

Prevalence of Blood Parasites in Dogs of Federal Capital Territory, Abuja, Nigeria

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ABSTRACT The complex public health challenge associated with the symbiotic relationship between humans and companion animals tend to alter the physiological attributes of humans and their pets. Thus, a study on the prevalence of blood parasites in dogs of FCT, Abuja, Nigeria was carried out from August to October, 2019. Blood samples were collected from 99 dogs and examined using thin smear microscopy. Also, the packed cell volume (PCV) of each sample was measured. Out of the 99 dogs screened, 48 (48.5%) were infected with one or more blood parasites. Exotic breeds had higher prevalence of infection 41 (48.9%) than the local breeds 7 (46.7%), but the difference was not significant ($P = 1$). *Dirofilaria* species was the most prevalent blood parasite. Variations in prevalence between blood parasite species was highly significant ($\chi^2 = 30.698$, $df = 5$, $P < 0.0001$). Parasitic infection in relation to dog varieties varied significantly ($\chi^2 = 123.94$, $df = 9$, $P < 0.001$). Cane corso was the most infected 2 (100.0%). Dogs from Wuse area were the most infected 10 (71.4%). Hence, blood parasitic infection in dogs in relation to locations showed a high significant difference ($\chi^2 = 11.898$, $df = 3$, $P < 0.01$). Adult dogs were more infected 34 (53.1%) than puppies 14 (40.0%), nevertheless, the difference was not significant ($\chi^2 = 1.0793$, $df = 1$, $P = 0.2989$). Prevalence of blood parasites in dogs was higher in male dogs 27 (54.0%) than in females 21 (42.9%) but the difference was not significant ($\chi^2 = 0.82454$, $df = 1$, $P = 0.3639$). The mean PCV level was significantly low in infected dogs compared to uninfected dogs. The four zoonotic parasites recorded in this study are of public health importance and calls for an urgent need for a One Health survey.

KEYWORDS: Dog breeds, Blood parasites, PCV, Zoonotic parasites, Public health, One Health, FCT-Abuja

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INTRODUCTION

Canis lupus familiaris (dog) is a domestic subspecies of the wolf, a mammal of the Canidae family of the order Carnivora. Dogs are not only “man’s best friend”, but they can also be trained to be man’s best helpers in many ways. For instance, guide dogs are trained to guide blind people through their daily activities, and also serve as family companions. Despite their importance in the daily lives of humans, dogs are susceptible to various diseases, ailment and poisons, some of which affect humans too (Macpherson *et al.*, 2013).

Infectious diseases commonly associated with dogs include rabies (hydrophobia) canine parvovirus, and canine distemper. Congenital disease of dogs can include a wide range from hip dysplasia and medial patellar luxation to epilepsy and pulmonic stenosis. Endoparasite infections have always been major problems in animal species. These blood parasites affect the blood vascular system, which may be the intra-erythrocytic parasite, the intra-leukocytic parasite or those living freely. The common blood parasites in dog are *Babesia*, *Trypanosoma* and *Ehrlichia* (Gadahi et al., 2008; Taylor et al. 2015; Phuyal et al., 2017).

Some studies in Nigeria have reported the presence of blood parasites in dogs (Leefflang et al., 1976; Jegede et al., 2014, Obeta et al., 2020; Oguche et al., 2020). However, there is paucity of information on blood parasites in dogs of Nigeria's capital city. Hence, the need for the study on prevalence of haemoparasites in dogs of FCT, Abuja, Nigeria. An association was also drawn between the prevalence of blood parasites in dogs and PCV status in the present study.

MATERIALS AND METHODS

Study Area

The study was carried out in the Federal Capital Territory (FCT) Abuja, Nigeria. Abuja is located in the centre of Nigeria and has a land area of 8000 square kilometer. It is bounded to the north by Kaduna State and on the south-west by Kogi State (FCDA Information, 2017).

Sample Collection and Processing

Blood samples were collected from ninety-nine (99) dogs presented to four veterinary clinics spreading across Wuse, Banex, Gwarimpa, and Kubwa areas between August and October, 2019. The biodata (i.e. sex, age, breed, and variety) of the dogs to be screened for blood parasites was recorded. Blood parasites were identified by obtaining blood from each animal (dogs) by veno-puncture of the cephalic vein and ethylene diamine tetra acetic acid (EDTA) bottle was used as anticoagulant (Phuyal et al., 2017). Each sample after collection was examined microscopically using thin smear, stained with giemsa stain, and examined for blood parasites as described by Phuyal et al. (2017).

Statistical Analysis

Data obtained were expressed in simple percentages and analyzed using R Console software (Version 3.2.2). Pearson's Chi-square test was used to compare the prevalence of blood parasites infection in dogs in relation to breed, varieties of dogs, locations, age groups, sex, as well as PCV status of the investigated dogs. The level of significance was set at $P < 0.05$.

RESULTS AND DISCUSSION

Prevalence of Blood Parasites in Dogs of FCT, Abuja

Out of the 99 dogs screened, 48 (48.5%) were infected with blood parasites in which the exotic breed had higher prevalence 41 (48.9%) than the local breed 7 (46.7%) as shown in Table 1. However, the prevalence rate of blood parasites in relation to breed showed no significant difference ($\chi^2 = 3.7599 \times 10^{-32}$, $df = 1$, $P = 1$). The about 50% prevalence of blood parasites in dogs of FCT, Abuja in this study is considerably high and of public health importance. The high prevalence of blood parasites in the FCT dogs may be attributed to the poor hygiene conditions in the areas where they are confined to. This agrees with the findings of Phuyal et al. (2017), Sabūnas et al. (2019), Obeta et al. (2020) and Oguche et al. (2020) who recorded the presence of blood parasites in dogs. The lack of variation in the prevalence of blood parasites in dog breeds clearly suggests that the parasites have no preferred breed, rather all breeds are vulnerable to parasitic infection. A similar report was made by Bhatta et al. (2018) who

observed that type of dog breed in Kathmandu Valley, Nepal had no significant effect on the prevalence of blood parasites.

Table 1. Checklist of parasites and their prevalence in dog breeds of FCT, Abuja between August and October, 2019

Dog Breed	No. examined	Prevalence of parasites identified (%)						Total (%)
		<i>Anaplasma</i>	<i>Babesia</i>	<i>Dirofilaria</i>	<i>Hepatozoon</i>	<i>Leishmania</i>	<i>Trypanosoma</i>	
Exotic breed								
Boerboel	3	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.0)
Cane corso	2	0(0.0)	0(0.0)	1(50.0)	0(0.0)	0(0.0)	1(50.0)	2(100.0)
Caucasian	19	0(0.0)	0(0.0)	4(21.1)	1(5.3)	1(5.3)	4(21.1)	10(52.6)
Dalmatian	2	0(0.0)	0(0.0)	1(50.0)	0(0.0)	0(0.0)	0(0.0)	1(50.0)
German shepherd	28	2(7.1)	0(0.0)	4(14.3)	3(10.7)	1(3.6)	4(14.3)	14(50.0)
Lhasa apso	12	0(0.0)	2(16.7)	2(16.7)	2(16.7)	0(0.0)	0(0.0)	6(50.0)
Mastiff	5	0(0.0)	0(0.0)	0(0.0)	1(20.0)	0(0.0)	0(0.0)	1(20.0)
Rottweiler	9	0(0.0)	0(0.0)	0(0.0)	2(22.2)	0(0.0)	3(33.3)	5(55.6)
Samoyed	4	0(0.0)	0(0.0)	1(25.0)	0(0.0)	0(0.0)	1(25.0)	2(50.0)
Subtotal (%)	84							41(48.8)
Local breed								
Mongrel	15	0(0.0)	0(0.0)	5(33.3)	2(13.3)	0(0.0)	0(0.0)	7(46.7)
Subtotal (%)	15							7(46.7)
Total (%)	99	2(2.0)	2(2.0)	18(18.2)	11(11.1)	2(2.0)	13(13.1)	48(48.5)

Of the ten (10) varieties of dogs screened, parasites were dominant in Cane corso 2 (100.0%), followed by Rottweiler 5 (55.6%), then Caucasian 10 (52.6%), Dalmatian, German shepherd, Lhasa, and Samoyed which had a prevalence of 50.0% each, Mongrel 7 (46.7%), Mastiff 1 (20.0%), while Boerboel was uninfected 0 (0.0%). Thus, there was very high significance difference ($\chi^2 = 123.94$, $df = 9$, $P < 0.001$) in the prevalence of blood parasite in relation to dog varieties. The 100% prevalence of parasitic infection in Cane corso over other dog varieties possibly suggests their fragile, inadequate immunogenic response and susceptible nature to haemoparasites, and the need for owners of such variety of dog to pay close attention to the overall hygiene condition of the area where they are kept. On the other hand, Phuyal *et al.* (2017) reported a higher prevalence of blood parasite in German shepherd.

Composition of Blood Parasites in Dogs of FCT, Abuja

Table 1 shows that the most prevalent blood parasite in dogs of the six genera recorded was *Dirofilaria* 18 (18.2%), followed by *Trypanosoma* 13 (13.1%), the *Hepatozoon* 11 (11.1%), while the least were *Babesia*, *Anaplasma*, and *Leishmania* 2 (2.0%). Therefore, the prevalence rate between blood parasite species in dogs showed a very high significant difference ($\chi^2 = 30.698$, $df = 5$, $P = 0.00001074$). Four genera (*Dirofilaria*, *Trypanosoma*, *Babesia*, and *Leishmania*) of the six blood parasites recorded in this study have been reported to be zoonotic (Macpherson *et al.*, 2013; Capelli *et al.*, 2018; Sabūnas *et al.*, 2019) which are of public health concern and shouldn't be taken for granted. The very high prevalence of *Dirofilaria* 18 (18.2%) in dogs of FCT, Abuja is in line with the findings of Ogbaje and Danjuma (2016) who recorded high prevalence of *Dirofilaria* in dogs of Makurdi, Benue State, Nigeria. Also, Joshua and Gonzalez-Miguel (2020) observed from thirteen published studies that *Dirofilaria* prevalence was high in Nigeria. Similarly, Capelli *et al.* (2018) showed that *Dirofilaria* is expanding its distribution in Europe which is seen as an emergent pathogen that is paradigmatic. Furthermore, Sabūnas *et al.* (2019) found autochthonous *D. repens* infection in dogs and humans in Lithuania. This is not in agreement with studies by Manandhar & Rajawar (2008) and Maharjan (2014) who reported *Ehrlichia* spp. (11.43%) and *Babesia* spp. (9.09%) respectively to be predominant over other blood parasites.

Location-Wise Prevalence of Dogs Parasitic Infection in FCT, Abuja

Dogs from Wuse area were the most infected with blood parasites 10 (71.4%), followed by those from Kubwa 12 (63.2%), Gwarinpa 13 (59.1%), while the least infected were dogs from Banex 13 (29.5%) as shown in Table 2. Hence, blood parasitic infection in dogs in relation to the four locations showed a high significant difference ($\chi^2 = 11.898$, $df = 3$, $P = 0.00774$). The location-wise variation in the prevalence of blood parasites may possibly be due to differences in microclimatic conditions across the areas which likely supports the breeding success of potential vectors. This agrees with Jegede *et al.* (2014) who reported the prevalence of blood parasites in Gwagwalada Area Council of the Federal Capital Territory, Abuja, Nigeria.

Table 2. Prevalence of blood parasites in dogs in relation to locations in FCT, Abuja

Location	No. examined	No. infected (%)
Wuse	14	10(71.4)
Kubwa	19	12(63.2)
Gwarinpa	22	13(59.1)
Banex	44	13(29.5)
Total	99	48 (48.5)

Age-Wise Prevalence of Dogs Parasitic Infection

Adult dogs were more infected 34 (53.1%) with blood parasites than puppies 14 (40.0%) (Table 3). Nevertheless, there was no significant difference ($\chi^2 = 1.0793$, $df = 1$, $P = 0.2989$) in the prevalence of blood parasites in dogs in relation to age groups. Adult dogs were more infected probably due to greater neglect by pet owners who prefer to care more for dogs less than 1 year of age compared to older dogs. This agrees with the studies of Gadahi *et al.* (2008), Subedi (2009), Jalali *et al.* (2013) and Elom *et al.* (2015) who found that dogs older than 1 year of age were more infected.

Table 3. Prevalence of blood parasitic infection in dogs in relation to age groups

Age group	No. examined	No. infected (%)
Puppy	35	14(40.0)
Adult	64	34(53.1)
Total	99	48(48.5)

*Sex-Wise Prevalence of Dogs Parasitic Infection***Table 4.** Prevalence of blood parasitic infection in dogs in relation to sex

Sex	No. examined	No. infected (%)
Male	50	27(54.0)
Female	49	21(42.9)
Total	99	48(48.5)

Prevalence of blood parasites in dogs was higher in male dogs 27 (54.0%) than females 21 (42.9%) as shown in Table 4. However, blood parasitic infection in dogs between males and females showed no significant difference ($\chi^2 = 0.82454$, $df = 1$, $P = 0.3639$). Despite the lack of variation in the prevalence of blood parasites in relation to sex, yet more males were infected. This finding in this study is similar to studies by Subedi (2009) and Papa (2016) who reported high prevalence in male dogs than females. On the contrary, Gadahi *et al.* (2008) and Elom *et al.* (2015) found that female dogs were more infected with blood parasites than males.

Prevalence of Dogs Parasitic Infection in relation to PCV Status

The standard PCV range in dogs is between 35.0% and 45.0%, but Table 5 shows that most dogs were below the standard PCV range in which all of them in that category 48 (100.0%) were infected, while those whose PCV levels fell within and above the standard PCV range had no blood parasitic

infection 0 (0.0%). Thus, there was a very high significant difference ($\chi^2 = 65$, $df = 2$, $P < 0.0001$) in the prevalence of parasitic infection in dogs in relation to their PCV status. All infected dogs were strongly associated with very low PCV status (i.e. below the standard range). This may be due to immune mediated damage to the bone marrow stem cells caused by blood parasites. This is in agreement with work by Maharjan *et al.* (2014) who found a lower mean PCV in infected dogs than the non-infected dogs. Also, low PCV can be attributed to immune mediated phenomena by auto antibodies directed against component of membrane of infected and uninfected erythrocytes, production of toxic hemolytic factors of the parasite, mechanical damage by trophozoite intraerythrocytic binary fission, erythrophagocytosis, and through release of vasoactive molecules such as kallikrein (Brockus & Andreasen, 2003; Schetters *et al.*, 2009).

Table 5. The association between PCV Status and prevalence rate of blood parasitic infection in dogs

PCV Status	No. examined	No. infected (%)
PCV below standard range (<35%)	48	48(100.0)
PCV within standard range (35-55%)	37	37(0.0)
PCV above standard range (>55%)	14	14(0.0)

CONCLUSION

This study identified the prevalence of four zoonotic parasites (*Dirofilaria*, *Trypanosoma*, *Babesia* and *Leishmania*) and two non-zoonotic parasites (*Hepatozoon* and *Anaplasma*) in dogs of FCT-Abuja, in which higher prevalence of the parasites was seen in male dogs. High occurrence of the parasites was encountered in Cane corso dog variety while the least infected was Boerboel. The prevalence of blood parasite was higher in adults than puppies. Dogs with very low PCV level were significantly infected than dogs whose PCV was within and above the standard range respectively. Considering the extensive prevalence status of blood parasites among the different dog breeds in this study, a One Health holistic approach is required for the prevention and control of haemoparasites in dogs of FCT-Abuja. This may involve the active participation, and cooperation of dog owners, veterinary and allied professionals and government regulatory agencies at all levels.

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