were found for *S. lupi* and *D. caninum* and the lowest parasite burden was recorded for *T. serrata* (9.1%). The sex of the euthanized dogs had a significant difference in the prevalence of GI helminthes in the two sexes ($p<0.05$). Female dogs (100%) were found to be more likely infected by gastrointestinal helminthes than male dogs (62.5%). From the whole gastrointestinal parasites, the highest and lowest mean worm burdens were seen for *S. lupi* (9.13) and *T. serrata* (1), respectively. Of these reported parasites some of them have public health importance but dogs harbouring the parasites are living freely and friendly with the public. Hence, there should be a practice of regularand appropriate stray dogs control and health management of owned dogs. In addition, further epidemiological studies should be conducted to investigate the rate of seasonal infection and the level of environmental contamination.

Key words: Gastrointestinal Parasites · Mekelle City · Necropsy Finding · Prevalence · Stray Dogs

INTRODUCTION

The dog (*Canisfamiliaris*) is a domestic animal that maintains close contact with humans and other animals, such that any lack of diagnosis or treatment against certain diseases favours the transmission of zoonotic diseases [1, 2]. Stray dogs are ownerless native dogs of mostly non descriptive nature which roam freely without human supervision [3]. Gastrointestinal (GI) parasites are common pathogens in stray dogs and some are reservoirs of parasitic infections of humans, particularly in urban areas and especially in informal urban areas. Some of the important zoonotic diseases include visceral larva migrants due to *Toxocaracanis,* cutaneous larva migrants caused by *Ancylostoma caninum* and *A. braziliensis,* giardiosis, cryptosporidiosis and echinococcosis [4].

Several species of internal parasites in dogs segregate their gastrointestinal habitat [5]. In low-income settings, treatments to eliminate these parasites are, if done at all often apply in advanced stages of disease, causing distress on pets and their owners [6, 7]. A number of surveys have been conducted on the prevalence and mortality from internal parasites of dogs and these studies have mainly been conducted in the developed countries especially in North America. The most frequently

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observed parasites include *hookworms*, *whipworms*, *ascarids*, *coccidia*, *tapeworms* and *heartworms* [8, 9]. 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 [10]. The distribution and intensity of parasitism in dogs are influenced by geographical, climatic, cultural and economic factors [11]. Furthermore, the level of hygienic conditions, lack of veterinary supervision and less awareness concerning zoonotic diseases exacerbate the transmission of these diseases [12].

Currently, information on the distribution, prevalence and parasitic burden of GI parasites of urban stray dogs is lacking in Ethiopia and has never been investigated on Tigray regional state even though very few studies have been completed on gastrointestinal helminthes in dogs especially in the central part of the country. Therefore, the current study was undertaken to determine the prevalence and intensity of GI parasites and to document the helminth biodiversity of stray dogs so as to provide baseline information on GI parasite infection of stray dogs on a local scale in Mekelle city.

MATERIALS AND METHODS

Study Area: The study was conducted from November 2009 to April 2010 in Mekelle city. Mekelle is the capital city of Tigray regional state which is located in the Northern part of Ethiopia, 783 km far from Addis Ababa (Figure 1). In general the region is bordered by Eritrea in the North, Sudan in Western part of the region, Afar and Amhara regions in Eastern and Southern part of the region respectively. Tigray region is located at 12°13' to14° 54' N and 36° 27' to 44° 18' E latitude with an elevation of 2084 meters above sea level, at which Mekelle is located at 39° 29' E and 13° 3' N of longitudes having an annual average temperature of 21°C and also experiences an annual rain fall of 600 mm mostly during the summer season. The population of the city led their livelihood some by trading and some are civil servants and with other minor house hold activities [13].

Study Design and Sample Collection: A cross-sectional study was conducted from November 2009 to April 2010 to determine the prevalence and intensity of GI parasites of stray dogs and to document the helminth biodiversity of euthanized stray dogs. For this, free roaming dogs of all age groups (puppy, young and adult) and both sexes (female and male) that were found in the study area were included.

Necropsy Finding and Parasite Identification: Free roaming dogs gathering around the Mekelle University students' cafeteria were euthanized using a meat embedded with strychnine as lethal bait. The euthanized dogs were transported toVeterinary Pathologyand Parasitology Laboratory of College of Veterinary Medicine, Mekelle University forthe laboratorial works. The different parts of the entire alimentary tract (oesophagus, stomach, small and large intestines) were tightly ligated with gauze and removed and their contents were taken in separate buckets and were passed through a series of graded screens (sieves) to remove faecal debris. They were washed separately and washings were collected for further parasitological examination as followed by Matthee *et al*. [14].

Parasites were recovered in a hot 0.85% NaCl solution. Olympus stereomicroscope was used to evaluated and quantified worm burdens. Worm counts were performed for all washings. *Nematode* specimens were fixed in warm ethanol (70%) (v/v) and worms were then be dehydrated in an ethanol series (70%-95%) and stored in 70% of ethanol containing 5% glycerol before being cleared in lactophenol and identified to species according to Skrjabin*et al*. [15]. For tapeworms, the specimens were fixed in ethanol (70%) (v/v) stained with carmine, differentiated in acid alcohol, cleared in xylene, mounted in canada balsam and identified morphologically to species according to descriptions of Schmidt [16]. Parasites were examined in a bright field Olympus microscope and micrographs were obtained using a camera fixed compound microscope. Parasite genera and species identifications were performed using the keys for helminth identification as described by Urquhart *et al*. [5] and Schnur's staining technique explained by Bayou [17].

Statistical Analysis: Statistical tests were performed using SPSS 15.0 windows version (SPSS Inc, Chicago, Illinois, USA). Chi-squared test was used to look the relationship between parasite prevalence with the host sex and significant correlations were declared by p-value and manually for the post mortem recovered parasites in which different indicators were used to evaluate epidemiological matters as well as the parasites communities' structure.

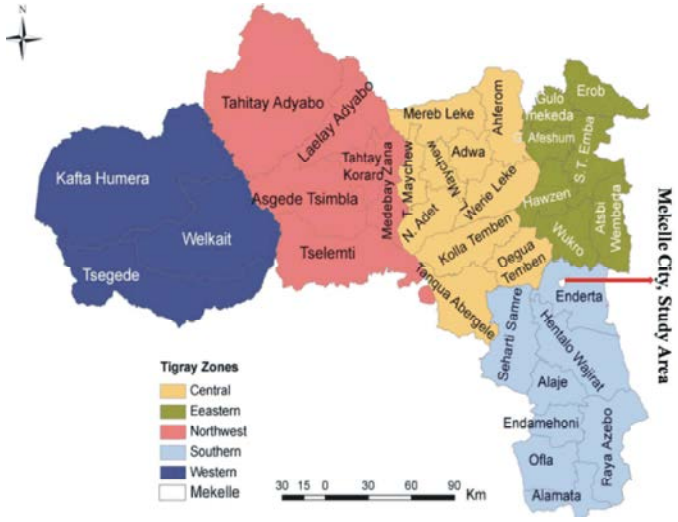

Fig. 1: Map of Tigray National regional State and Study areas

For each sample, calculation was done for the percentage of infected dogs. The prevalence of dogs parasitized (number of hosts infected with one or more individuals of a particular parasite species divided by the number of examined hosts, [18] were analysed using descriptive statistics. Variables such as, abundance, intensity and diversity were handled similarly.Parasites were isolated and grouped according to methods previously described based on the value of the 'Importance Index, I' [19,20]. The Importance index was calculated as followed:

$$I_j = (A_j \times B_j / A_i \times B_i) \times 100$$

where,

A^j = Number of parasite for species j;
B^j = Number of hostinfected with species j;
A^i = Total number of parasite observed and
B^i = Totalnumber of infected hosts with any parasite species.

Species with an importance index higher than 1 was considered dominant, species with an importance index between 0.01-1 were considered co-dominant and species with an importance index less than 0.01 were considered as subordinate. For each *nematode* species, the intensity of the infection (total number of nematodes observed from the same species divided by the number of infected samples with these species), the abundance (total number of *nematodes* from the same species divided by the total number samples) and its prevalence as described by Margolis *et al*. [21] and Torina *et al*. [20].

RESULTS

Out of the total11 dogs, whose gastrointestinal tracts collected and examined, 72.72% were found to be harbor*cestodes*, *nematodes* and mixed infections. Five species of *cestodes a*nd two species of *nematodes* were found to be adult worms in their respective hosts. Species-specific overall prevalence of gastrointestinal parasitesrevealed thatthe highest parasite burdens (72.72%) were found for *S. lupi* and *D. caninum* and the lowest parasite burden was recorded for *T. serrata* (9.1%) (Table 1).

Table 1: The overall burden of GIparasites recovered from euthanized dogs

Parasites Spp.	No. of Infected Dogs	Percentage of Infected Dogs
Cestodes		
T. hydatigenia	7	63.63
D. caninum	8	72.72
T. ovis	6	54.54
T. multicepes	6	54.54
M. lineatus	3	27.27
Nematodes		
S. lupi	8	72.72
T. serrata	1	9.1

Table 2: Burden of adult GI parasites in relation to sex of euthanized dogs

Sex	Examined Dogs	Infected Dogs (%)	Relative Risk Factor
Female	3	3(100)	1.6
Male	8	5(62.5)	
Total	11	8(72.72)	

Table 3: Intensity of GI parasites in the euthanized dogs

Parasite Spp.	No. of Infected Dogs	Total Worms	Mean Worm Burden	Total Worms Recovered (%)
T. hydatigenia	7	28	4	16.28
D. caninum	8	30	3.75	17.44
T. ovis	6	17	2.83	9.9
T. multicepes	6	13	2.16	7.56
M. lineatus	3	10	3.33	5.8
S. lupi	8	73	9.13	42.44
T. serrata	1	1	1	0.6

The sex of the euthanized dogs had a significant difference in the prevalence of gastrointestinal helminthes in the two sexes ($p<0.05$). Female dogs (100%) were found to be more likely infected by gastrointestinal helminthes than male dogs (62.5%) and the relative risk factor calculated to be 1.6 (Table 2).

From the whole gastrointestinal parasites, the highest mean worm burden was seen for *S. lupi* (9.13) but the lowest gastrointestinal parasite intensity was recorded for *T. serrata* (1). In addition, *S. lupi*, *D. Caninum* and *T. hydatigenia* were accounted 42.44%, 17.44% and 16.28%, respectively, while the individual prevalence of *T. ovis*, *T. multicepes*, *M. lineatus,*and *T. Serrata*were found to be 9.9%, 7.56%, 5.8% and 0.6%, respectively, out of the total worms recovered from euthanized dogs during the study period (Table 3).

DISCUSSION

The present necropsy and parasitological finding revealed that 72.72% were found to be harbor*cestodes*, *nematodes* and mixed infections. Five species of *cestodes* and two species of *nematodes* were found to be adult worms in their respective hosts. Generally, from the result, cestodal infections were higher than the nematodal infection. This might be related to the culture of the society/owners to feed their pets' raw meat and the ever thrown offals carelessly any whereanywhere if they were found unsuitable to be consumed. Species-specific overall prevalence of gastrointestinal parasitesrevealed thatthe highest parasite burdens (72.72%) were found for *S. lupi* and *D. caninum* and the lowest parasite burden was recorded for *T. serrata* (9.1%).

The current overall prevalence of gastrointestinal parasite is in accord with the previouscoprological studies done by Zelalem and Mekonnen[22]in Bahir Dar Town, Ethiopia (78.1%) [23] in Ilam province of Iran (78.57%) [24] in Cordoba, Spain (71%) and Minnaar *et al*. [25] in free State Province, South Africa (76%). But it is lower than thenecropsy and/or coprologica lfindings of Endrias, Yohannes and Berhanu [26] in Ambo town, Central Ethiopia (86.54%) [27] in Wondo Genet, Southern Ethiopia (100%) [28] in Chittagong Metropolitan, Bangladesh (95%) [29] in Hawassa Town, Ethiopia (86.8%), [30] in Bahir Dar town, North-western Ethiopia (84.78%) [31] in Hawassacity, Ethiopia (84.6%) [32] in Hawassa, Southern Ethiopia (89.3%) [33] Dschang, Cameroon (88.5%), [34] in the Rabat region, Morocco (100%) [35] in Argentina (89.13%) [36] in North-east Gabon (94.1%) [37] in Kaduna State, Nigeria (93.8%) [38] in Karachi, Sindh (86.0%) [39] in Durban and Coast, South Africa (82.5%) and Tarish *et al.* [40] in the Baghdad area, Iraq (100%). However, it is higher than the necropsy and/or coprological findings of the studies carried out by Guesh *et al*. [41] in Mekelle city, Ethiopia (30.5%) [42] in Mekellecity, Ethiopia (33.0%) [43] in Debre Zeit, Ethiopia (51%) [44] in Gondar, Ethiopia (14.7%) [45] in and around Arusha Municipality, Tanzania (59.3%), [46] in Ponte de Lima, Portugal (63.17%)[47]in Mar del Plata city, Argentina (41.25%) [48] in Bhubaneswar, Odisha, India (41.56%) [49] in Western Pomerania, Poland (34.84%) [50] in Lahore, Pakistan (37%) [51] in Nagpur city (66.2%) [52] Sa˜o Paulo State, Brazil (54.3%). The possible reasons for the wide range of differences among the gastrointestinal parasites' prevalence might be the factors like geographical location, the presence or absence of the intermediate hosts of the corresponding parasites, status of animal ownership, sampling protocols, demographic factors, anthelmintic usage and diagnostic techniques which were also given as the possible justifications by Mundim *et al*. [53] and Katagiri and Oliveira-sequeira [52]. The difference in the prevalence between our study and these authors could be attributed to geographical areas and/or health care and animal management practice followed. 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 group of dogs. Although the exact role of dog in the transmission of parasites to humans in the study area has not been clearly determined [1] they may have serious public health implication by acting as important source of infection.

The sex of the euthanized dogs had a significant difference in the prevalence of gastrointestinal helminthes in the two sexes ($p<0.05$). Female dogs (100%) were found to be more likely infected by gastrointestinal helminthes than male dogs (62.5%) and the relative risk factor calculated to be 1.6. This might be related to the difference in the number of examined dogs of both sexes. This is in agreement with the reports of Endrias, Yohannes and Berhanu [26] in Ambo town, Central Ethiopia and Shubhagata *et al*. [28] in Chittagong Metropolitan, Bangladesh.

From the whole gastrointestinal parasites, the highest mean worm burden was seen for *S. lupi* (9.13) but the lowest gastrointestinal parasite intensity was recorded for *T. serrata* (1). In addition, *S. lupi*, *D. Caninum* and *T. hydatigenia* were accounted 42.44%, 17.44% and 16.28%, respectively, while the individual prevalence of *T. ovis*, *T. multicepes*, *M. lineatus,* and *T. Serrata*were found to be 9.9%, 7.56%, 5.8% and 0.6%, respectively, out of the total worms recovered from euthanized dogs during the study period.

CONCLUSION AND RECOMMENDATIONS

The current study revealed that a high prevalence of different gastrointestinal parasites of stray dogs of Mekelle city which suggested that stray dogs are more prone to various helminth infections as they feed on rubbish bins and due to lack of health management. In addition, the high abundance of enteric parasites is probably directly related to high density of stray dogs. Concurrent infections with two or more parasite species were more common. The sex of the euthanized dogs had a significant difference in the prevalence of gastrointestinal helminthes in the two sexes. Some of these reported parasites have public health importance but dogs harbouring the parasites are living freely and friendly with the public and have a contact with owned dogs and serve as a source of infection for both human beings and owned dogs. Hence, there should be a practice of regular and appropriate stray dog control and health management of owned dogs. In addition, further epidemiological studies should be conducted to investigate the rate of seasonal infection and the level of environmental contamination.

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