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Detection and identification of gastrointestinal parasites in dogs presented to veterinary clinics in Abeokuta, South-western Nigeria

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Abstract

Gastrointestinal parasites of dogs have been incriminated in cases of morbidity and mortality; hence, this study was undertaken to investigate the presence and distribution of gastrointestinal parasites in dogs presented to different veterinary clinics in Abeokuta, Ogun State. One hundred and twenty faecal samples were collected between February to September 2018 from three different veterinary clinics into universal sample bottles that were properly labeled with the age, sex and breed. Samples were processed with Mini-FLOTAC® kit using salt and sugar solution at a specific gravity of 1.3. Data were analyzed with descriptive statistics and Chi square test was used to determine the association between variables. Of the 120 dogs screened, 37(30.8%) were positive for one or more gastrointestinal helminths: males had a prevalence of 24(20%) while females had a prevalence of 13(10.8%). Prevalence of 29(24.1%) and 8(6.7%) was reported in young and adult dogs respectively. Of the different breeds of dogs sampled; the Nigerian local breed had the highest prevalence 21(17.5%) of gastrointestinal helminths, followed by German shepherd 8(6.7%), Rottweiller 5(4.2%), Boerboel 1(0.8%) Samoyed 1(0.8%) and Pitbull 1(0.8%). A statistically significant association ($p<0.05$) was recorded between gastrointestinal helminth infection and breed while no statistically significant association ($p>0.05$) was observed between age, sex and gastrointestinal helminth infection. Six different genera of helminths were recorded in this study: *Ancylostoma caninum* (17.5%), *Toxocara canis* (14.1%), *Toxascaris leonina* (2.5%), *Dipylidium caninum* (2.5%), *Trichuris vulpis* (1.7%) and *Taenia* spp (1.7%). The findings from this study indicated moderate prevalence of gastrointestinal helminth infection. The presence of *Ancylostoma caninum*, *Toxocara canis* and *Dipylidium caninum* infection in this study raises concern about the zoonotic potential of these parasites due to the close relationship between man and dogs.

Keywords: Dogs, Gastrointestinal parasites, Helminths, Mini-FLOTAC®, Salt, Sugar solution

Introduction

Dogs (*Canis familiaris*) have a close association with humans, providing security, companionship, and can be owned for various reasons such as hunting, herding livestock, guarding and business (Headey *et al.*, 2002, Ntampaka *et al.*, 2017, Chidumayo, 2018).

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 risk of infection because of their direct and indirect contact with dogs as compared to adults. Several reports incriminate dogs as hosts to various intestinal parasites with zoonotic importance, these infections are transmitted to humans through direct contact with infected dogs or exposure to environments contaminated with dog faeces (Degefu *et al.*, 2011; Moro & Abah, 2019).

The common enteric parasites of dogs are *Toxocara canis*, *Ancylostoma caninum*, *Taenia hydatigena*, Echinococcus spp, *Dipylidium caninum*, *Trichuris vulpis*, *Giardia* spp, *Cryptosporidium* spp and *Cystisospora canis* (Kahante *et al.*, 2009; Ayinmode *et al.*, 2016). These canine intestinal parasites have a faecal-oral transmission cycle and a major component for spread of these parasites is the shedding of eggs, oocysts, cysts and larvae into the environment (Claerebout *et al.*, 2009; Kahante *et al.*, 2009).

Dogs are frequently infected with intestinal parasites that are responsible for chronic asymptomatic type of infections, however, these infections pose serious health challenges to dogs, in which variety of clinical signs such as unthriftiness, malaise, irritability, mild diarrhoea, melena, vomiting, anorexia, anaemia, and poor hair coat, depending on the type of infection and burden of the parasite, have been reported (Ezema *et al.*, 2019; Moro & Abah, 2019).

The presence of gastrointestinal infection is confirmed usually by copromicroscopic technique, the most common being the direct faecal smear or floatation methods such as the simple tube floatation or centrifugal floatation (Maurelli *et al.*, 2014). The most utilized floatation techniques for canine parasite diagnosis are the floatation in tube and the Wisconsin technique (Mes *et al.*, 2007; Bergquist *et al.*, 2009).

The Mini-FLOTAC® is a promising diagnostic technique combining high sensitivity with low cost through an easy approach. It has a simple design, which is based on only two components, the base and the reading disc. The device includes also two 1ml flotation chambers designed for optimal examination of faecal sample suspensions (Cringoli *et al.*, 2013). Mini-FLOTAC® has already been validated for the diagnosis of most important human nematodes such as soil transmitted helminths and trematodes (*Schistosoma*) (Barda *et al.*, 2013) and it shows promising results in veterinary parasitology for the diagnosis of helminths in pets and livestock (Cringoli *et al.*, 2013).

Floatation solution used in copromicroscopy study include but not limited to the use of Sheather's solution, saturated sodium chloride solution, sodium nitrate solution, magnesium sulfate and zinc sulfate solution (MAFF, 2006). Another potent but under-utilized floatation solution is the combination of sugar and salt solution which gives best result due to its specific gravity of 1.30, it has good viscosity and quality, inexpensive to prepare, gives a clear view when viewed under the microscope and it is environment friendly.

To date, to the best of our knowledge, various studies have been carried out on gastrointestinal parasites of dogs in different parts of Nigeria. Christopher *et al.* (2015) and Ehimiyein *et al.* (2018) carried out studies on dogs in Zaria, Kaduna State. Also in Ibadan, Oyo State, Ayinmode *et al.* (2016) and Sowemimo & Ayanniyi (2017) carried out different studies on dogs. Other studies were carried out in Plateau State (Chanding *et al.*, 2018), Maiduguri, Borno State (Ezema *et al.*, 2019), Abua area of Rivers State (Moro & Abah, 2019) and Lagos State (Olatunji, 2020) but none has been reported in Ogun State. To this end; this study aimed at determining the prevalence of gastrointestinal helminths of dogs in Abeokuta, Ogun State using combination of salt and sugar as floatation solution.

Materials and Methods

Study area

The study was conducted in Abeokuta, the largest city in Ogun State and capital of Ogun State, Nigeria. It is situated on the east bank of the Ogun River, near a group of rocky outcrops in a wooded savanna. It lies between Latitude 7°9'39" N and Longitude 3°20'54" E. It has an estimated population of 449,088 (Hoiberg, 2010).

Sampling area

Samples were collected from three (3) Veterinary clinics in Abeokuta namely: Veterinary Teaching Hospital, Federal University of Agriculture Abeokuta, Ogun State Veterinary Hospital Complex, Ita-Eko and Arojo Veterinary Services; a private outfit. The choice of the Veterinary Clinics was based on their

strategic locations in the city and high patronage of clients they enjoyed. The Veterinary Teaching Hospital can be regarded as a tertiary health center for the other two veterinary clinics and various others in the state.

Sample collection and processing

Dogs recruited in this study were classified into two groups based on their age; those less than one year from the clinic records were classified as young dogs and those from one year and above were regarded as adults. Other parameters that were documented are the sex and breed of the dogs. Between February to September 2018, 120 faecal samples were collected from properly restrained dogs per rectum with a gloved finger and dispensed into universal sample bottles and labeled appropriately, before being transported in ice box to the Parasitology Laboratory, of the Department of Veterinary Microbiology and Parasitology, College of Veterinary Medicine, Federal University of Agriculture, Abeokuta, Ogun State for further analysis.

Floatation solution preparation

Combination of salt and sugar at a specific gravity of 1.3 was used as floatation solution for this study. It was prepared according to the protocol of RVC/FAO (2021). The prepared solution was stored in a covered container with daily determination of specific gravity before use.

Faecal analysis

Using the MINI-FLOTAC® kit, University of Naples, Italy; two grams (2g) of collected faeces per dog was weighed, 18ml of the salt and sugar floatation solution was added using the calibrated cone in the kit, and the MINI-FLOTAC® cup, and these were then homogenized. Using the filling holes, the floatation chambers of the MINI-FLOTAC® reading disc were filled with faecal suspension until each of the 2 holes were filled up, to avoid formation of air bubbles, the floatation chambers were filled with the Mini-FLOTAC® apparatus held at a slope. The Mini-FLOTAC® reading disc was allowed to stand for 10 minutes, after expiration of 10 minutes, the key was used to translate the reading disc (Cringoli *et al.*, 2017).

Data analysis

Data obtained were entered into Microsoft excel spread sheet. Obtained data were subjected to descriptive statistical analysis using percentages for prevalence across different age, sex and breed; Chi square test was adopted to determine association between variables (age, sex and breed) and presence/ absence of gastrointestinal helminth eggs using the Statistical Package for Social Sciences (SPSS) Version 20 with $p \leq 0.05$ taken to be significant.

Results

A total of 120 dogs were sampled in this study, 37(30.8%) of which were positive for one or more genera of gastrointestinal helminth.

Six genera of helminths were recorded in this study with the following prevalence; *Ancylostoma caninum* (17.5%), *Toxocara canis* (14.1%), *Toxascaris leonina* (2.5%), *Dipylidium caninum* (2.5%), *Trichuris vulpis* (1.7%) and *Taenia* spp (1.7%), across the various age, sex and breed of dogs sampled in the study (Table 1).

Ninety-five (95) young dogs were sampled in this study out of which 29(24.1%) were positive for one or more genera of gastrointestinal helminth. Twenty-five adult dogs were sampled and 8 (6.7%) were positive for one or more gastrointestinal helminth infection. Statistical analysis revealed no significant ($p > 0.05$) relationship between the age of dogs and the presence or absence of gastrointestinal helminth (Table 2).

Seventy-two (72) male dogs were sampled in this study, of which 24(20%) were positive for one or more genera of gastrointestinal helminth. Forty-eight female dogs were sampled in this study and 13 (10.8%) were positive for one or more genera of gastrointestinal helminth. Statistical analysis revealed that the level of significance was higher than that set for the study ($p>0.05$) indicating that there was no significant relationship between the sex of the dog sampled in this study and the presence or absence of gastrointestinal helminth

Table 1: Gastrointestinal parasites detected and their prevalence

Parasites	No. infected	Prevalence (%)
Ancylostoma caninum	21	17.5
Toxocara canis	17	14.1
Toxascaris leonine	3	2.5
Dipylidium caninum	3	2.5
Trichuris vulpis	2	1.7
Taenia spp	2	1.7

Table 2: Prevalence of gastrointestinal helminth infection across the ages, sex and breeds of dogs sampled in this study (n=120)

Variable	No. examined	No. Infected	Prevalence (%)	OR(95%CI)	P-value
Age					
Young (<1 year)	95	29	24.1	1.0(0.35-2.8)	1.0
Adult (>1 year)	25	8	6.7	Ref	
Total	120	37	30.8		
Sex					
Male	72	24	20	1.4(0.56-3.3)	0.6
Female	48	13	10.8	Ref	
Total	120	37	30.8		
Breed					
Boerboel	24	1	0.8	Ref	
Nigerian local breed	40	21	17.5	25.42(3.13-206.8)	0.000*
German shepherd	34	8	6.7	7.1(0.8-60.9)	0.09
Rottweiller	10	5	4.2	23(1.763-11330	0.01*
Caucasian	7	-	-	1.6(0.05-590.1)	0.6
Samoyed	1	1	0.8	1.6(0.05- 590.1)	0.3
Pitbull	3	1	0.8	23(0.2-1878)	0.4
Great Dane	1	-	-	11.5(0.01-939.8)	0.2
Total	120	37	30.8		

(Table 2). Of the sampled breed, Nigerian local breed had the highest prevalence 21(17.5%) of gastrointestinal helminth, followed by German shepherd with a prevalence of 8(6.7%), Rottweiller 5(4.2%), Boerboel 1(0.8%), Samoyed 1(0.8%) and Pitbull 1(0.8%). Statistical analysis showed that there is a significant ($p<0.05$) relationship between the breeds of dogs and the presence or absence of gastrointestinal helminth (Table 2).

Discussion

Gastrointestinal parasites of dogs are among the most common pathogenic agents encountered by veterinarians dedicated to companion animals; they are one of the main causes of mortality in dogs (Martínez-Moreno *et al.*, 2007) and poses danger to the animals, the owners and the veterinarians as several of canine intestinal parasites are considered zoonotic and of public health importance (Moro & Abah, 2019).

The prevalence of gastrointestinal helminth infection in this study is lower compared to reports of 33.4% among dogs presented to the veterinary clinic, slaughtered dogs and collected faeces of dogs on the streets in Zaria, Kaduna State (Ogbaje *et al.*, 2015), 38.0% among hunting dogs in Borno State (Mustapha *et al.*, 2016), 43.3% in dogs` faeces shed on the street of Ibadan, Oyo State (Ayinmode *et al.*, 2016), 47.1% among community dogs in Ilesa, Osun State (Sowemimo & Ayanniyi, 2017), 65.0% among community dogs in Abua area of Rivers State (Moro & Abah, 2019) and 66.1% among slaughtered and household dogs in Jos, Plateau (Kutdang *et al.*, 2010). However, the findings from this study is higher when compared to an epidemiological study carried out among dogs presented to veterinary clinics in Ibadan by Sowemimo & Asaolu (2008) with a prevalence of 24.7%. These previous reports together with the findings from this study confirms that canine gastrointestinal parasites are endemic in Nigeria.

In comparison to findings in other parts of the world, the prevalence in this study was higher when compared to a study carried out in Calgary Alberta by Joffe *et al.* (2011) with a value of 16.5%, and lower to a study carried out in Durban and Coast, South Africa by Mukaratirwa & Singh (2010), Ethiopia by Dagmawi *et al.* (2012) and Central Queensland by Gillespie & Bradbury (2017) with prevalences of 85.2%, 86.8% and 40% respectively. Reason for the difference in prevalence might be due to various factors, such as premium placed on dog, lack of awareness of zoonotic parasites by dog owners, indiscriminate feeding, poor level of hygiene by dog owners and lack of veterinary services in the area.

The parasites detected in this study is in agreement with what Sowemimo & Ayanniyi (2017) reported in a study carried out in Ilesa, Osun State with *Toxocara canis*, *Ancylostoma caninum* and *Dipylidium caninum* been the most prevalent gastrointestinal helminths reported in the study.

Prevalence of the gastrointestinal helminths reported in this study are lower compared to values reported by Kutdang *et al.* (2010) in a study carried out in Jos, Plateau State who reported a prevalence of 11.8% for *Dipylidium caninum*, 50.1% for *Ancylostoma caninum*, 31.8% for *Toxocara canis* and 12.9% for *Taenia* spp. However, this study revealed a higher prevalence when compared to the report of Christopher *et al.* (2015) in Northern Nigeria (Zaria), which reported a prevalence of *Toxocara canis* (8%), *Ancylostoma caninum* (8%) and *Taenia* spp (5%). Ancylostoma spp had the highest prevalence among the intestinal parasites detected in this study which is in agreement with the findings of Olatunji (2020) in Lagos metropolis. It however, disagrees with the findings of Sowemimo & Ayanniyi (2017) who reported *Toxocara canis* as the most frequently observed helminth with a prevalence of 30.5% while *Ancylostoma caninum* and *Dipylidium caninum* had prevalence of 28.2% and 9.8% in their study carried out in Ilesa, Osun State.

In relation to studies done in other parts of the world, prevalence of gastrointestinal parasites was lower when compared with the reports of Getahun & Addis (2012) in Ethiopia who reported prevalence of 32.8% *Ancylosotoma* spp, 26.6% *Toxocara canis*, 21.6% *Dipylidium* spp, 22.4% *Taenia* spp and 8.6% Trichuris spp., Mukaratirwa and Singh (2010) reported 53.8% Ancylostoma spp, 7.9% Trichuris spp, 7.9% *Toxocara canis* and 0.4% *Toxascaris leonina* in a study carried out in South Africa. The demonstration of *Ancylostoma caninum* and *Toxocara canis* in this study and its presence in earlier reports in other States of the country may suggest the possibility of its endemicity in the country.

Prevalence of gastrointestinal helminths across age group agrees with previous findings that reported high prevalence of intestinal parasites among puppies in studies conducted in Jos, Plateau State (Kutdang *et al.*, 2010), Bahir Dar Town, Ethiopia (Getahun and Addis, 2012) and Ilesa, Osun State (Sowemimo & Ayanniyi, 2017). The reason for the increase in the prevalence of intestinal parasites among young dogs could be due to the interaction of the puppies with the soil and trans-mammary infection from the bitches.

Prevalence of intestinal parasites among the sexes recorded in this study revealed a high prevalence among the males, which correlates with the reports of Kutdang *et al.* (2010) and Sowemimo & Ayanniyi (2017) who reported a high prevalence of intestinal parasites in male dogs compared to female in studies conducted in Jos, Plateau State and Ilesa, Osun State respectively. The high prevalence of gastrointestinal helminthes in male dogs might be due to the fact that they tend to travel long distances to search for female partners during the breeding season (Mustapha *et al.*, 2016) which could increase their susceptibility to infection.

In relation to the breeds of dogs sampled in this study, the Nigerian local breed had the highest prevalence for gastrointestinal parasite when compared to the exotic breeds which is in concert with the study of Pam *et al.* (2015) and Moro & Abah (2019) who reported high prevalence of gastrointestinal parasites in local breeds of dogs when compared to the exotic breeds in Jos, Plateau State and Abua area of Rivers State respectively. The higher prevalence in local breeds of dogs in this study, does not agree with the findings of Kutdang *et al.* (2010) that reported a higher prevalence in Alsatians 91%, with local and mixed breeds having 66% and 52.6% respectively in a study conducted in Jos, Plateau State. Getahun & Addis (2012) also reported that the exotic breed had a higher prevalence of 81.3% for intestinal parasites compared to the local breed 76.6% in Bahir Dar Town, Ethiopia. The reason for the increase in prevalence of intestinal helminth in local breeds of dogs could be due to the fact that most owners of local dogs do not take proper care of the dogs and most times the dogs are left to fend for themselves by roaming freely in the community.

The Mini-FLOTAC® was used with salt and sugar floatation solution in this study because of its high specific gravity of 1.30 which was able to effectively float gastrointestinal helminth from six different genera, belonging to the class Nematoda and Cestoda. The presencea of *Ancylostoma caninum*, *Toxocara canis* and *Dipylidium caninum* infection with high prevalence in this study raises concern about the zoonotic potential of these parasites due to the close relationship between man and dogs, thus public awareness is recommended. Also, necessary measures should be taken to prevent transmission of disease to humans.

Conflict of Interest

The authors declare that there is no conflict of interest.

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