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PREVALENCE OF *TOXOCARA CANIS* AND ASSESSMENT OF KNOWLEDGE, ATTITUDE, AND PRACTICES OF THE COMMUNITY IN BISHOFTU TOWN, CENTRAL ETHIOPIA

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Abstract

A cross-sectional study was conducted in order to determine the prevalence of *Toxocara canis*, potential risk factors, and knowledge, attitude, and practices in Bishoftu, central Ethiopia. Fecal samples were taken from 300 randomly selected dogs of different sex, age group, breeds, and diarrheal status. The samples were processed using a flotation technique to detect the eggs of *Toxocara canis.* The current result revealed an overall prevalence of 32.33% (95% CI: 27.07 - 37.95) of *Toxocara canis*. The prevalence of the disease was 30.30% (95% CI: 22.61 - 38.90), 31.06% (95% CI: 23.30 - 39.70), and 44.44% (95% CI: 27.94 - 61.90) in young, adult and older dogs, respectively. The prevalence of *Toxocara canis* was 32.43% (95% CI: 26.77 - 38.50) and 31.71% (95% CI: 18.08 - 48.09) in female and male dogs, respectively. The present findings indicated that there were statistically significant links between the prevalence of *Toxocara canis* regarding dog breeds and diarrheal status ($p < 0.05$). The prevalence was higher in German Shepherd breed dogs (56.52%; 95% CI: 34.49 - 76.81) than in local dog breeds (30.32%; 95% CI: 24.97 - 36.11). The prevalence of the disease was higher in diarrheic dogs (46.48%; 95% CI: 34.55 - 58.71) than in non-diarrheic dogs (27.95%; 95% CI: 22.24 - 34.24). The knowledge, attitude, and practice assessment in the present study indicated poor dog management practices and insufficient public awareness. Most dog owners (56.7%; 95% CI: 50.85 - 62.35) did not deworm their dogs regularly, while 90.67% (95% CI: 86.79 - 93.71) fed dogs raw animal products. The present finding indicated that most respondents were not aware of zoonotic canine parasites (83.7%;

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95% CI: 81.18 - 89.43) and toxocariasis (80.7%; 95% CI: 75.74 - 84.98). This study demonstrates a higher prevalence of *Toxocara canis* and lower public awareness about the disease. Therefore, this study recommends strategic deworming of dogs, better dog management, and increased public awareness in order to control the impact of the disease on animal and human health.

Key words: Attitude, Bishoftu, Dog, KAP, Prevalence, *Toxocara canis,* Zoonosis

PREVALENCIJA *TOKSOCARA CANIS* I PROCENA ZNANJA, STAVA I PRAKSE ZAJEDNICE U GRADU BISHOFTU, CENTRALNA ETIOPIJA

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Kratak sadržaj

U Bišoftu, centralna Etiopija, izvršena je studija preseka sa ciljem da se odredi rasprostranjenost *Toxocara canis*, potencijalni faktori rizika, kao i da se utvrdi kakav je stav javnosti, praksa držanja pasa i stepen informisanosti kada je u pitanju ovaj parazit. Uzeti su uzorci fecesa od 300 nasumično izabranih pasa različitog pola, starosti, rase i učestalosti pojave dijareje. Ovi uzorci su obrađeni putem tehnike flotacije kako bi se detektovala jajašca *Toxocara canis.* Dobijeni rezultat je pokazao prevalenciju od 32.33% (95% CI: 27.07 - 37.95) *Toxocara canis*. Prevalencija je bila: 30.30% (95% CI: 22.61 - 38.90) kod mladih, 31.06% (95% CI: 23.30 - 39.70) kod odraslih i 44.44% (95% CI: 27.94 - 61.90) kod starijih pasa. Prevalencija *Toxocara canis* je bila 32.43% (95% CI: 26.77 - 38.50) kod pasa ženskog pola i 31.71% (95% CI: 18.08 - 48.09) kod pasa muškog pola. Dobijeni rezultati pokazuju da je bilo značajnih statističkih razlika između prevalencije *Toxocara canis* kada je u pitanju rasa pasa i učestalost pojave dijareje ($p < 0.05$). Prevalencija je bila veća kod nemačkog ovčara (56.52%; 95% CI: 34.49 - 76.81) nego kod lokalnih rasa pasa (30.32%; 95% CI: 24.97 - 36.11). Rasprostranjenost ove bolesti bila je veća i kod pasa sa dijarejom (46.48%; 95% CI: 34.55 - 58.71) nego kod pasa koji nisu imali dijareju (27.95%; 95% CI: 22.24 - 34.24). Kada su

u pitanju informisanost, stav i praksa držanja pasa, ova studija je pokazala da je način držanja pasa neadekvatan i da javnost nije dovoljno informisana o ovom parazitu. Većina vlasnika (56.7%; 95% CI: 50.85 - 62.35) ne vrši redovno čišćenje pasa od parazita, dok 90.67% (95% CI: 86.79 - 93.71) hrani pse sirovim namirnicama životinjskog porekla. Studija pokazuje i da većina ispitanika nije čula za zoonotske parazite kod pasa (83.7%; 95% CI: 81.18 - 89.43) i toksokariozu (80.7%; 95% CI: 75.74 - 84.98). Studija pokazuje visoku prevalenciju *Toxocara canis* kao i nedovoljnu informisanost javnosti o ovoj bolesti. Stoga se preporučuje čišćenje pasa od parazita, bolji uslovi držanja pasa kao i podizanje svesti javnosti o ovom problemu kako bi se kontrolisao uticaj bolesti na zdravlje životinja i ljudi.

Ključne reči: stav, Bišoftu, pas, informisanost, stav i praksa, prevalencija, *Toxocara canis*, zoonoze

INTRODUCTION

Pet animals play a significant role in society worldwide. They are important companions, contributing to the physical, social, and emotional well-being of their owners, especially children. It has been reported that pet owners visit their doctor less often, use fewer medications, and have lower blood pressure and cholesterol levels than non-pet owners (Martins et al., 2023). Dogs are the most sociable canids, adapted to human habitation worldwide. Although they offer significant benefits to many people, dogs can be a potential public health risk, since natural transmission of parasitic infections from dogs to humans may occur, either directly or indirectly through environmental factors (Robertson et al., 2000). Dogs are definitive hosts for several enteric parasites with zoonotic importance, among which *Toxocara canis* is the one that is regarded as the most common (Khante et al., 2009; Soriano et al., 2010).

Toxocariasis is a zoonotic disease caused by the larval stage of *Toxocara canis* (*T. canis*) which is the common roundworm living in the intestines of almost all animal species and humans. It is also found in a larval form in the tissues of all these animals (Despommier, 2003). It is a cosmopolitan parasite of canines and the major agent of human toxocariasis causing serious health problems in many countries (Fan et al., 2003). Epidemiological studies indicated that the prevalence of *T. canis* infection was 9.5% in Brazil (Mundim et al., 2001), 3.1% in North Central Colorado, USA (Hackett and Lappin, 2003), 8.5% in the Netherlands (Nobel et al., 2004), and 21% in central Ethiopia (Yacob et al., 2007). Mature *T. canis* nematodes live in dogs' intestines (the

definitive hosts) and produce large numbers of unembryonated eggs that are excreted in the feces. It is a potential source of environmental contamination posing a high risk of infection for healthy dogs and people (Fahrion et al., 2008). These eggs are not immediately infectious; they develop to the infective stage (third-stage larvae) in the environment. Survival and development are affected by both temperature and exposure to moisture. Although many eggs may no longer be viable after 6 months, some can survive in the soil for a year or more (Himsworth et al., 2010).

Dogs can become infected by ingesting embryonated eggs from the environment, through the transplacental route in the uterus, larvae in their dam's milk, or the tissue of paratenic hosts. Humans get infected by ingestion of embryonated eggs either from the soil, dirty hands, raw fruits and vegetables, or larvae from undercooked meat of paratenic hosts. *T. canis* infection in humans can cause symptoms related to the internal organs (visceral larva migrans), eye (ocular larva migrans), or brain (cerebral larva migrans) due to larva migration (Despommier, 2003). Currently, there is an increase in the dog population in both urban and rural settlements in developing countries due to the use of dogs for security, hunting, and other recreational activities (Ceballos et al., 2014). Even though some dogs are looked after adequately, many communities still have large populations of stray domestic dogs without control and with little or no access to veterinary care. The increase in the freely roaming dog population leads to environmental contamination with dog faeces, which is a potential risk for dogs and public health due to the possibility of transmission of zoonotic parasites (Chomel and Ben, 2011).

T. canis is a highly prevalent disease in Ethiopia, with both animal and public health implications (Dubie et al., 2023; Yacob et al., 2007). However, epidemiology of the disease and the awareness of the public are inadequately comprehended in Bishoftu, central Ethiopia. Studies that generate basic information on the level of disease, environmental contamination by parasitic eggs, and human awareness are prerequisites and have significant roles in the effective prevention and control of *T. canis*. Moreover, understanding communities' perceptions towards dog husbandry, contact with pets, and knowledge about zoonotic disease are important steps towards the development and implementation of appropriate disease prevention and control strategies. Therefore, the objectives of this study were to determine the prevalence of *T. canis* infection in dogs, identify putative risk factors, and to assess the communities' knowledge, attitude, and practices regarding dog management practices, zoonotic canine parasitic diseases, and their public health implications in Bishoftu, central Ethiopia.

MATERIAL AND METHODS

Description of the study area

The study was conducted in Bishoftu, a town in central Ethiopia located in Oromia National Regional State, East Shewa Zone, located 47 kilometers southeast of Addis Ababa (Figure 1) at latitude and longitude of 8˚35'N and 40˚E with an elevation 1860 meters above sea level. It is the administrative center of Ade'a woreda. It experiences bimodal patterns of Rainfall with the main rainy season extending from June to September with an average rainfall of about 880 mm. The mean annual minimum and maximum temperatures are 12.3 °C and 27.7 °*C*, respectively with an average of 20 °*C*. The mean relative humidity is 61.3% (Yemenu and Chemeda, 2010).

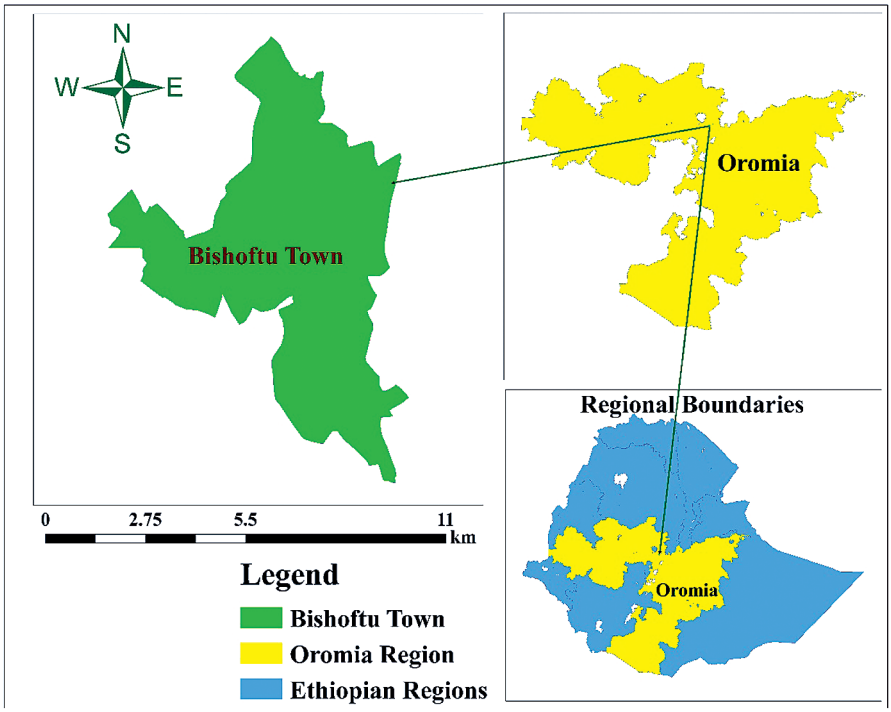

Figure 1: Map of Bishoftu town in central Ethiopia

Study design

A cross-sectional study was conducted in order to determine the prevalence of *T. canis* infection in dogs and assessment of knowledge, attitude, and practice of the community in the study area through the processing of fecal samples that were collected from randomly selected houses and a questionnaire survey.

Study Animals

The dog populations in the selected households of Bishoftu town were used as the study animals. Furthermore, interviews were conducted with dog owners to gauge their knowledge, attitudes, and perceptions regarding disease prevention and control strategies, as well as the zoonotic significance within the community. During the sampling period, health care, feeding and watering practice, dog handling, hygienic conditions, contact between people and dogs and other related information was recorded using a semi-structured questionnaire.

Sampling method and sample size determination

Simple random sampling method was the sampling technique used to select dogs for sampling of feces and the sample size included all dogs in randomly selected houses. The sample size was determined using the formula given by Thrusfield (2005), with a level of confidence of 95% and absolute precision of 5%. For the sample size determination, prevalence of 21% was used according to the study conducted by (Yacob et al., 2007) in the study area. Therefore, the required sample number was 255. However, the study was conducted on 300 dogs, with the aim to increase the accuracy of the result.

Sample collection

Fresh fecal samples weighing about 20 g were collected from each dog's rectum using disposable examination gloves. The samples were put in a separate plastic container and the sampling containers were labeled with the necessary information (breed, sex and age, fecal consistency). The samples were then transferred to an ice box, and immediately taken to Addis Ababa University College of Veterinary Medicine Parasitology Laboratory for processing.

Laboratory Diagnosis

Coprological examination for the detection of *T. canis* eggs was performed using simple floatation techniques. The flotation fluid was prepared by taking 400 g of sodium chloride (NaCl) into to1000 mL of tap water and stirring to dissolve the salt crystals (Awoke et al., 2011). About 3 gm of the fecal sample was placed into a mortar and crushed, then diluted with 45 mL flotation solution. The sample was then filtered into a beaker using a sieve, then the filtrate was poured into a clean test tube and after that a cover slip was placed on the filled test tube and left to stand for 20 minutes. The cover slip was later transferred onto a glass slide and examined under a microscope for separation of *T. canis* eggs in the sample based on their morphological characteristics according to Hendrix and Sirois (2007) and Kim et al. (2020).

Questionnaire survey for KAP assessment

Dog owners were interviewed about the knowledge, attitude, and practices of the community when it comes to disease prevention and control strategies and their zoonotic importance. During the sampling period, health care, feeding and watering practices, dog handling, hygienic conditions, contact between people and dogs and other related information was recorded using a semi-structured questionnaire.

Data management and analysis

The data collected from the field and parasitological investigations were entered into a Microsoft Excel spreadsheet. The imported data included the results of the questionnaire survey, putative risk factors, and the laboratory results of the disease status. The data was then checked and coded properly. The data was analyzed using STATA statistical software (Stata-SE version 14), and the results were presented in tabulated and frequency distribution tables. Descriptive statistics were used to summarize the KAP survey. The chi-square test was used to determine the association between presumed risk factors and the prevalence of *T. canis* infection. The potential factors were considered statistically significant factors of *T. canis* when the p-value was lower than 0.05 at a 95% CI.

RESULTS

Prevalence of Toxocara canis and associated risk factors

A total of 300 dogs (259 males and 41 females) were examined. Out of these, 97 dogs were found positive for *Toxocara canis*. The overall prevalence of *T. canis* in those dogs was found to be 32.3% (95% CI: 27.07 - 37.95). The current finding revealed that old dogs were more affected with *T. canis* than other age groups (Table 1). Out of the 36 examined old dogs, 16 dogs (44.4%) were infected with *T. canis,* whereas from the 132 young and 132 adult dogs 40 (30.3%) and 41 (31.1%) dogs were infected with *T. canis,* respectively.

Table 1. The prevalence of *T. canis* among dogs with different age categories

Age	Total examined	Positives	Prevalence (95% CI)	*p*-value	X^2
≤ 1year	132	40	30.30 (22.61 - 38.90)	0.252	2.760
1 -7 years	132	41	31.06 (23.30 - 39.70)		
Above 7 years	36	16	44.44 (27.94 - 61.90)		
Total	300	97	32.33 (27.07 - 37.95)		

The prevalence of *T. canis* in male and female dogs was 84 (32.4%) and 13 (31.7%), respectively, as shown in Table 2. However, there was no significant difference in the prevalence of the disease between male and female dogs ($p > 0.05$). There was a significant link between the prevalence of *T. canis* and dog breed ($p < 0.05$). The prevalence of the disease was 30.3% (95% CI: 24.97 - 36.11) in local and 56.5% (95% CI: 34.49 - 76.81) in German Shepherd breed dogs (Table 3).

Table 2: Prevalence of *T. canis* between male and female dogs

Sex	Total examined	Positives	Prevalence (95% CI)	*p*-value	X^2
Male	259	84	32.43 (26.77 - 38.50)	0.927	0.009
Female	41	13	31.71 (18.08 - 48.09)		
Total	300	97	32.33 (27.07 - 37.95)		

Table 3: Prevalence of *T. canis* on local and German Shepherd dog breeds

Breed	Total examined	Positives	Prevalence (95% CI)	*p*-value	X^2
Local	277	84	30.32 (24.97 - 36.11)	0.010	6.661
German shepherd	23	13	56.52 (34.49 - 76.81)		
Total	300	97	32.33 (27.07 - 37.95)		

The present study indicated that the presence of diarrhea was significantly associated with *T. canis* infection of dogs ($p < 0.05$). The dogs with diarrhea were more affected with the disease than dogs without clinical diarrhea. The present finding showed that the prevalence of the parasite was 46.5% (95% CI: 34.55 - 58.71) in diarrheic dogs and 27.9% (95% CI: 22.24 - 34.24) in non-diarrheic dogs as stated in Table 4.

Table 4: Prevalence of *T. canis* by fecal consistency among diarrheic and non-diarrheic dogs

Fecal consistency	Total examined	Positives	Prevalence (95% CI)	*p*-value	X^2
Diarrheic	71	33	46.48 (34.55 - 58.71)	0.004	8.507
Non-diarrheic	229	64	27.95 (22.24 - 34.24)		
Total	300	97	32.33 (27.07 - 37.95)		

Knowledge, attitude, and practice assessment

Regarding knowledge, attitude, and practice of the public, the study showed that of 300 dog owners, 184 (61.3%) kept dogs for security purposes, 62 (20.7%) as a pet and 54 (18%) for both security purposes and as a pet. Of 300 dog owners, 74% (95% CI: 68.65 - 78.87) provided a house for their dogs and 78 (26%) did not provide any shelter for their dogs. The majority of owners 170 (56.7%) did not take their dogs to the veterinary clinic for deworming on a regular basis and only 130 (43.3%) owners dewormed their dogs regularly. Most of the owners 60.7% (95% CI: 54.89 - 66.23) clean their dogs' houses (Table 5).

Table 5: Knowledge, attitude, and practice of the respondents on pet husbandry

Variables	No. of respondents	Proportion (95% CI)
Purpose of dog keeping		
Security	184	61.3 (55.57-66.87)
Hobby	62	20.7 (16.23-25.70)
Both	54	18.0 (13.82-22.82)
Does your dog have a house?		
Yes	222	74.0 (68.65-78.87)
No	78	26.0 (21.13-31.35)
Is your dog dewormed regularly?		
Yes	130	43.3 (37.65-49.15)
No	170	56.7 (50.85-62.35)
Do you keep the dog and its house clean?		
Dog is washed and the house is cleaned	102	34.0 (28.65-39.67)
The house is washed and cleaned	16	5.3 (3.08-8.52)
Only house cleaned only	182	60.70 (54.89-66.23)
Where does your dog defecate?		
Inside the house	41	13.7 (9.99-18.08)
Outside the compound	205	68.3 (62.74-73.56)
Anywhere within and outside the compound	54	18.0 (13.82-22.82)

Variables	No. of respondents	Proportion (95% CI)
What is the dog's waste disposal site?		
Municipal garbage site	154	51.3 (45.52-57.12)
Along the roadsides	146	48.7 (42.88-54.48)
Is your dog tied permanently?		
Yes	46	15.3 (11.45-19.92)
No	254	84.7 (80.08-88.55)
What do you feed your dog?		
Raw meat	110	36.7 (31.20-42.40)
Cooked meat	18	6.0 (3.59-9.32)
Household leftovers	10	3.3 (1.61-6.04)
Raw meat and household leftovers	162	54.0 (48.18-59.74)
How do you feed your dog?		
On the floor	60	20 (15.62-24.98)
In a bowl	240	80.0 (75.02-84.38)
Does your dog have access to the outdoors?		
Yes	265	88.3 (84.15-91.74)
No	35	11.7 (8.26-15.85)

Most dog owners (54%; 95% CI: 48.18 - 59.74) fed raw meat and household leftovers to their dogs -110 (36.7) of them fed only raw meat, 18 (36%) of dog owners fed their dogs cooked meat, while 10 (3.3%) of them fed only household leftovers. The majority of dogs (68.3%) defecated outside the compound; 41 (13.7%) dogs defecated in their house while 54 (18%) dogs defecated everywhere. In total 154 (51.3%) dog owners disposed of waste from the doghouse to the municipal landfill and 146 (48.7%) disposed of waste along roadsides. The majority of dog owners (80%) provided feed to their dogs in a bowl and 88.3% (95% CI: 84.15 - 91.74) eat outdoors (Table 5).

The present finding indicated that 93.3% (95% CI: 89.89 - 95.88) of the respondents have children, whereas 35 (11.7%) do not have children in their homes. The finding indicated that 53.7% (95% CI: 47.84 - 59.42) of the respondents and their families had experienced close contact with their dogs and 27% of them stated that there was a contact between their dogs and only their children, whereas 19.3% of them had no contact with their dogs and fam-

ily at all. Similarly, 247 (82.3%) respondents reported that their children play in their compound and 40 of them stated that their children play on the roadsides, while 13 (4.3%) of children play everywhere (Table 6).

Table 6: Zoonotic disease, sanitation, and pet contact related attitude and knowledge of the respondents

Variables	No. of respondents	Proportion (95% CI)
Are children presence?		
Yes	280	93.3 (89.89-95.88)
No	20	6.7 (4.12-10.11)
Dog Contact History		
No contact with children	58	19.3 (15.02-24.26)
Very close contact with all of us	161	53.7 (47.84-59.42)
The dog only plays with children	81	27 (22.06-32.40)
Children's playing areas		
In the compound	247	82.3 (77.54-86.48)
On the **roadsides**	40	13.3 (9.70-17.71)
Anywhere	13	4.3 (2.33-7.30)
Do the children bite their nails?		
Yes	242	80.7 (75.74-84.98)
No	58	19.3 (15.02-24.26)
Do children wash their hands before a meal?		
Yes	281	93.7 (90.29-96.14)
No	19	6.3 (3.86-9.71)
What type of food do you feed your children?		
Raw vegetables	11	3.7 (1.84-6.47)
Only cooked foods	289	96.3 (93.53-98.16)
Do you know that parasitic diseases are transmitted from dog to human?		
Yes	49	16.3 (12.33-21.01)
No	257	83.7 (81.18-89.43)
Have you heard of toxocariasis?		
Yes	58	19.3 (15.02-24.26)
No	242	80.7 (75.74-84.98)

Regarding the hand-washing practice of their children before meals, the finding indicated that handwashing was practiced by 93.7% (95% CI: 90.29 - 96.14) of the respondents, and 6.3% of the respondents never wash their children's hands. The respondents indicated that 3.7% fed their children raw vegetables, whereas 96.3% of respondents fed their children only cooked foods. The level of awareness of the community on parasitic diseases indicated that 83.7% of them didn't know that parasitic diseases can be transmitted from dogs to humans, whereas 19.3% of respondents were aware of the fact that parasitic diseases can be transmitted from dogs to humans, and 80.7% (95% CI: 75.74 - 84.98) of them do not have information about the disease toxocariasis (Table 6).

DISCUSSION

The present study found a higher prevalence of *T. canis* in Bishoftu, central Ethiopia. Coprological examination of 300 samples revealed that the overall prevalence of *T. canis* was 32.3% (95% CI: 27.07 - 37.95). The finding regarding the prevalence of *T. canis* in the current study was in line with the studies that reported 39.79% in Bahir Dar (Abere et al., 2013), 38.8% in Hawassa (Dejene et al., 2013), and 36.6% in Ilam province (Alimohammad et al., 2011). However, this finding was higher than in the studies that reported 21% in Central Ethiopia (Yacob et al., 2007), 17.1% in Ambo (Endrias et al., 2010), 4.2% in Canada (Joffe et al., 2011), 7.9% in South Africa (Mukaratirwa and Singh, 2010), 5.54% in Brazil (Oliveira-Sequeira et al., 2002), 3.8% in India (Keshaw et al., 2016), 13.7% in Tanzania (Swai et al., 2010) and 26.6% in Bahir Dar (Zelalem and Mekonnen, 2012). A higher prevalence of *T. canis* in the present study might be due to the widespread parasites, poor management and feeding systems of the dogs, ecological factors required for the biology of the parasites, season of study, size of taken samples, and public awareness regarding dog health care.

The present study revealed that there was no statistically significant difference ($p > 0.05$) in the prevalence of the disease among age groups, but old dogs were more affected than other age groups. Similarly, Endrias et al. (2010) and Dubie et al. (2023) reported insignificant association of *T. canis* with age categories. The higher prevalence of the disease in older dogs might be due to the higher chance of exposure to contaminated feed or environment, the geriatric body defense system, and poor management systems. Accordingly, there was no significant difference ($p > 0.05$) observed in the prevalence of *T. canis* between male and female dogs. Likewise, several studies also reported that sex was not significantly associated with *T. canis* infection (Alimohammad et al., 2011; Dubie et al., 2023). The similarity in the prevalence of *T. canis* in female

and male dogs might be due to similar management practices for both sexes.

The present study revealed a statistically significant difference ($p < 0.05$) in the prevalence of *T. canis* between local and German Shepherd dog breeds. In line with this finding, Abere et al. (2013) reported significant difference in the prevalence of the disease among dog breeds. This difference might be due to the resistance of local breeds or adaptation to the endemic parasites because of frequent exposure. The finding of the present study indicated a significant difference in the prevalence of *T. canis* between diarrheic and non-diarrheic dogs. Similarly, studies revealed that the presence of diarrhea was significantly associated with *T. canis* infection (Zelalem and Mekonnen, 2012). The findings suggested that *T. canis* should receive appropriate attention and consideration in the diagnosis of canine diarrhea.

The questionnaire survey revealed poor dog management practices and lower awareness of the public on zoonotic canine parasitic diseases. The present study showed that most dog owners clean only the dog's house and do not keep the hygiene of their dogs. Accordingly, most owners do not take their dogs to veterinary clinics for deworming on a regular basis. Similarly, several studies (Holland, 2017; Schwartz et al., 2021; Abadilla and Paller, 2022) reported poor dog management, absence of or infrequent dog deworming, and poor hygiene. The majority of dogs were fed household leftovers and raw animal products that can certainly lead to exposure to helminth infections. In line with this, Finley et al. (2008) stated the increasing provision of raw feed to dogs is a major potential source of zoonotic pathogens. The present study revealed that most dogs defecate outside the compound anywhere. The present findings and several studies indicated poor pet management practices and lower public awareness in most developing countries.

The present study revealed that over 50% of the children and their families had close contact with their dogs. The present finding was similar to a previous study in the Netherlands (Overgaauw et al., 2009). The findings imply a high risk of contracting zoonotic parasitic diseases from dogs. Hygienic practices such as hand washing after contact with dogs were practiced in most homes with dogs. In line with this finding, Stull et al. (2013) stated that owners who are not concerned about the hygienic status of their dog, should be washing their hands regularly. However, Overgaauw et al. (2009) reported that most dog owners wash their hands less frequently after a contact with their dogs. Hand hygiene plays a significant role in preventing and reducing the risk of zoonotic infections, such as toxocariasis, especially in developing countries.

The present study indicated that most dog owners (83.7%; 95% CI: 81.18 - 89.43) had poor knowledge about the zoonotic transmission of canine parasitic diseases. In line with this finding, a study conducted in Hawassa showed that

97% of the respondents were not aware of zoonotic canine parasitic diseases (Dejene et al., 2013). In another study in Ambo, 55.7% of the owners had no knowledge about the role of dogs in transmitting diseases to humans (Endrias et al., 2010). Accordingly, most dog owners (80.7%; 95% CI: 75.74 - 84.98) had no awareness about the disease toxocariasis. Similarly, several studies (Kantarakia et al., 2020; Tamiru et al., 2022; Ntampaka et al., 2022) reported lower public awareness on toxocariasis and its zoonotic transmission. The present study indicated lower public awareness of zoonotic canine parasitic diseases. Awareness about the risk of zoonotic diseases such as toxocariasis is a prerequisite for effective disease prevention, hygienic practices, and better dog management practices.

CONCLUSION

The present study revealed a widespread distribution of *T. canis* infection in dogs in Bishoftu, central Ethiopia. The study identified that dog breeds and the presence of diarrhea were significantly associated with the prevalence of *T. canis*. The prevalence of the disease was higher in German Shepherd dog breed and in dogs with the clinical diarrhea. The knowledge, attitude, and practices assessment indicated poor dog management and lower hygienic practices. Most dogs were fed raw animal products, they defecated everywhere, and were not dewormed regularly. The awareness of the public about zoonotic canine parasitic diseases and toxocariasis was lower. The current higher prevalence of *T. canis* in dogs and the lower public awareness of the disease in Bishoftu in central Ethiopia call for the need for implementation of appropriate control and prevention measures. Therefore, this study recommends strategic deworming of dogs against helminths, better dog management and hygienic practices, and awareness of the community about zoonotic canine diseases and sanitary measures to control the impact of the disease in animals and human health.

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Author's Contribution:

H.A. conception and designing, sample collection and laboratory investigation; H.A. & A.E. data analysis, results and interpretation, drafting the manuscript; A.E. revising the manuscript and approving the final version.

Competing interest

The authors declare that there is no conflict of interest associated with the research reported in this article.

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