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Research Article

Investigations on the Haemoprotozoan Parasites of Nigerian Local Breed of Dogs in Gwagwalada Federal Capital Territory (FCT) Nigeria

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Abstract

Background: Haemoprotozoan diseases have been recognized globally as emerging problems in the livestock industry, including dogs.

Materials and Methods: Between May and October 2016, blood samples collected from randomly selected 109 local breed of dogs in Gwagwalada, FCT were examined for the presence of haemoprotozoa. **Results:** Of the 109 dogs examined, 60 (55.0%) were male and 49 (45.0%) female. Of these, 84 (77.1%) were infected with haemoparasites. Prevalence of infection in the male dog was 76.7% and in female dog, 77.6%. Haemoprotozoa encountered among the dogs were *Babesia* sp., 48 (57.1%), *Hepatozoon* sp., 33 (39.3%) and *Trypanosoma* sp., 3 (3.6%). All age groups of the local breed of dogs were infected, but this decreased in older dogs. Ticks collected from the dogs were of the genus *Rhipicephalus*. Dogs with brown hair coat were infested with 60.5% of the ticks, while those with white and brown/black hair coats had 3.7 and 2.5% tick infestations, respectively. About 37 of the dogs infested with ticks and 11 of those without ticks were infected with *Babesia* sp. Thirty of the tick infested and 3 of the non-infested dogs had *Hepatozoon* sp., while 3 of the tick infested dogs and none of those without ticks were infected with *Trypanosoma* sp. Ten of the dogs with ticks and 15 of those without ticks had no haemoprotozoan infection. **Conclusion:** It was therefore concluded that local breed of dogs in Gwagwalada are highly infected with *Rhipicephalus* borne haemoparasites and thus need adequate veterinary attention.

Key words: Haemoprotozoans, ticks, local dogs, Gwagwalada

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

For so many years now, domestic dogs (*Canis lupus familiaris*) have continued to command the communal, natural and passionate satisfaction of their owners. They have also been of benefit to humanity in the areas of companionship, guard, hunting and as draught animals^{1,2}. Dogs equally serve as meat in some local communities in Nigeria, especially Gwagwalada in this regard³⁻⁵.

Notwithstanding their important contributions to humanity, previous studies in Nigeria have revealed that dogs are often afflicted with a plethora of tick borne haemoprotozoans⁶⁻¹⁰.

Haemoprotozoans are unicellular parasitic organisms under the sub-kingdom Protozoa¹¹ that primarily infect the vascular system, mostly the red blood cells of their mammalian hosts. The transmission to their hosts is usually by the bite of specific arthropod vectors, such as ticks^{12,13}.

Haemoprotozoan infections are common in dogs in tropical countries¹⁴. For instance, investigations have revealed that canine babesiosis and trypanosomosis transmitted by *Rhipicephalus sanguineus* are the commonest haemoprotozoan parasites of dogs which result in considerable financial losses arising from treatment and high mortality rate^{15,16}.

Studies in areas close to the FCT, showed a relatively high prevalence of *Babesia canis* and *Hepatozoon canis*⁶ among dogs in Zaria and its environs, in which the author noted that these organisms occurred singly, rather than as mixed infections of both parasites despite their being transmitted by the same vector. It was also reported⁶ that the occurrence of the parasites in dogs is age dependent rather than breed or sex dependence and does not depend on the infestation rate of the tick vector.

The clinical and epidemiological implications of haemoprotozoan infections in dogs and those at risk cannot be overemphasized as this could adversely affect their nutritional, physiological and behavioral well-being¹⁷⁻¹⁹. These implications could be magnified in the local dogs, since less veterinary attention and other good management practices are rendered to them.

Although epidemiological studies have established haemoprotozoans as major constraints in the breeding of domestic dogs in Nigeria^{6,20,21}, there is paucity of information on the prevalence of these parasites among local breed of dogs in the Federal Capital Territory, Abuja, Nigeria. The aim of this study therefore is to determine the prevalence of haemoprotozoan parasites in local breed of dogs in

Gwagwalada Area Council of the Federal Capital Territory and attempt to bridge the information gap.

MATERIALS AND METHODS

Area of study: This study was conducted in Gwagwalada area council which is one of the six area councils of the Federal Capital Territory, Abuja-Nigeria. It is located geographically in the central part of Nigeria between latitude 8°-25" and 9°-29" and longitude 6°-45" and 7°-45" East of the Greenwich. It has a guinea savannah type of vegetation with raining season stretching from April-October and dry season from November-March and the temperature ranges 30-37°C yearly with the highest temperature experienced in the month of March^{22,23}.

Experimental animals: Local breed of dogs kept in Gwagwalada area council, FCT Abuja were sampled in this study. Permission to bleed the dogs and collect blood samples was sought from the owners keeping such dogs, before commencing the experiment, which lasted from May to October, 2016.

Sample collections: Blood samples were collected from 109 randomly selected local breed of dogs in Gwagwalada, using a sterile 21 gauge hypodermic needle attached to a 5 mL syringe through the cephalic vein of such dogs. About 4 mL of blood was collected from each of the randomly selected dogs and put into a sample bottle containing ethylenediaminetetraacetic acid (EDTA) and rocked gently to enable the anti-coagulant make contact with the blood. The sex, age, color of hair coat of the dog examined and presence or absence of ticks on it were recorded. Ticks samples observed were also collected and preserved in sample bottles containing 70% ethanol for identification in the laboratory.

Sample analyses: Some of the blood samples collected was used to do wet mount. This was done by using a micropipette to dispense two drops of the fresh blood in the middle of a clean grease-free glass slide and covered with a cover slip. It was then viewed with a light microscope (x10 objective) for the presence of motile haemoprotozoa.

Thereafter, thin blood smear was made by placing a drop of blood with the aid of a micropipette at one end of the clean grease-free glass slide. A spreader was used to make contact with the blood at an angle of about 45° and then pushed forward smoothly through the length of the glass slide and allowed to air-dry for 17-20 min. It was then fixed with 100%

methanol and kept in a jar for 3-5 min and then stained with Giemsa, following standard parasitological procedures²⁴. The slide was viewed at x100 magnification of the microscope with oil immersion for haemoprotozoan parasites.

Analysis of data: The collected data were analyzed using descriptive statistics such as simple averages, percentages and tabulations to determine the association between the occurrence of haemoprotozoan parasites in relation to species of parasites, sex and age of the dogs. These methods were also used to determine the influence of hair coat colour of the dogs on tick infestations.

Table 1: Overall prevalence of haemoprotozoan parasites in local breed of dogs according to sex

Sex of dog	No. of infected dogs (%)	No. of non-infected dogs (%)	Total (%)
Male	46 (76.7)	14 (23.3)	60 (55.1)
Female	38 (77.6)	11 (22.5)	49 (45.0)
Total	84 (77.1)	25 (22.9)	109

Table 2: Prevalence of different haemoprotozoan species in local breed of dogs

Haemoprotozoa	No. of infected dogs	Infected dogs (%)
<i>Babesia</i> sp.	48	57.1
<i>Hepatozoon</i> sp.	33	39.3
<i>Trypanosoma</i> sp.	3	3.6
Total	84	100.0

RESULTS

The overall prevalence of haemoprotozoan parasites in local dogs according to their sex is presented in Table 1. Out of the 109 local dogs examined, 60 (55.1%) were male and 49 (45.0%) female. Of the dogs examined, 84 (77.1%) were infected with haemoprotozoa. About 46 (76.7%) of this infection was in the male dogs and 77.6% in the female.

Table 2 shows the prevalence of different haemoprotozoan species encountered among the local breed of dogs examined in Gwagwalada. A total of 84 (100%) of these dogs were infected with haemoprotozoan parasites. Out of these, *Babesia* sp., was observed in 48 (57.1%) of the dogs, *Hepatozoon* sp., in 33 (39.3%) and *Trypanosoma* sp., in 3 (3.6%). There was no mix infection with these parasites. The haemoprotozoa observed in the local breed of dogs examined in Gwagwalada are shown in the Fig. 1a-c.

The prevalence of haemoprotozoan parasites across the different age groups of the local breed of dogs in Gwagwalada is shown in Fig. 2. Haemoprotozoa infected all age groups of the dogs. The highest occurrence of these parasites was among the dogs within the age group of 6-12 months, which was 42.9%. This was followed by the infection (25 and 29.8%) recorded among the dogs that were between 13-25 months

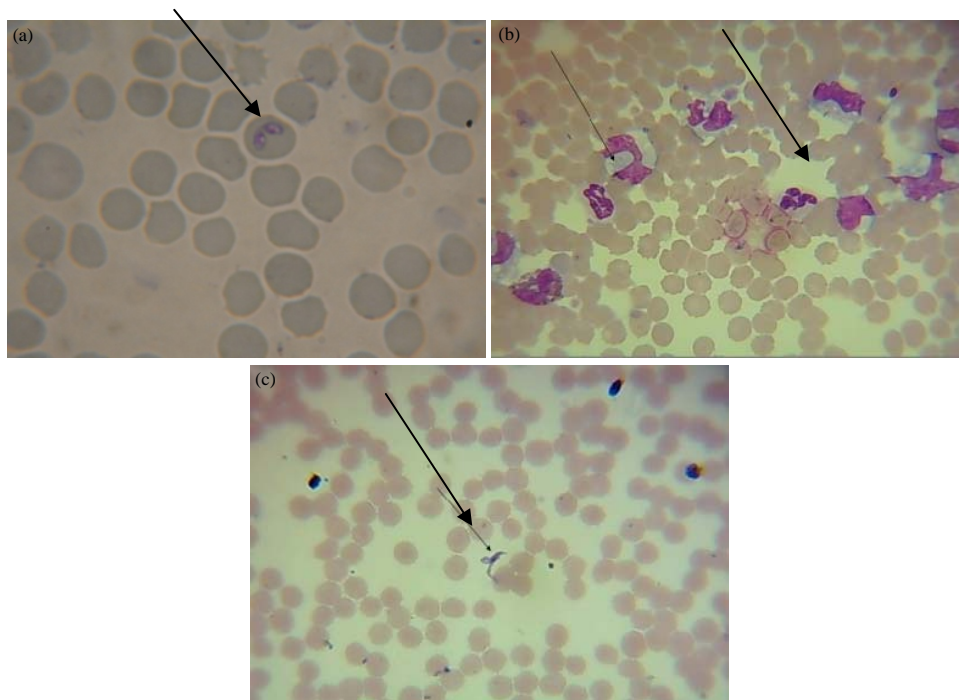


Fig. 1(a-c): Haemoprotozoa of local dogs examined in Gwagwalada, (a) Red blood cell infected with *Babesia* sp., (b) Gamonts of *Hepatozoon* sp., in the cytoplasm of neutrophil and (c) *Trypanosoma* sp., located extra cellularly in the blood stream

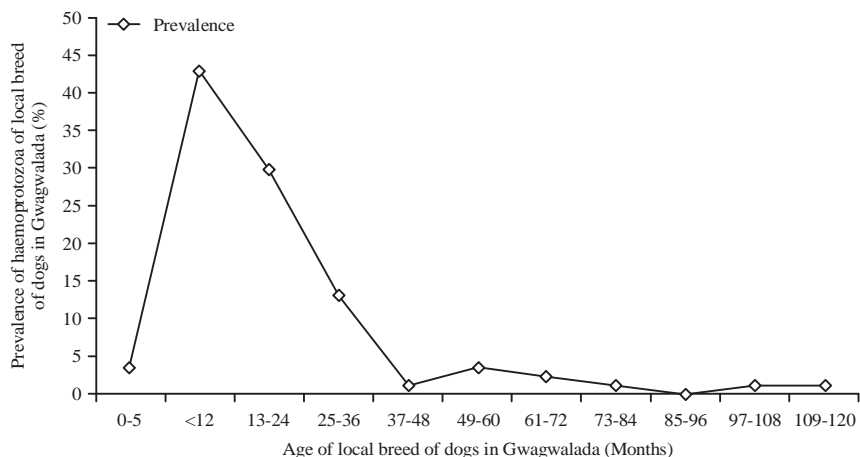


Fig. 2: Infection pattern of haemoprotozoa according to the age groups of local breed of dogs in Gwagwalada

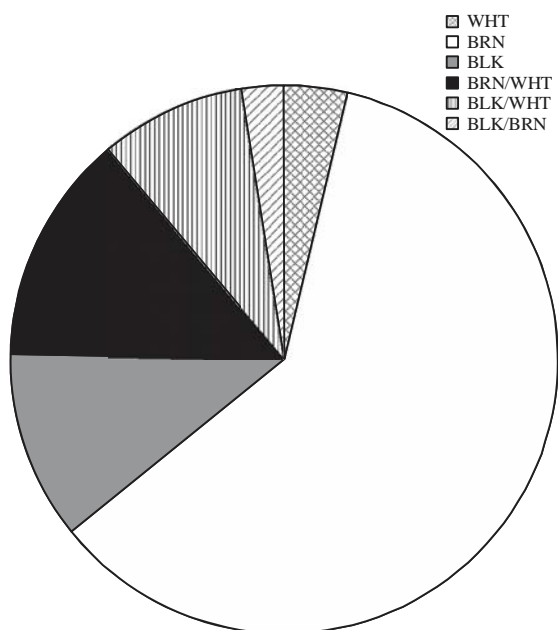


Fig. 3: Tick infestation according to coat colour of local breed of dogs in Gwagwalada

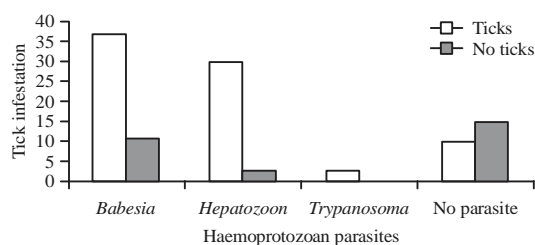


Fig. 4: Prevalence of haemoprotozoa in dogs with or without tick infestation

of age. The infection rate among the older dogs was 1(1.2%), which was recorded in the animals aged between 72 and 120 months. Dogs less than 6 months of age recorded 3.6% prevalence of haemoprotozoan infections.

Distribution of tick infestation according to the colour of hair coats of local breed of dogs examined in Gwagwalada is presented in Fig. 3. About 49 (60.5%) of the dogs with brown coloured hair coat were infested with ticks. Moderate tick infestations were recorded among dogs with brown/white, black and black/white colour hair coats as 13.6, 11.1 and 8.6%, respectively. The least tick infestations were encountered on dogs with white (3.7%) and brown/black (2.5%) hair coats.

Figure 4 shows how the tick and non-tick infested dogs were infected with the haemoprotozoan parasites. About 37 of the dogs infested with ticks and 11 of those without ticks were infected with *Babesia* sp. Thirty of the tick infested and 3 of the non-infested dogs had *Hepatozoon* sp., while 3 of the tick infested dogs and none of those without ticks were infected with *Trypanosoma* sp. Ten of the dogs with ticks and 15 of those without ticks had no haemoprotozoan infection.

DISCUSSION

In this study, the overall prevalence (77.1%) of haemoprotozoans (*Babesia*, *Hepatozoon* and *Trypanosoma* species) in local dogs was high. This does not agree with the results of many researchers^{6,25,26}, who reported different prevalence rates of 17.3, 42.1 and 23.33% in Zaria, Vom and Abuja, respectively. This discrepancy could be attributed to the fact that the workers investigated haemoparasitism in different breeds of dogs found in their areas and not specifically in local dogs. However, our finding partially agrees

with the reported prevalence of 71.4% for indigenous dogs in Ikwuano local government area of Abia State²⁷.

Although not statistically proven, the prevalence of haemoprotozoa was higher in the female than male dogs. It had earlier been reported⁶, that the occurrence of haemoparasites in dogs is not sex dependent. However, the higher prevalence in the female could be due to the fact that female dogs are usually more sedentary especially after the arrival of their offspring, which increases the risk of infestation with the tick vector of *Babesia canis* and *Hepatozoon canis*. It can also be explained by the fact that the female dogs are more exposed to the vectors of haemoprotozoa than males because of their contact with many male dogs during heat. The peculiar reproductive activities in female animals which lead to stress and subsequent reduction in their immunity and resistance to diseases could be another reason for this sexual dimorphism^{16,27,28}.

Babesia and *Hepatozoon* species are among the most widely distributed haemoparasites of dogs, occurring in almost everywhere their tick vector *Rhipicephalus sanguineus* is found²⁹. The former is highly pathogenic and is the major cause of haemolytic anaemia in dogs in the tropics²⁵. The occurrence of mild *Trypanosoma* infection in the local dogs is note worthy, as none of the other workers reported this in their studies.

It is equally not surprising to have observed the array of haemoprotozoa in this study, since all the dogs examined here were of local breed that usually receive little or no veterinary care. There was no mixed infection with the parasites encountered in this study. This is contrary to a report of mixed infection with *Babesia* and *Hepatozoon* species in the dogs examined Zaria⁶. The reason for the non existence of mixed infection observed in our study is not known, but will be an interesting study for the future.

All age groups of the local breed of dogs were infected, but this decreased in older dogs. However, the infection was mostly acquired when the dogs were between the ages of 7 and 36 months and less when they were less than 6 months. This could be due to the existence of maternal immunity in the younger dogs which helps them resist infections such as those arising from haemoprotozoan parasites^{29,30}. The higher haemoprotozoan infections in the dogs within 7-36 months of age agrees with previous researchers³¹⁻³³ who reported that infectivity rate of haemoprotozoa occurred more within three years of age. This might be explained by the fact that this group of dogs is more agile and once given the opportunity, would roam about indiscriminately to where they acquire the vectors of these parasites thus, resulting in higher infections recorded. In addition, their habit of playing on

the grasses enables them to constantly pick up questing ticks waiting for available hosts.

Ticks collected from the body of the dogs were identified as belonging to the genus *Rhipicephalus*. The infestation of this tick on dogs is influenced by the colour of the hair coat. In this study, brown colour hair coat was found to be more (60.5%) attractive to the ticks than any other colour. This is why *Rhipicephalus* is also known as "Brown dog tick". Their preference for brown and other colours than white could be for camouflage. But in contrast, Opara and Ezeh³⁴ reported the most preference for the white hair coat among the cattle they examined. The reason for this disagreement cannot be given here. However, it does appear that the preference could either be specie related or that *R. sanguineus* unlike other ticks develops better under higher temperature conditions (20-35°C) and relative humidity (35-95%), which the white colour offers³⁵.

The infection rates of the haemoprotozoa were high. It increased with high tick infestation. This reaffirms the fact that marked tick infestation influences parasitaemia in the local dogs. This finding is in consonant with the report of Konto *et al.*²¹, who opined that the occurrence of haemoparasites like *Babesia* sp., is vector dependent. It however disagrees with Okubanjo *et al.*⁶ who reported that the mere presence of ticks does not affect the level of parasitaemia in dogs. However, parasitaemia is influenced not just by the number of ticks, but the number of infected ticks which successfully transmit the pathogens they carry while feeding on the dog.

CONCLUSION

The results of this study have shown that canine babesiosis, hepatozoonosis and trypanosomosis could be critical in the health status of local dogs kept by residents of Gwagwalada, FCT. The relatively high prevalence of these parasites among the local dog population in Gwagwalada metropolis, calls for an urgent veterinary attention in order to ameliorate the risk faced by these animals.

The occurrence of the parasites in dogs is age and not sex dependent. *Rhipicephalus* sp., was the only tick infesting the dogs examined and could be the sole vector of the haemoprotozoa encountered in this study.

SIGNIFICANCE STATEMENTS

- Local breed of dogs benefit people in Gwagwalada in the areas of companionship, guard, hunting and as draught animals

- Dogs serve as meat here and some other areas in Nigeria
- They are adversely affected by a variety of tick-borne haemoprotozoans
- Local dogs are not always given adequate veterinary attention
- Proper public awareness is needed on proper health care for local breed of dogs and the risk associated with their indiscriminate roaming in disease transmission

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