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Prevalence of *Babesia canis* and *Hepatozoon canis* in Zaria, Nigeria

OO Okubanjo*, OA Adeshina, ID Jatau & AJ Natala

Department of Veterinary Parasitology and Entomology, Faculty of Veterinary Medicine, Ahmadu Bello University, Zaria- Nigeria

*Correspondence: Tel.: 2348033250890, E-mail: sokubanjo2005@gmail.com

Abstract

The study was carried out to show the prevalence of *Babesia canis* and *Hepatozoon canis* in dogs within Zaria. Between the months of May and August 2010, blood samples collected from 150 dogs were processed using Giemsa stained thin blood smear and examined for the presence of *B. canis* and *H. canis*. Of the 150 dogs sampled, 84 (56%) were males and 66 (44%) were females. 106 (70.7%) were adults aged 1 year and above while 44 (29.3%) were dogs below the age of 1 year. Local breeds numbered 111 dogs constituting (74%) of the total number sampled, while 20 (13.3%) and 19 (12.7%) were foreign and cross breed respectively. One hundred and five (70%) of all dogs sampled were unconfined while 45 (30%) were confined. *B. canis* and or *H. canis* occurred in 26(17.3%) dogs, of which 10(38.5%) and 12(46.2%) had single infection of the former and later respectively, while 4(15.4%) had mixed infections of both parasites. The occurrence of the haemoparasites was significantly higher (X^2 = 12.20, p < 0.05, OR= 4.467) in younger dogs than in the adults, but there was no statistically significant association between the occurrence of the parasites and the breed (X^2 = 0.3794, p > 0.05) or sex (X^2 = 1.237, p > 0.05) of the sampled dogs. All the infected dogs were as well infested by the tick vector *Rhipicephalus sanguineus* with the non-confined dogs having significantly higher (X^2 = 37.93, p < 0.05) tick infestation rates. The infestation rates in both confined and non-confined groups had no statistically significant association to the respective levels of haemo-parasitism.(X^2 = 0.1410, p < 0.05, OR= 1.24).

Keywords: *Babesia canis*, Dogs, *Hepatozoon canis*, Prevalence, Zaria.

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Introduction

Dogs are important household pets mostly kept for various other reasons which include security purposes (personal and military), sheep herding, protection against predators, hunting and leading of the blind. There has been increased interest in keeping dogs in Nigeria for security or pets and for food (Kamani *et al*., 2011). In Zaria, dogs are kept mainly as household guards and are generally free range with some being restricted in the daytime. The roaming nature of these dogs exposes them to various diseases including parasitism. Parasitism is one of the most serious health hazards in canine practice and the affected dogs may harbour parasites with zoonotic implications thereby constituting health hazard to their owners and public in general (Adejoke, 2005).

The climatic and topographic characteristics of Zaria are such that favour all year round propagation of ectoparasites which habour and transmit parasitic pathogens from one susceptible host to another (Natala *et al*., 2009). Thus, for the effective utilization of the potentials of dogs, it is of utmost importance that their health is maintained optimally. Proper understanding of the pattern of distribution of these pathogens in dog population is pertinent for the design of effective control strategies. The present study was carried out to determine the pattern of occurrence of *Babesia canis* and *Hepatozoon canis,* two of the most common and widely distributed canine haemoprotozoans. The study is in relation to some parameters such as age, sex, breed of dog and degree of confinement in Zaria of Kaduna State, Nigeria.

Materials and methods

Study area

The study was conducted in the metropolitan area of Zaria, Kaduna state, Nigeria. Zaria is a very large, heterogeneous city with a population of 1,490,000 coming from different parts of Nigeria. It is second in size only to Kaduna, the State capital. Zaria is located between latitude 11°07'N and longitude 7°44'E within the Northern guinea savanna zone. It possesses a tropical continental climate with a pronounced dry season, lasting up to six months (November-April). The rainy season lasts from late April to October. The average rainfall ranges from 1000-1250 mm and the average daily temperature ranges from 19-33°C.

Study population

A total of 150 dogs from several areas of Zaria metropolis were sampled from Sabon gari, Wusasa, Zaria city, Samaru, Ahmadu Bello University (A.B.U.) main campus, Palladan, Aviation quarters, Government Reservation Area (G.R.A) and Bethel. The choice of the dog numbers to be sampled in each area, depended largely on the permissions from owners to allow their dogs to be sampled. Dogs sampled included local dogs (Mongrels), foreign breeds and cross breeds. Cross breeds were considered to be crosses between foreign and local dogs.

Laboratory analysis

Blood samples were collected from the dogs via the cephalic vein and used to prepare thin blood smears which were stained with Giemsa and examined microscopically for the presence of *Babesia canis* and *Hepatozoon canis* (Adam *et al*., 1971). Identification of a large elongate rectangular gamont with acentrically placed nucleus in cytoplasm of neutrophil (Figure 1) and or large pyriform shaped merozoite within an erythrocyte (Figure 2) indicated that the particular dog from which the sample was taken, is infected with the *Babesia canis* and or *Hepatozoon canis* respectively (Soulsby, 1982).

Statistical analysis

The data collated were analyzed using descriptive statistics (percentages and tabulations). The *chi-squared* and *odds ratio* test was used to determine the association between the occurrence of *B. canis* and *H. canis* infection in relation to the age, sex, breed, tick infestation and degree of confinement of dogs in Zaria. Values of p<0.05 were considered significant.

Results

The prevalence of *Babesia canis* and *Hepatozoon canis* infection in dogs sampled from different parts of Zaria metropolitan area is shown in Table 1. Out of the 150 dogs sampled 26 (17.3%) had *B. canis* and or *H. canis* infection. Ten (38.5%) and 12 (46.2%) of the infected dogs habour single infection of *B. canis* and *H. canis*, respectively, while 4 (15.4) had mixed infections of *B. canis* and *H. canis.* There was no statistically significant association (X^2 = 14.80, p > 0.05) between occurrence of *B. canis* and *H. canis* and area of sample collection in Zaria.

Table 2 shows the prevalence of *B. canis* and *H. canis* in Zaria based on the sex of sampled dogs. Of the 150 dogs sampled, 84 (56%) were males while 66 (44%) were females. Sex specific rates of haemoprotozoan (*Babesia canis* and *Hepatozoon canis*) infections were 14.3% and 21.2% respectively for male and female dogs. The infected male dogs had 19.2% infection rates each for single *B. canis* and *H. canis* respectively, while only 7.7% of them had mixed infection with both parasites. Single *H. canis* infection rate (26.9%) was higher in the female infected dogs than single *B. canis* infection (19.2%). Mixed infections by both parasites was similarly lower (7.7%) in the female dogs. There was no significant association (X^2 = 1.237, p > 0.05, OR = 0.6190) between sex and occurrence of the haemoparasites. The age distribution of *B. canis* and *H. canis* infection in dogs in Zaria is given in Table 3. Dogs of less than 1 year of age had significantly (X^2 = 12.20, p < 0.05, OR= 4.467) higher rate (34.1%) of infection than the adult dogs (10.4%). The rates of single and mixed infections in the younger dogs were 53.3%, 40% and 6.7% for single *H. canis*, single *B. canis* and mixed infections with the two parasites respectively. In the adult dogs however 36.4% each of the infected dogs had single *B. canis* and *H. canis* infections, and 27.3% of them had mixed infections of both parasites.

Table 4 describes the breed distribution of *Babesia canis* and *Hepatozoon canis* in dogs in Zaria. The breed specific rate was higher in the cross breeds (21.1%) followed by foreign breeds (20%) and least in the local breeds (16.2%). The single and mixed species infection rates were 33.3%, 50% and 16.7% in the local breed of dogs for *B. canis, H. canis* and mixed infections respectively. Infected cross breeds and foreign breeds of dogs each had a 50% infection rate for *B. canis.* The cross breeds had in addition 25% infection rates each for both single and mixed infections of *H. canis.* However, the infected foreign breeds of dogs had no record of mixed infection. There was however no statistically significant (X^2 = 0.3794, p > 0.05) association between the breeds of dogs sampled and the occurrence of the infections. Table 5 describes the prevalence of tick infestation and haemo-parasitism in dogs in Zaria in relation to the dogs' confinement. Of the 150 dogs sampled 113 (75.3%) were infested with ticks. Twenty-six (23%) of the tick infested dogs had *B. canis* and or *H. canis* infections, while 87 (77%) of the dog infested with tick had no haemo-parasitic infection. Non confined dogs had a higher rate of tick infestation (89.5%) than in the confined dogs (42.2%). The rates of haemo-parasitic infections in the tick infested confined and non confined dogs were 26.3% and 22.3% respectively. There was statistically significant association (X^2 = 37.93, p < 0.005) between degree of confinement and occurrence of tick infestation. In comparing the number of tick infested dogs in both confined and non-confined groups with the presence of haemo-parasites in such infested animals, there was no statistically significant association present (X^2 = 0.1410, p < 0.05, OR= 1.24).

Table 1: Prevalence of *Babesia canis* and *Hepatozoon canis* in dogs in Zaria.

Sample area	No. Of dogs sampled	No. (%) infected	No. (%) infected with *B. canis*	No. (%) infected with *H. canis*	No. (%) with mixed infection
S/gari	18	4	3	-	1
Wusasa	10	3	1	2	-
Zaria city	8	3	1	1	1
Samaru	31	7	2	3	2
ABU	35	3	2	1	-
Palladan	17	5	1	4	-
Aviation	10	-	-	-	-
GRA	7	-	-	-	-
Bethel	14	-	-	1	-
Total	150	26 (17.3)	10 (38.5)	12 (46.2)	4 (15.4)

X^2 = 14.80, df= 8, p= 0.0631

Table 2: Sex distribution of *Babesia canis* and *Hepatozoon canis* infection in dogs in Zaria.

Sex	No. of dog sampled	No. (%) infected	No. (%) with *B. canis* infection	No. with *H. canis* infection	No. (%) with mixed infection
Male	84	12 (14.3)	5 (19.2)	5 (19.2)	2 (7.7)
Female	66	14 (21.2)	5 (19.2)	7 (26.9)	2 (7.7)
Total	150	26 (17.3)	10 (38.5)	12 (46.2)	4 (15.4)

X^2 = 1.237, df= 1, p = 0.2660, OR= 0.6190, (CI = 0.2647 to 1.448)

Table 3: Age distribution of *Babesia canis* and *Hepatozoon canis* infection in dog in Zaria.

Age	No. of dog sampled	No. (%) infected	No. (%) with *B. canis* infection	No. with *H. canis* infection	No. (%) with mixed infection
Young (< 1 year)	44	15 (34.1)	6 (40)	8(53.3)	1(6.7)
Adult (> 1 year)	106	11 (10.4)	4 (36.4)	4 (36.4)	3 (27.3)
Total	150	26 (17.3)	10 (38.5)	12 (46.2)	4 (15.4)

X^2 = 12.20, df= 1, p = 0.0005, OR= 4.467, (CI = 1.848 to 10.80)

Table 4: Breed distribution of *Babesia canis* and *Hepatozoon canis* infection in dogs in Zaria

Breed	No. of dog sampled	No. (%) infected	No. (%) with *B. canis* infection	No. with *H. canis* infection	No. (%) with mixed infection
Foreign	20	4 (20)	2 (50)	2 (50)	0
Cross	19	4 (21.1)	2 (50)	1(25)	1(25)
Local	111	18 (16.2)	6 (33.3)	9 (50)	3 (16.7)
Total	150	26 (17.3)	10 (38.5)	12 (46.2)	4 (15.4)

X^2 = 0.3794, df= 2, p = 0.8272

Table 5: Prevalence of tick infestation and haemoprotozoan parasitism in dogs in Zaria in relation to confinement

Confinement	No. of dog sampled	No. (%) of dogs with tick infestation	No. (%) of tick infested dogs with haemoparasite infection				No. (%) of tick infested dogs without haemoparasite infection
			B. canis	*H. canis*	mixed	Total	
Confined	45	19(42.2)	2 (10.5)	2 (10.5)	1(5.3)	5 (26.3)	14 (73.7)
Not confined	105	94(89.5)	8 (8.5)	10 (10.6)	3(3.2)	21 (22.3)	73 (77.3)
Total	150	113 (75.3)	10 (8.8)	12 (10.6)	4 (3.5)	26 (23)	87 (77)

X^2 = 37.93, df= 1, p = 0.0001, OR= 0.08552, (CI = 0.0317 to 0.2022)

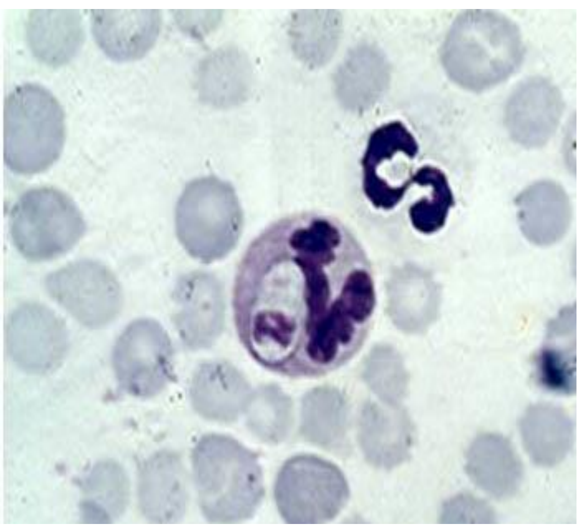

Plate I: Giemsa stained thin blood smear showing *H. canis* in neutrophil (X1000)

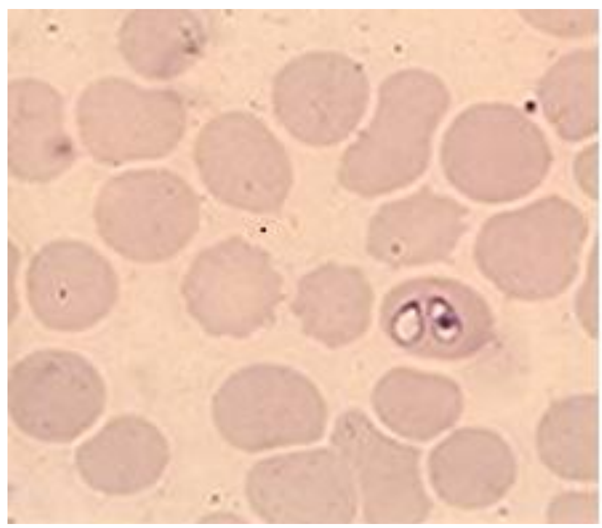

Plate II: Giemsa stained thin blood smear showing *B.canis* in red blood cell (X1000)

Discussion

Babesia canis and *Hepatozoon canis* are among the most widely distributed haemo parasites of dogs occurring in almost anywhere their tick vector *Rhipicephalus sanguineus* is reported (Taylor *et al*, 2007). The former is highly pathogenic and is the major cause of haemolytic anaemia in dogs in the tropics (Kamani *et al*, 2011) while the later is in most cases associated with mild infection (Taylor *et al*, 2007). The present study shows a 17.3% prevalence of haemoparasitic infection in dogs in Zaria. This is lower than the 42.1% previously reported by Kamani *et al*. (2011) in Vom, Plateau state Nigeria. Differences in climatic conditions as well as proper Veterinary services due to presence of Veterinary teaching hospital in Zaria may have contributed to the lower prevalence in Zaria.

Younger dogs of less than one year of age have significantly higher rate of infection than the adult dogs. This agrees with previous reports that younger dogs are more susceptible to babesiosis and hepatozoonosis due to their underdeveloped immune system (Taylor *et al*, 2007; Ivanov & Tsachev, 2008). Unconfined dogs had higher infestation rates with the tick vector *Rhipicephalus sanguineus* and this is consistent with the findings of Amuta *et al* 2010. This could be attributed to the roaming nature of the non-confined dog that predisposes them to attachments by various stages of the ticks. Some owners may effect tick control but due to their inability to put their dogs on leash, the dogs still go out and get infested with the tick vector, resulting in a total waste of resources in controlling the tick vector, also the high tick infestation could be attributed to the seasonal upsurge in tick population in Zaria between the months of June and August (Natala *et al,* 2009). The nature of the lifecycle of the tick could also be responsible for the degree of tick infestation, being a 3-host tick; all the developmental stages of the tick may not be found on the same host, thereby making control very difficult (Urquhart *et al,* 1996).

All the dogs infected with the haemoparasites were as well infested with the tick vector indicating that the tick is responsible for the transmission of the parasites. However, higher proportion of the tick infested dogs were not harbouring the parasites which implies that majority of the tick vectors are clean of infection by *B. canis* or *H. canis* in the sample area. Inspite of the fact that there was statistically significant difference between the infestation rate between confined and non-confined dogs in this study, the presence of haemo-parasites as indicated by the infection rate in both groups was not statistically significant! In other words, whether the tick infestation was slight or heavy and occurred in the confined or non-confined group of dogs made no difference in the degree of parasitism as the level of parasitism within all groups of tick infested animals remained within the same range and were deemed statistically insignificant. This is really quite interesting as it seems to suggest that majority of the vectors either have been cleansed of their infections before feeding or were never infected in the first instance.

In the transtadially transmitted *H. canis* infection since the parasites are transmitted transtadially, subsequent developmental stages of the tick will be free of infection, hence tick infestation may be high but yet there will be less occurrence of the parasites in the dog population. In the transovarially transmitted *B. canis* infection, infected engorged adult female *Rhipicephalus sanguineus* ticks are expected to ensure entire generations of already infected ticks. There therefore should theoretically be an increase in the infection rate (haemo-parasites) as the rate of "infected" tick infestation increases. This has appears not to be the case in the study areas in Zaria. Perhaps the presence of the Veterinary Teaching Hospital and subsequent visits of most of the dogs sampled (data not shown) ensured the elimination of haemo-parasites and their vectors from dogs so presented in the hospital, with the concomitant reduction of ticks infected with haemo-parasites in the environment. Also the easy availability and use of Diminazene aceturate, Berenil® in dogs by Vets and non-Vets alike may have unwittingly caused the reduction of the haemo-parasites in the vertebrate hosts available for infection or re-infection in the tick vector. The resulting implication is a generation of ticks cleansed of haemo-parasites in the study area prompting the belief that the host-vector-parasite dynamics have been changed, atleast in the study area, a phenomenon that needs further study. Sex did not appear to be a factor on the rate of the haemo-parasitic infection in the present study which may be attributed to similar management of both sexes in the sample area.

In conclusion, the result of the present study has shown that the prevalence of *B. canis* and *H. canis* is relatively high in the dog population of Zaria and environs. The parasites usually occur as single infections rather than as mixed infections of both parasites despite being transmitted by the same vector. Also the occurrence of the parasites in dogs in Zaria is age dependent but not breed or sex dependent and does not also depend on the infestation rate of the tick vector *R. Sanguineous* on the canine host. It is recommended that there should be proper public awareness on the need for proper health care for dogs and the danger associated to their indiscriminate roaming in disease transmission. Dogs owners should also imbibe the culture of proper prevention and control measures to ticks and tick borne diseases through regular tick bath, monitoring and grooming of dogs, fumigation of kennels and houses with acaricides and regular patronage to veterinary services.

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