Scholar **J** *Scholar J 2023, 1:4*

Research Article

Prevalence of Zoonotic Helminthes in Domesticated Dogs in Northcentral Nigeria

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Received 10 December 2022; Acceptance 17 February 2023; Published 14 April 2023

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How to cite this article: Anzaku (2023). Prevalence of zoonotic helminthes in domesticated dogs in northcentral Nigeria *Scholar J*, **1**:4 https://scholarj.com/ojs

Abstract
Dogs are the most common pet animals worldwide, providing companionship, security and a source of dietary protein. Zoonotic helminthes of dogs is a global problem particularly in the developing countries and these dogs, regardless of their benefits, pose a public health risk as they are potential carriers of some pathogens. This study attempted to bridge the dearth of information on the prevalence of zoonotic helminthes of domestic dogs in Bwari Area Council and to establish some of the risk factors that may be associated with endoparasitism. Fecal samples were collected between April to July 2019 to determine the prevalence of zoonotic helminthes in the area. A total of 210 dogs were sampled. Faecal samples were examined using standard flotation and sedimentation techniques to examine for the presence of helminthes ova. The overall prevalence of helminth parasites was 49.52%, and single helminth infections were as follows: Ancylostoma caninum (30.48%), Toxocara canis (8.10%), Dipylidium caninum (6.19%), Trichuris vulpis (3.81%) and Taenia spp (0.95%). In this study, mixed infections with more than one helminth parasite species were found in 16.34% of the cases. A strong association was observed between prevalence and age of the dogs, with younger dogs having higher rate of infection than older dogs. The presence of the zoonotic helminths indicates that dogs play an important epidemiological role as reservoirs of infections in the area. Moreover, routine treatment of dogs with anthelminthic drugs was not a common practice and public awareness regarding parasites of zoonotic importance was limited. It was therefore recommended that the risk of acquiring parasitic infection transmitted by dogs could therefore be reduced if legislation on the restriction of stray dogs is formulated and enforced.
Keywords: Zoonotic, Helminthes, Domesticated Dogs

Introduction

Dogs are the most successful canids, one of the most domesticated animals worldwide and they have helped in physical, social and emotional well-being of their owners, particularly children [1]. Some studies mentioned that having dogs as pets is associated with a higher level of self-esteem in children [2] and the reason for keeping dogs, their value and veterinary care tend to vary according to culture, status, social interest and economics activities of the people. In Nigeria dogs are important animals in a lot of urban and

rural households, serving as house guards in the majority of the cases, pets and also as food in some parts of the country. Despite their benefits to their owners, there are well documented health hazards associated with humans association with dogs. A number of infections, in particular parasitic diseases, capable of being transmitted from pets to human, had been reported and summarized by many authors [1-2]. Among the zoonotic parasites that have been widely studied and recognized as a significant public health problem worldwide are the following helminth zoonotic parasites: *Taenia* spp, *Echinococcus* spp., *Toxocara canis*, *Dipylidium caninum* and *Ancylostoma* spp. These and others are important in developing countries; due to the presence of uncontrolled population of dogs existing in close proximity to increasing density of human population in both rural and urban environment [3].

Dogs have close contact with humans and this represents a serious potential source of direct transmission of parasites from dogs to humans [4]. Dogs act as reservoirs of many parasites of zoonotic potential such as *Taenia* sp., hydatid tapeworm (*Echinococcus* sp.), *Diphylidium caninum,* dog roundworm (*Toxocara canis),* dog hookworm (*Ancylostoma* sp.), *Giardia* sp., and *Cryptosporidium* sp. [5-6]. Therefore, food and water contaminated with dog faeces and dog meat serve as the major sources involved in the intake of gastrointestinal (GI) zoonotic parasites *via* oral route into the humans [7]. Although most protozoan and helminth species frequently found in the GI tracts of dogs are cosmopolitan, the prevalence varies considerably from one region to another. Furthermore, the level of hygienic conditions and the lack of veterinary attention and zoonotic disease awareness in those countries, exacerbate the transmission of these diseases [8]. To minimize the transmission of zoonotic parasite diseases, data must be collected on the prevalence of parasites and habits of dog owners. To this end, this study examines prevalence of zoonotic helminthes in domesticated dogs in northcentral Nigeria.

Experimental Procedures

The study animals were dogs owned by residents of Bwari Area Council -Abuja, northcentral Nigeria. A random house-to-house screening of dogs was conducted between April- July, 2019, two times weekly. Systematic random sampling method was employed in selecting the 210 screened dogs. Thereafter, pre-labeled specimen containers were used for the collection of stool samples. In households with more than one dog, only one dog (chosen by the dog owner) was included. The samples were then transported to microbiology laboratory of Veritas University, Abuja for further examination. Microscopic examination was carried out by using the simple flotation technique and sedimentation technique. The ova of parasites seen were identified using an atlas. About two to three grams of stool sample was taken in a beaker and 30 milliliters (ml) of sodium chloride/sugar mixture flotation fluid (sp. gr. 1.28) was added through simple flotation technique. The faeces and flotation fluid were thoroughly mixed with a mixing stick and filtered with a tea strainer. The filtered sample was poured into a test tube and placed on a test tube rack to stand. The test tube was topped with the suspension, leaving a convex meniscus at the top of the tube and a coverslip was carefully placed on top of the test tube. The test tube was then left to stand for 10-15 minutes and then the coverslip was lifted and placed on a microscope slide and examined at x10 and x40objective lens.

Additionally, wet mount preparation was done for fresh stool samples (2mg) taken were placed on a slide with a wooden applicator and emulsified with saline for diarrheic and semi-solid samples. Iodine was used for formed stools. The slides were then covered with a coverslip and examined under the microscope using the x10 objective lens then x40.

For each of the faecal sample collected, 4 g was dissolved in tap water and mixed thoroughly in a sedimentation technique by [9]. The suspension was then filtered through a wire mesh sieve and allowed to settle for one hour. The resulting supernatant was gently decanted and the sediments transferred to shallow glass petri dishes and examined for the presence of helminthes or segments of it. Thereafter, 1-2 drop(s) of the sediment was placed on a glass slide in triplicate and a drop of iodine solution added and covered with cover slip. These were viewed under the microscope (×10) for the presence of any helminthes eggs.

Results and Discussion

Out of the 210 dogs' faecal samples examined, the prevalence of intestinal helminth parasites eggs was 49.52% (104) (Table 1). During the study period the most frequently observed helminth parasite species in domestic dogs of Bwari Area Council were Nematodes; *Ancylostoma caninum* (30.48%), *Toxocara canis* (8.10%), *and Trichuris vulpis* (3.81%). Followed by Cestodes; *Dipylidium caninum* (6.19%), and *Taenia spp* (0.95%) (Table 1).

Table 1. Overall prevalence of zoonotic helminthes in domestic dogs in Bwari Area Council.

Helminths	Species of helminth	Number of positive samples	Prevalence (%)
Nematodes	*Ancylostoma caninum*	64	30.48
	Toxocara canis	17	8.10
	Trichuris vulpis	8	3.81
Cestodes	*Dipylidium caninum*	13	6.19
	Taenia spp	2	0.95

The prevalence of the various intestinal helminths recovered in relation to sex of dogs sampled is presented in Table 2 there was no significant difference in prevalence of intestinal helminths in male and female dogs. Female dogs showed 50.78% infection out 128 samples and male dogs showed 47.56% infection out 82 samples.

Table 2. Overall prevalence of zoonotic helminthes in dogs in relation to sex in Bwari Area Council

Sex	Number of dogs examined	Number of dogs infected	Percentage infected (%)
Male	82	39	47.56
Female	128	65	50.78
Total	210	104	49.52

Table 3. Overall prevalence of zoonotic helminthes of dogs in Bwari Area Council in relation to sex and specie

Helminths	Prevalence Rate of Infection (%)	
	Male (82)	Female (128)
Ancylostoma caninum	25	39
Dipylidium caninum	7	10
Toxocara canis	2	6
Trichuris vulpis	5	8
Taenia spp	0	2
Total = 104	39	65

Out of the 104 positive samples there was an overall mixed infection of 51(18.27%) of which 9 (8.65%) samples had mixed infection of two parasite species of *Ancylostoma caninum* and Toxocara *canis*, 6 (5.77%) had *Ancylostoma caninum* and *Diphylidium caninum,* while 2 (1.92%) with *Ancylostoma caninum* and *Taenia spp.* (Table 4).

Table 4. Mixed infections detected among the positive samples of dog faeces in Bwari Area Council.

Mixed-parasitism	Number of infected dogs	Percentage infected (%)
Ancylostoma caninum + *Toxocara canis*	9	8.65
Ancylostoma caninum + *Dipylidium caninum*	6	5.77
Ancylostoma caninum + *Taenia spp*	2	1.92
Total	17	**6.34**

The prevalence of helminthes parasite in different age groups of dogs studied (Table 5) showed that young dogs between the 7-12 months had the highest infection rate while the least was among the older dogs between age of 4-6 years. There was a significant difference in infection rates among the different age groups of dogs examined.

Table 5. Overall prevalence of zoonotic helminthes in relation to age group and sex of dogs in Bwari Area Council

Variable	Category (months/years)	Number of positive samples (%)	Number of negative samples (%)
Age Group	0-6mnths	21(56.75)	16(43.24)
	7-12mnths	47(83.93)	09(16.07)
	2-3yrs	32(34.78)	60(65.22)
	4-6yrs	4(16.00)	21(84.00)
Sex	Male	39(47.56)	43(52.44)
	Female	65(50.78)	63(49.22)

Parasites species detected with respect to age of dogs showed that *Ancylostoma caninum* had the highest infection rate as it infected the three age groups of dogs in significant numbers, Other parasites that showed significant infections across the age groups include *Dipylidium caninum* and *Toxocara canis* . *Taenia spp* were not significant across the age groups (Table 6).

Table 6. Overall prevalence of zoonotic helminthes of dogs in Bwari Area Council in relation to age and specie

Helminth	Category	Number examined	Number infected	Prevalence (%)
Ancylostoma caninum	0-6months	37	14	37.84
	7-12 months	56	27	48.21
	2-3 years	92	21	22.83
	4-6 years	25	2	8.00
			Total = 64	
Toxocara canis	0-6 months	37	3	8.11
	7-12 months	56	8	14.29
	2-3 years	92	5	5.43
	4-6years	25	1	4.00
			Total = 17	
Trichuris vulpis	0-6 months	37	3	8.11
	7-12 years	56	3	5.36
	2-3 years	92	2	2.17
	4-6 years	25	0	0
			Total= 8	
Dipylidium caninum	0-6 months	37	1	2.70
	7-12 months	56	8	14.29
	2-3 years	92	3	3.26
	4-6 years	25	1	4.00
			Total= 13	
Taenia spp	0-6 months	37	0	0
	7-12 months	56	1	1.79
	2-3 years	92	1	1.09
	4-6 years	25	0	0

Total= 2

There is a dearth of information on the prevalence of zoonotic helminthes in domestic dogs of Bwari Area Council. This study provides baseline data on these zoonotic helminthes in the area. The most commonly sampled dogs in this study were local breeds and the age of all the dogs ranged from less than three months to dogs about six years old. This means that local breeds are the most common dogs in Bwari Area Council and because of the few numbers of exotic breeds observed in the study, the effect of breed, was not considered seriously.

The findings of this study revealed a high prevalence (49.52%) of helminths of zoonotic importance, namely *Toxocara canis*, hookworm (*Ancylostoma caninum)* Dipylidium *caninum, Trichuris vulpis and Taenia spp .* The parasites observed in this study is similar to those that have been reported in dogs and other canids by [10-11] in different studies and locations within Nigeria and other countries with a significant difference in the prevalence between regions. In this study, the overall prevalence of zoonotic helminths (49.52%) is was comparable with prevalence of 52.5% and 47.1% reported by [12-13] in Southeastern and southwestern Nigeria. It was lower than 62.6%, 85%, 66.1% and 78.9% reported by [14,15]. However, moderately lower prevalence rate of 36.7 %, 33.9 % and 24.7 % was reported in Makurdi, Ibadan and Zaria respectively [16]. These observations confirm that the canine parasitic helminthes are endemic in Nigeria and there is need to pay careful attention to them as dogs serve as the vectors of serious parasitic diseases with zoonotic implications.

The high prevalence rate could be attributed to lack of awareness of zoonotic parasites by dog owners, lack of veterinary services in the study area, poor level of hygiene by dog owners, indiscriminate feeding, and the generally poor socio-economic condition prevailing in the study area. This may also be due to the conditions the countries involved which are conducive for the development, survival and transmission of infective stages of the parasites.

The presence of hookworm (*A. caninum*) and Toxocara in this study is significant due to their zoonotic implications considering the high prevalence of intestinal helminth infections recorded in dogs and the close bond in which dogs live together with people. The risk of transmission of these parasites to humans seems to be obvious.

The predominant species of zoonotic helminth parasite observed in this study was *A. caninum* (30.48%), which agrees with [11,12,14] who found the highest prevalence of isolated parasites to be *A. caninum* in Jos, Nigeria and other researchers from Makurdi and Calabar all in Nigeria but differed from the findings of [16-17] which reported *Toxocara canis* having higher prevalence rate. The reason for this variation may be as a result of the geographical location and conditions, level of hygiene and sanitary practices, and the fact that *Ancylostoma caninum* is the widest spread of hookworm species which parasitizes dogs throughout the tropics and subtropics [10]. The high prevalence rate of *Ancylostoma caninum* in this study is a serious threat to public health in the area, especially in communities that are socio-economically disadvantaged. In these communities, poor levels of hygiene, and overcrowding, coupled with lack of veterinary attention and zoonotic awareness may exacerbate the risk of the disease transmission. The young dogs within the age group of 7-12 months had the highest prevalence rate of infection with all the parasites detected in this study. High prevalence of parasitic infections in the dogs within the age group of 7-12 months agrees with the findings of [10]. This high prevalence could be due to; interaction with the soil, lack of care by the owner, poor level of hygiene, lack of healthy food as dog owners allows dogs to roam the streets looking for condemned offal and faeces to eat, unlike the puppies that are kept in the house and not allowed to roam about due to their tender age which is properly fed and given attention and therefore, the rate of it becoming vulnerable or susceptible to parasitic infection is low [10].

The prevalence of *T. canis* in dogs examined in this study was 8.10%. Several syndromes have been ascribed to *Toxocara species* which include visceral larva migrans, ocular larva migrans and some

neurologic and atopic symptoms [18]. The prevalence of *T. canis* presents a potentially serious condition that might increase the possibility of many children in the study area harbouring T. canis . Studies on the prevalence and other intestinal parasites of dogs in various areas of the United States of America (USA) have shown that a prevalence of 7% for T. canis infection among a population of dogs should be considered hazardous to children [13]. This is because of the daily shedding of many thousands of eggs into the environment which may lead to environmental contamination and thereby exposing children to accidental ingestion of the eggs as a result of their play habit.

The prevalence pattern of *T. canis* in this study was age dependent; *T. canis* dropped with age of dog. This pattern has been observed previously by [11,16,17]. This study observed the highest prevalence of toxocariasis in puppies within 7-12 months of age. This study has also revealed that the prevalence of *T. canis* in local breeds was significantly higher than in exotic breeds (Alsatians, mongrels German shepherd and Rottweiler). However, [11] reported similar parasite prevalence among pure and mixed breed.

In this study, most of the dogs sampled in the study area are free range and receive only limited care from their resource limited owners. The prevalence of *Toxocara canis* infection in free range dogs could be due to their scavenging habits which exposed them to natural infections. They can also contaminate the environment with faecal matter, many of which contains viable and infective ova and under suitable environmental conditions such as that in tropical area become embryonated in the soil and thereby poses risk to humans.

D. caninum, a zoonotic tapeworm was found in 6.19% of the examined dogs. Although the presence of *Taenia spp* in dogs examined does not pose any direct health risk to man, eggs of *T. hydatigena* passed with faeces of infected dogs may contaminate grazing fields and subsequently infect ruminants [16]. The overall parasites prevalence recorded in this study is strongly associated with age. The overall prevalence of helminth parasites was significantly higher in young dogs (< 1 year-old) than in older dogs. This is partially due to parasite specific immunity usually acquired with age or probably as a result of single or repeated exposures.

Infection by more than a single helminth parasite otherwise multiple parasitism was encountered less than infection with single species, this was similar with works by [11,17,19]. As explained by [14], mixed infections endorse the critical role of dogs as reservoirs of zoonotic gastro intestinal parasites and hence put dog owners at great risk of acquiring more than one zoonotic infection from dogs. The reason for this observation may be that the dogs were not properly taken care of by their owners and also the poor management practices as most dog owners allowed their dogs to roam freely in the community and feed on both condemned food and human faeces which increases the susceptibility of the dogs to parasitic infections.

Conclusion

Prevalence of zoonotic helminthes in domesticated dogs in northcentral Nigeria is presented. This study provides current information on the infection rates in dog populations in Bwari Area Council and it has shown that the gastrointestinal helminth parasites identified i.e *T. canis, A. caninum, D. caninum, Trichuris vulpis,* and *Taenia spp* are zoonotic parasites with prevalences constituting public health problems in the study area. This prevalence has also been observed to be higher in younger dogs. Hence, intervention measures are important to reduce the chances of transmission of parasites from dogs to humans. The transmission of parasites between humans and dogs is majorly due to contamination with dog faeces. Based on the findings, the study recommends that the risk of acquiring parasitic infection transmitted by dogs could therefore be reduced if legislation on the restriction of stray dogs is formulated and enforced. In addition, relevant agencies should begin or continue mass enlightenment of dog owners on the role of dogs in disease transmission and the need to take their dogs for regular veterinary check-up and treatment.

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