

Epizootiology of zoonotic parasites of dogs in Abua area of Rivers State, Nigeria

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ABSTRACT

The study investigated zoonotic parasites of dogs in Abua area of Rivers State. Out of the 400 samples analysed 260(65%) were found to be positive with different parasite species. Parasite species recovered showed, *Ancylostoma caninum* and *Strongyloides stercoralis* were found in all the communities while *Taenia spp.* was found in only one community. There was a statistically significant difference in infection rates among the different age groups of dogs examined ($X^2 = 59.79$, $df = 4$, $P = 0.000$). 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 ($X^2 = 50.28$, $P = 0.000$), followed by *Strongyloides stercoralis* ($X^2 = 24.87$, $P = 0.000$). Other parasites that showed significant infections across the age groups include *Diphylidium caninum* ($X^2 = 9.63$, $P = 0.008$) and *Toxocara canis* ($X^2 = 6.98$, $P = 0.03$). All the other parasites; *Spirocerca lupi*, *Baylisascaris procyonis*, *Taenia spp.* were not significant across the age groups. There was an overall mixed infection of 51(19.62%) of which 22 (8.46%) samples had mix infection of two parasite species of *Ancylostoma caninum* and *Strongyloides stercoralis*, 12 (4.62%) had *Ancylostoma caninum* and *Diphylidium caninum*, while 1(0.34%) with *Toxocara canis* and *Ancylostoma caninum*. A mix infection of three parasite species was 6.15% comprising *Ancylostoma caninum*, *Strongyloides stercoralis* and *Diphylidium caninum* was recorded. In conclusion, Prevalence of zoonotic parasites of dogs in Abua was high. So, there is an urgent need for education of dog owners in the area to reduce this high infection rate and to reduce the danger of transmission of these infections to human as a result of ignorance on the part of the dog owners.

1. 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 (Dohoo, McDonnell, Rhodes, & Elazhary, 1998; Robertson, Irwin, Lymbery, & Thompson, 2000). Some studies mentioned that having dogs as pets is associated with a higher level of self-esteem in children (Knobel, Laurenson, Kazwala, Boden, & Cleaveland, 2008; Paul, King, & Carlin, 2010). However, despite the beneficial effects, close bonds between dogs and humans; in combination with inappropriate human practices and behaviour remain a major threat to public health, with the dogs that host a large number of infective stages of parasites can be transmitted to humans and other pets (Robertson et al., 2000). It is the close contact between dogs and humans that increases the risk of transmission of different zoonotic diseases. Zoonotic infections are infections of animals that are naturally transmitted to humans. As such they are worldwide and often spread to humans through their companion with

domesticated animals (Goldsmid, Speare, & Bettiol, 2003). Dogs are frequently infected with intestinal parasites. Moreover, several canine intestinal parasites are zoonotic and are considered important to public health. Although dogs are often considered members of the family by their owners, it is important to emphasize that they may be vectors of zoonotic intestinal parasites. For example, the causative agents of protozoonoses are *Entamoeba histolytica* and *Giardia intestinalis*. Although internal parasites cause mostly chronic asymptomatic type of infections, they can cause clinical disease in dogs depending on the burden and pathogenicity of parasites. In addition, dogs are definitive hosts for range of parasites with heterogeneous life cycles for which herbivorous and omnivorous animals serve as intermediate hosts such as *Echinococcus spp.* and *Neospora spp.*

The common enteric parasites of dogs are *Toxocara canis*, *Ancylostoma caninum*, *Taenia hydatigena*, *Echinococcus spp.*, *Diphylidium caninum*, *Trichuris vulpis*, *Giardia spp.*, *Cryptosporidium spp.* and *Cystoisospora cana* (Kahante et al., 2009; Palmer, Thompson, Traub, Rees, & Robertson, 2008). These canine intestinal parasites have an oral-

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faecal transmission cycle and a major component for spread of these parasites is the shedding of oocysts or cysts and eggs or larvae into the environment (Kahante et al., 2009 and Claerebout et al., 2009). Gastrointestinal parasites of dogs pose serious impact both on the host and human beings. They interfere with successful rearing of dogs and cause retarded growth, reduction of work and feeding efficiency and general ill health (Soulsby, 1982).

Dogs aid as vectors of parasitic diseases with zoonotic characteristics. The transmission of zoonotic agents could be through direct contact with animal secretion and excreta, infected water and food, or through direct contact with animal (Bugg, Robertson, Elliot, & Thompson, 1999). Knowing that dogs serve as reservoir, carriers and transmitter of several pathogens, including parasites, which are considered zoonotic and a number of them are of significant public health concern (Traub, Robertson, Irwin, Mencke, & Thompson, 2005 and Gracenea, Gómez, & Torres, 2009). Nowadays, the domestication of dogs is rapidly increasing and as dogs live with humans in the house, people especially children are exposed to them and are at special risk of infection because of their direct and indirect contact with dogs as compared to adults.

These canine infections have oral- faecal transmission cycle. Therefore, Poor awareness, personal hygiene and level of environmental sanitation can facilitate their transmission. There is a general lack of awareness of intestinal parasites of dogs and zoonotic disease of dogs in Abua as there is a dearth of information on work which has been done on parasites of dogs in Rivers State. The aim of this work was to investigate the prevalence of intestinal parasitic infection and awareness of zoonotic parasites of dogs in Abua/Odua, Rivers State.

2. Materials and methods

2.1. Study area

The study was carried out in Central Abua, in Abua/Odua Local Government Area (LGA) of Rivers State, Nigeria. Fig. 1, Map of Rivers State showing Abua/Odua Local Government Area. It is geographically located between Latitudes 4.5 and 6.0 degrees north of the equator and Longitude 6.0 and 7.0 degrees east of the Greenwich Meridian and has a population of 282,410 (Nation Bureau of Statistics, 2010). The LGA is 65 km from Port Harcourt and has an area of 70 km². Central Abua is comprised of nine communities; Otari, Omokwa, Odaga, Omelema, Okana, Omaraka Ogbema, Omalem and Emilaghan. Fig. 2 shows the communities sampled. These nine communities are situated where the local government secretariat is located and are considered the most civilized and industrialized place in Abua/Odua (Comson, 1987). The area experiences periodic flooding and high rainfalls between March and October, it is endowed naturally with tropical rainforest and many mangrove swamps. The people of Abua were predominantly farmers, hunters and fishermen and some engaged in timber felling, but with advent of civilization a large proportion of the population are now in different businesses and are self-employed yet many are still subsistence farmers, growing banana, cassava, and plantain. Most of the farmers walk to their farmlands on barefoot along with their children and accompanied by their dogs.

2.1.1. Study animals

The study animals were dogs between the ages 6 weeks to 10 years found in 8 communities (Otari, Omokwa, Odaga, Omelema, Okana, Ogbema Omalem and Emilaghan) in Central Abua. Any breed of the dogs that was reasonably stable in health since majority of the dog owners do not know much about their breeds.

2.2. Ethical consideration

Permission for this study was obtained from the Office of Research and Development, University of Port Harcourt. Dog owners from the

respective communities were informed before carrying out the study. Dog owners had the right to accept or reject supporting the study with no consequences.

2.3. Determination of sample size

Since there is no available data on the population of dogs in Abua/Odua, the population size was calculated using the formula given by Rose et al. (2015).

$$n = \frac{4 \times p \times q}{d^2}$$

Using 50% expected prevalence and 5% desired absolute precision at 95% confidence interval.

Were

n = required sample size

P = confidence level at 95%

d = margin of error at 5% (students value of 0.05)

Using an approximate 95% confidence level, taking worst case scenario and set $p = 0.5$, $q = 1 - p$, and $d = 0.05$. From the calculation a total of 400 samples were collected.

2.4. Sampling techniques

A total of 420 sample bottles were randomly distributed to household members of dog owners in the communities and fresh faecal samples were randomly collected and placed in clean labelled 30 ml bottles. Out of which only 400 samples were collected as the others did not comply and was taken to the parasitology laboratory of Animal and Environmental Biology department in University of Port Harcourt for examination for canine parasites.

2.5. Laboratory examination of samples

2.5.1. Formol-ether concentration technique (sedimentation method)

Formol-ether concentration method was used as described by Arora and Brij (2010) for examination of parasites eggs. All the faecal samples were concentrated using Formol-Ether concentration technique, 4 ml of thoroughly mixed stool sample was poured into a glass tube containing 4 ml of 10% formalin. The suspensions were sieved using a coffee strainer into a centrifuged tube and the filtrates were centrifuged at 2000 rpm for 2 min. The supernatant was discarded and the sediment re-suspended in 10 ml of physiological saline with 1 to 2 mL of ether (ethyl acetate). The tube was closed with a stopper and shaken vigorously. The stopper was removed and the tube centrifuged at 2000 rpm for 2 min. Four layers were visible; the top layer of ether, a second layer of plugs of debris, a third layer of formalin and a fourth layer of sediment. The plug of debris was detached leaving a small amount of formal saline for re-suspending the sediment. Few drops were placed on a clean glass slide at a time, covered with a cover slip and viewed under the microscope at x10 and x40 objective respectively; this was repeated until the sediment was completely examined.

2.6. Data analysis

Statistical analysis was done using SPSS version 19. Data obtained were presented as prevalence (%) and intensities. Chi-squared tests were used between parasites prevalence and host age and to compare prevalence of parasites in the eight communities. The chi-square (χ^2) test was used to assess difference in frequency of parasites between the age groups and communities. In all cases, 95% confidence interval and p value ≤ 0.05 were considered significant.



Fig. 1. Map of rivers state showing Abua/Odual local government area.

3. Results

Out of the 400 samples analysed 260 (65%) were found to be positive with parasite eggs of different species. The parasite infection rate seemed to be high among the eight communities (Table 1). Emilaghan was found to have the highest number of infection 45 (75%) followed by Omokwa with 41 (74.5%) and Omalem had the least number of infection 13(43.33%). However, there was no significant difference between the communities ($\chi^2 = 12.277$, $p = 0.092$). From the parasite species recovered from the eight communities in central Abua (Table 2), *Ancylostoma caninum* and *Strongyloides stercoralis* was found in all the communities while *Taenia spp.* was found in only one community.

The prevalence of intestinal parasites in different age groups of dogs studied (Table 3) showed that young dogs between the 7-12 months had the highest infection rate while the least was among the older dogs between age ≥ 7 years. There was a significant difference in infection rates among the different age groups of dogs examined ($X^2 = 59.79$, $df = 4$, $P = 0.000$)

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 ($X^2 = 50.28$, $P = 0.000$), followed by *Strongyloides stercoralis* ($X^2 = 24.87$, $P = 0.000$). Other parasites that showed significant infections across the age groups include *Diphylidium caninum* ($X^2 = 9.63$, $P = 0.008$) and *Toxocara canis* ($X^2 = 6.98$, $P = 0.03$). All the other parasites; *Spirocerca lupi*, *Baylisascaris procyonis*, *Taenia spp* were not significant across the age groups (Table 4)

Out of the 260 positive samples there was an overall mixed infection of 51(19.62%). Of which 22 (8.46%) samples had mix infection of two parasite species of *Ancylostoma caninum* and *Strongyloides stercoralis*, 12 (4.62%) had *Ancylostoma caninum* and *Diphylidium caninum*, while 1(0.34%) with *Toxocara canis* and *Ancylostoma caninum*. A mix infection of three parasite species was 6.15% comprising *Ancylostoma caninum*, *Strongyloides stercoralis* and *Diphylidium caninum* was recorded (Table 5).

4. Discussion

The overall prevalence rate of 65% recorded in this study is high and consistent with similar studies from other parts of Nigeria; Jos in Plateau State, Ilorin in Kwara State, Enugu in Enugu state and Zuru in

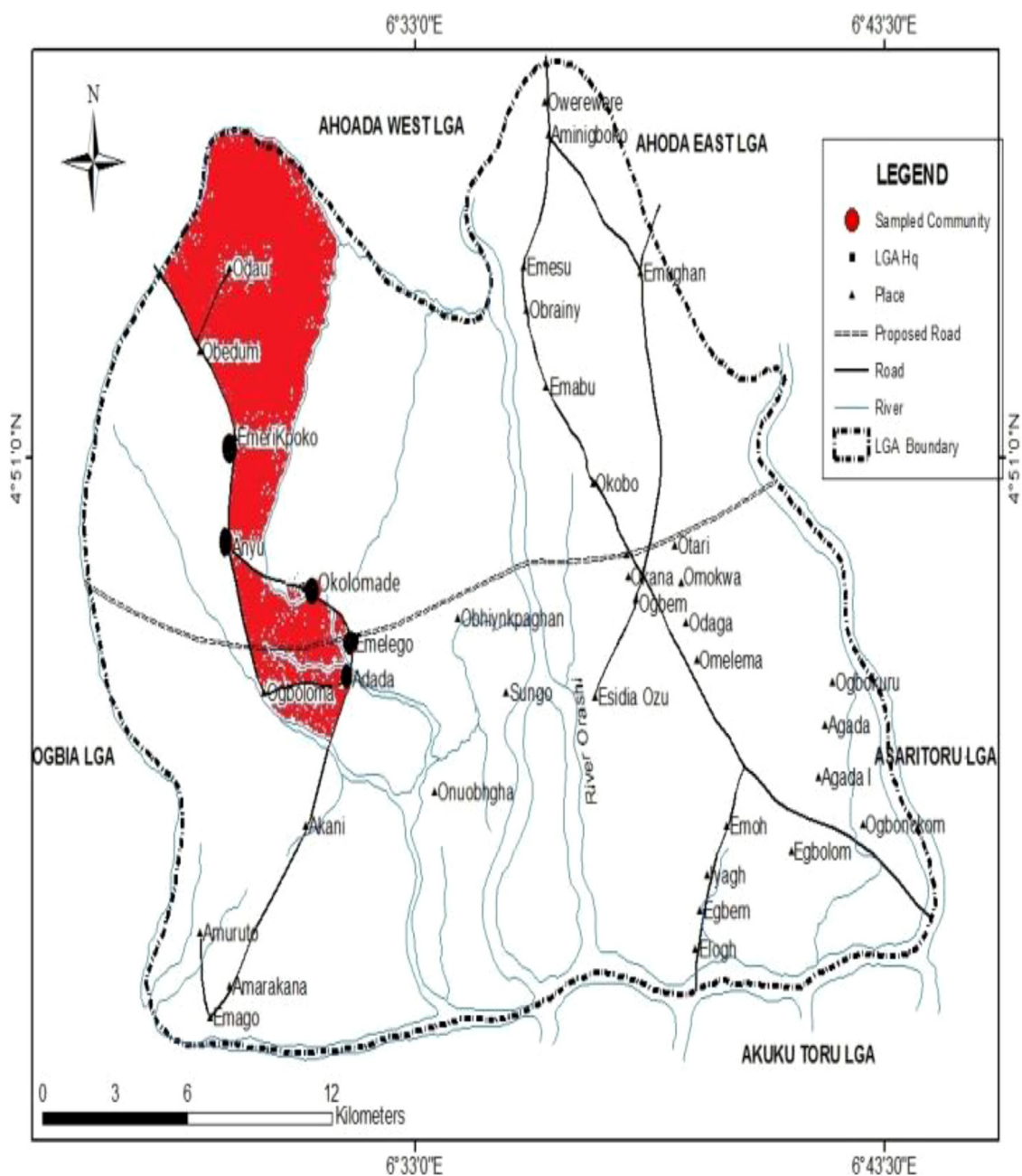


Fig. 2. Map of Abua/Odual local government area showing selected communities.

Table 1
Prevalence of infection in the eight communities in Central Abua.

Communities	Total examined	Infected (%)	χ^2	P
Otari	39	23(58.97)		
Omokwa	55	41(74.55)		
Omalem	30	13(43.33)		
Odaga	50	33(66)		
Omelema	52	32(61.54)		
Ogbema	63	39(61.90)		
Okana	51	34(66.66)		
Emilaghan	60	45(75)		
Total	400	260(65)	12.277	0.092

Kebbi State where 66.1 %, 68.4 %, 68.5 % and 78.9 % were reported respectively (Anene, Nnaji, & Chime, 1996; Kutdang, Bukbuk, & Ajayi, 2010; Magaji, Mohammed, Saulawa, & Salihu, 2012; Ugbomoiko, Ariza,

& Heukelbach, 2008). However, moderately lower prevalence rate of 36.7 %, 24.7 % and 33.9 % was reported in Makurdi, Ibadan and Zaria respectively (Ogbaje, Ofukwu, & Ajogi, 2015; Omudu & Amuta, 2007; Swemimo, 2008). These observations confirm that the canine parasites 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. This high prevalence is not peculiar to Nigeria as the prevalence rate of infection recorded in this study is lower than what was reported in other parts of the world; Spain, Mexico, South Africa and Morocco where 71 %, 85 %, 76%, 100 % respectively were reported (Eguia-Aguilar, Cruz-Reyes, & Martinez-Maya, 2005; Martinez-Moreno et al., 2007; Minnaar, Krecek, & Fourie, 2002; Pandey, Dakkak, & Elmamoune, 1987). 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. It may also be due to the

Table 2
Prevalence of parasite species in the eight communities in Central Abua

Parasites species	Otari (n = 23) %	Omokwa (n = 41) %	Odaga (n = 33) %	Omalema (n = 32) %	Omalem (n = 13) %	Ogbema (n = 39) %	Okana (n = 34) %	Emilaghan (n = 45) %	Total (n = 260) %
<i>A. caninum</i>	11(47.83)	16(39.02)	17(51.52)	22(68.75)	17(13.77)	27(69.23)	22(64.71)	29(64.44)	
<i>S. stercoralis</i>	9(39.13)	19(46.34)	13(39.40)	13(40.63)	12(92.31)	19(48.72)	25(73.53)	18(40.00)	
<i>D. caninum</i>	2(8.70)	6(14.63)	–	4(12.5)	–	11(28.21)	3(8.82)	2(4.44)	
<i>T. canis</i>	1(4.35)	–	–	1(3.13)	–	4(10.26)	–	2(4.44)	
<i>S. lupi</i>	–	1(2.44)	–	7(21.5)	–	–	–	–	
<i>Taenia spp</i>	–	–	–	–	–	–	1(2.94)	–	
<i>B. procyonis</i>	–	–	3(9.09)	5(15.63)	–	–	–	9(20.00)	
<i>Trichuris sp</i>	–	–	–	–	1(7.69)	2(5.13)	–	–	

Table 3
Prevalence of parasites in different age groups of dogs in Central Abua.

Ages	No examined	No infected	X ²	P
0–6 months	65	32(49.23)		
7–12 months	101	93(92.02)		
2–3years	110	70(63.64)		
4–6years	81	51(63.10)		
≥ 7 years	43	14(32.56)		
Total	400	260(65)	59.79	0.000

fact that the samples were collected from the local communities, this agrees with the report by Mukaratirwa and Singh (2010) on the high prevalence of gastrointestinal parasites in local breeds of dogs when compared to the exotic.

In this study, *Ancylostoma caninum* a hookworm was found to be the most prevalent parasite with highest occurrence across the community. This finding agrees with Kutdang et al. (2010) who found the highest prevalence of isolated parasites to be 50.1 % of *A. caninum* in Jos, Nigeria and other researchers from Makurdi and Calabar all in Nigeria (Iboh, Ajang, & Abraham, 2015; Matthew, Seer, & David, 2016) but at variance with Ugbomoiko et al. (2008) who found *Toxocara canis* to be the most prevalent of the isolated parasites in Ilorin. Though some researchers outside Nigeria tend to agree with this later observation, for example, Szabová et al. (2007) reported higher prevalence of *Toxocara canis* in Slovak Republic and Amissah-Reynolds, Monney, Adowah, and

Table 4
Prevalence of parasites species detected with respect to age of dogs in central Abua.

Risk factors	Categories	No examined	No infected	Prevalence (%)	χ ²	P
<i>Ancylostoma caninum</i>	Puppies	65	33	50.77	50.284	0.000
	Young	211	51	24.17		
	Adults	124	77	62.10		
<i>Strongyloides stercoralis</i>	Puppies	65	18	27.70	24.871	0.000
	Young	211	49	23.22		
	Adults	124	61	49.19		
<i>Diphylidium caninum</i>	Puppies	65	3	4.62	9.629	0.008
	Young	211	9	4.27		
	Adults	124	16	12.90		
<i>Toxocara canis</i>	Puppies	65	4	6.15	6.983	0.03
	Young	211	3	1.42		
	Adults	124	1	0.81		
<i>Spirocerca lupi</i>	Puppies	65	0	0.00	4.299	0.117
	Young	211	3	1.42		
	Adults	124	5	4.03		
<i>Baylisascaris procyonis</i>	Puppies	65	0	0.00	3.472	0.176
	Young	211	11	5.21		
	Adults	124	6	4.84		
<i>Taenia spp</i>	Puppies	65	0	0.00	2.231	0.328
	Young	211	0	0.00		
	Adults	124	1	0.81		
<i>Trichuris sp</i>	Puppies	65	0	0.00	0.258	
	Young	211	3	1.42		
	Adults	124	0	0.00		

Table 5
Multiple infections detected among the positive samples of dog faeces in Central Abua.

Poly-parasitism(n = 260)	No infected	Prevalence%
Double parasitism		
<i>A. caninum</i> + <i>S. stercoralis</i>	22	8.46
<i>A. caninum</i> + <i>D. caninum</i>	12	4.62
<i>T. canis</i> + <i>A. caninum</i>	1	0.34
Total	35	13.46
Triple parasitism		
<i>A. caninum</i> + <i>S. stercoralis</i> + <i>D. caninum</i>	16	6.15
Total	16	6.15

Agyemang (2016) also had similar report from Ghana. The reason for this variation may be as a result of the geographical location, level of hygiene, and the fact that *Ancylostoma caninum* is the widest spread of hookworm species which parasitizes dogs throughout the tropics and subtropics. 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 (Craig & Macpherson, 2000).

The young and adult dogs had the highest prevalence rate of infection with all the parasites detected in this study, except *Toxocara canis* (6.15%) that recorded the highest prevalence in the puppies. The

high prevalence of parasitic infections in the young and adult dogs agrees with the findings of Ajayi (1989). 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 allow 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. The high prevalence of *Toxocara canis* recorded in this study on the puppies compares with other studies carried out in other parts of Nigeria; Kutdang et al. (2010) recorded an overall prevalence of (66.1%) in Jos North and Jos South of Plateau State; Biu, Aitiya, Paul, and Konto (2012) 27.3% in Borno State, 41.7% reported from Ilorin, Kwara State by Ugbomoiko et al. (2008). From Ile-Ife, 51.4% was reported by Sowemimo (2007) and from other parts of the world; from Czech Republic (6.5%) by Dubna et al., 2007, Fortaleza Brazil (8.7%) by Klimpel, Heukelbach, Pothmann, & Ruckert, 2010, Japan (12.5%) by Yamamoto, Kon, Saito, Maeno, & Koyama, 2009 and Ethiopia (21%) by Yacob, Ayele, Fikru, and Basu (2007). High prevalence of this parasite has been reported by various researchers both in stray dogs and wild canids such as foxes (Dubinsky, Havasiova- reiterova, petko, Hovorka, & Tomasovicova, 1995; Olorcain, 1994). In Nigeria dogs, age and sex of dogs have been reported as risk factors for *T.canis* transmission (Sowemimo & Asaolu, 2008). This high prevalence in this age group agrees with the transmission pattern of the parasite, which is mainly by transplacental and trans mammary routes (Sprent, 1957,1961), it can also be attributed to poor management systems, health care and degree of environmental contamination with infective stages of the parasite.

Infection by more than a single parasite otherwise multiple parasitism was encountered. Infection with two parasites had 8.46 % prevalence while with three parasites was 6.15 %. Similar observation was reported by earlier researchers (Akao et al., 2003; Swai, Kaaya, Mshanga, & Mbise, 2010 Iboh et al., 2015). Kutdang et al. (2010) had explained that 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 cared for by their owners and also the level of hygiene by the dog owners which was poor as most dog owners allowed their dogs to roam freely in the community and feed on both condemned food and human wastes which increases the vulnerability of the dogs to parasitic infections.

In conclusion, Prevalence of zoonotic parasites of dogs in Abua is high. So there is an urgent need to create awareness among dog owners in the area to reduce this high infection rate and necessarily, reduce the danger of transmission of these infections to human as a result of ignorance on the part of the dog owners. The awareness would educate the dog owners on proper care of dogs, personal hygiene and environmental sanitation so as to avert possible outbreak of zoonotic infection in the area.

Conflict of interest

The authors declare that there is no conflict of interest.

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