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Babesia canis Infection and its Associated Risk Factors Among Dogs in Jere Local Government Area, Borno State, Nigeria

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ABSTRACT

Epidemiological investigation was carried out to determine the prevalence of canine babesiosis in Jere Local Government Area (LGA) from January 2020 to February 2021. Blood samples were collected from a total of 280 dogs, and the samples were evaluated for Babesia canis (B. canis) infection. The data obtained were analyzed to determine the prevalence of B. canis and the relationship of the infection to age, sex, breed, management practices, dog use and presence or absence of tick on the dogs was also ascertained. A total of 36 (12.8%) dogs tested positive for the infection in the study area. Twenty three (8.2%) males tested positive for B. canis while 13 (4.6%) of females were positive. According to age, 15 (5.3%) of young dogs were positive while 21 (7.5%) of adults were positive for the infection. The prevalence was significantly higher (P<0.05) in local breeds of dogs than in exotic and cross breeds. The prevalence was higher among stray dogs with tick infestation than those without tick infection. However, there was no significant differences (P<0.05) between age, and sex of the infected dogs. The present study recorded highest prevalence in dogs from Shagari and Gomboru wards, followed by Bulumkutu and University quarters, the least prevalence was seen in dogs in custom area. It was concluded that B. canis infection was prevalent in the study area and affect dogs irrespective of their age, sex, breed, management practices and locations. Therefore, regular treatment and responsible dog ownership were recommended.

Keywords: Canine, Babesia, Prevalence, Infection, Risk factors.

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INTRODUCTION

Canine babesiosis is an infectious tick-borne disease caused by protozoan haemoparasites of the genus *Babesia* [1]. Babesiosis is one of the most important quick spreading tick-borne infections of dogs with a worldwide distribution [2]. They are transmitted primarily through tick bites during blood meal [3]. Babesiosis is an emerging infectious disease [4] caused by two distinct species [5] belonging to the genus *Babesia* [4]. *Babesia canis* is characterized morphologically as large (2.5 – 5.0µm) and *Babesia gibsoni* as small (1.0 – 2.5µm) [6]. Canine babesiosis is characterized by a wide range of clinical manifestations [7], from sub-clinical disease to life threatening conditions, with severity of clinical sign depending on the species involved and host immune response against the infection [8].

Canine babesiosis according to Dipeolu [9] is endemic in Nigeria because tick vectors of *Babesia* spp occur in large numbers in most parts of Nigeria. *B. canis* can affect dogs of all ages, although puppies are mostly affected [10]. The prevalence varies from one part of the country to another [11]. In Nigeria, several reports exist on the endemicity of *Babesia* infection in various states of the country, across various geographical distributions [12], [13], [14] and [15]. However, there is a dearth of information on the prevalence and risk factors associated with *Babesia* infection in the study area especially when there is an increase in dog population. Dogs are used as pets, security, hunting and breeding purposes. Therefore, the present study aimed to determine the prevalence of canine babesiosis and its associated risk factors in Jere LGA for the purpose of prophylaxis and effective control of the disease.

MATERIALS AND METHODS

Study Area

The study was conducted in Jere, Borno State, Nigeria. Jere lies between latitudes 11°40" and 12°05"N and longitudes 13°05" and 12°20"E. The climate of the area is dry and hot for most part of the year with minimum temperature ranging from 15 to 20°C and maximum ranges of 37 to 45°C. The annual rainfall ranges from 500 to 700 mm characterized by high variability and intensity. The rainy season usually last from May to September with relatively low humidity [16] and then followed by a long dry season.

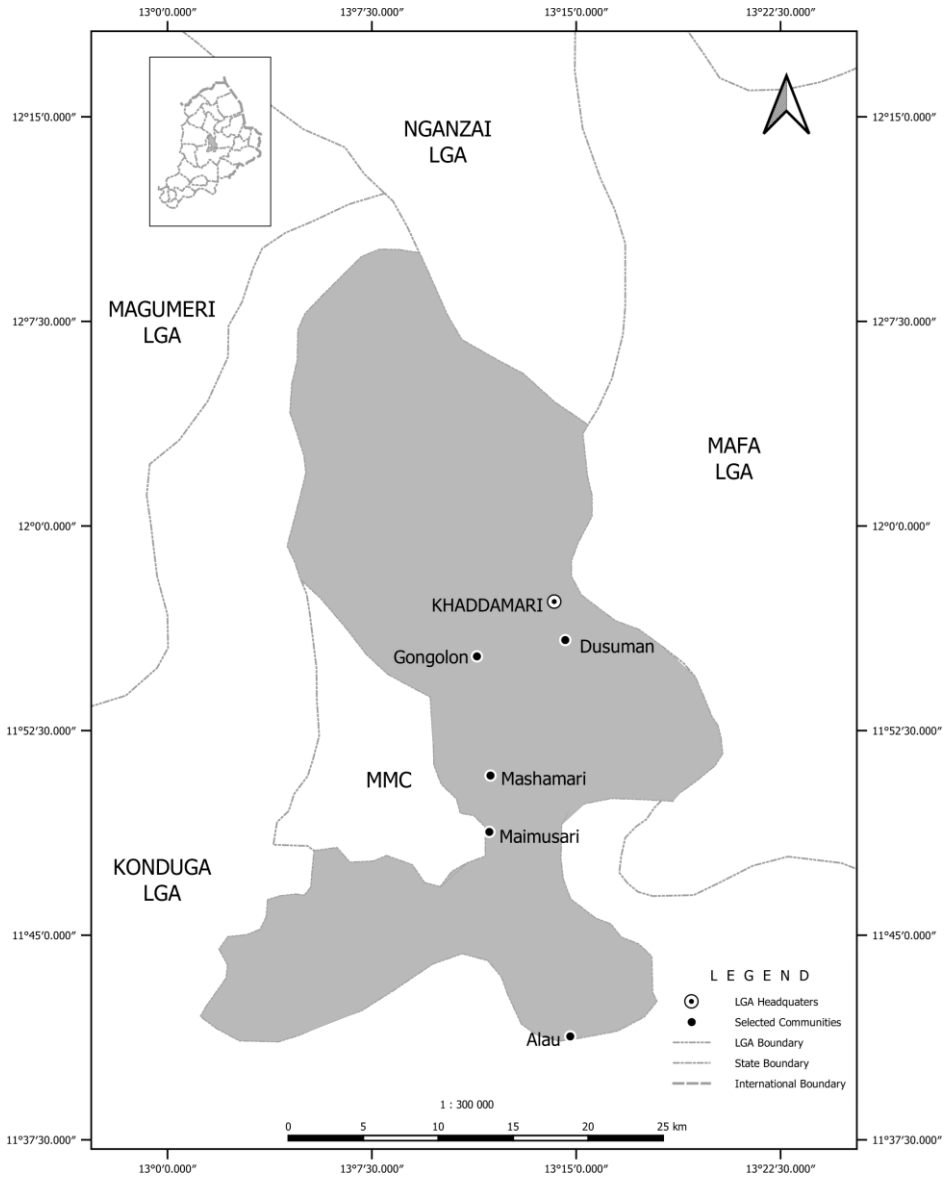

Figure 1: Map of Jere Local Government showing the sample area; Source: Google Map.

Study Animals and Sample Collection

A total of 280 apparently healthy dogs were sampled in the present study. Sampling was done based on convenience method from January 2020 to February 2021. Prior to blood collection, information regarding age, sex, breed, management practices, dog use and presence or absence of ticks were recorded. Age was categorized as young or adult [17], breeds were categorized as exotic, local and cross [14], and dog use was categorized as pet, security and hunting [18]. For the blood sample collection, dogs were adequately restrained. Five millilitres (5ml) of blood was aseptically collected through the cephalic vein using 5ml disposable syringe of 23 gauge needle and emptied into sample tubes containing EDTA as anticoagulant. These samples were stored in an ice pack box and transported to the Department of Veterinary Parasitology and Entomology, Faculty of Veterinary Medicine, University of Maiduguri for processing and analysis.

Parasitological Analysis of Blood Samples

The blood samples were parasitologically analysed immediately after each sampling exercise using standard method [19]. A drop of blood was placed near one end of a clean glass slide and a spreader was used to prepare the thin smears. The thin smears were air dried and fixed in methanol for 3-5 minutes. The slides were stained in 10% Giemsa for 25-30 minutes and examined under oil immersion lens (X100) for the presence of intra-erythrocytic merozoites of *Babesia*.

Data Analysis

Data obtained were analyzed using statistical package for social science (SPSS Version 20). Results were expressed as percentages and presented in forms of tables. Results were later subjected to chi-square analysis. Value of $P < 0.05$ were considered significant.

RESULTS

The overall prevalence of *Babesia* species infection among dogs in Jere local government was 12.8% (Table 1). In terms of age, there was higher prevalence of the infection in the adults (7.5%) as compared to the young (5.3%) as shown in table 1. There was also a higher prevalence in males (8.2%) than females (4.6%) as indicated in Table 1. Local dogs had a higher prevalence rate of 7.5% as compared to exotic (3.9%) and cross breeds (1.4%) as shown in Table 2. In terms of management, dogs kept outdoors had a higher prevalence of 7.8% as compared to those managed indoors (5.0%) (Table 2).

Hunting dogs had a higher prevalence of 8.5% as compared to security and pet dogs with prevalence of 3.5% and 0.8% respectively (Table 3). Dogs with Tick infestation had a higher prevalence of 8.5% then dogs without tick (4.3%) as depicted in Table 3. As regards to sample locations, old Maiduguri and Shagari wards recorded the highest prevalence of 3.5% each followed by Bulumkutu, University quarters and Custom areas that showed the prevalence values of 2.5%, 2.2%, and 1.1% respectively as shown in Table 4.

Table 1: Prevalence of *Babesia canis* infection in Jere LGA according to Age and sex Distribution

Parameters	Number of Dogs Examined	Number of Dogs infected	Prevalence (%)	95% Confidence Interval (Lower and Upper Limits)
Age				
Young (< 1 Year)	120	15	5.3	0.0772, 0.196
Adult (> 1 Year)	160	21	7.5	0.0875, 0.1924
Total	280	36	12.8	
Sex				
Male	107	23	8.2	0.1478, 0.302
Female	173	13	4.6	0.0444, 0.1143
Total	280	36	12.8	

Table 2: Prevalence of *Babesia canis* in Jere LGA according to Breed and Management Practice

Parameters	Number of Dogs Examined	Number of Dogs infected	Prevalence (%)	95% Confidence Interval (Lower and Upper Limits)
Breed				
Exotic	78	11	3.9	0.806, 0.2351
Local	181	21	7.5	0.0771, 0.1708
Cross	21	04	1.4	0.0767, 0.400
Total	280	36	12.8	
Management				
Indoor (Owned)	203	14	5.0	0.0415, 0.1125
Outdoor (Stray)	77	22	7.8	0.1913, 0.3949
Total	280	36	12.8	

Table 3: Prevalence of *Babesia canis* infection among Dogs based on purpose and Tick Infestation.

Parameters	Number of Dogs Examined	Number of Dogs infected	Prevalence (%)	95% Confidence Interval (Lower and Upper Limits)
Dogs Use				
Hunting	120	24	8.5	0.1564, 0.3121
Security	95	10	3.5	0.0682, 01135
Pet	65	02	0.8	0.0476, 0.2136
Total	280	36	12.8	
Tick Infestation				
Present	155	24	8.5	0.1564, 03121
Absent	125	12	4.3	0.0346, 0.1034
Total	280	36	12.8	

Table 4: Prevalence of *Babesia canis infection* among dogs based on Sampled Locations

Parameters	Number of Dogs Examined	Number of Dogs infected	Prevalence (%)
Custom Area	35	03	1.1
Shagari Ward	95	10	3.5
University Quarters	90	06	2.2
Old Maiduguri Ward	40	10	3.5
Bulumkutu Ward	20	07	2.5
Total	280	36	12.8

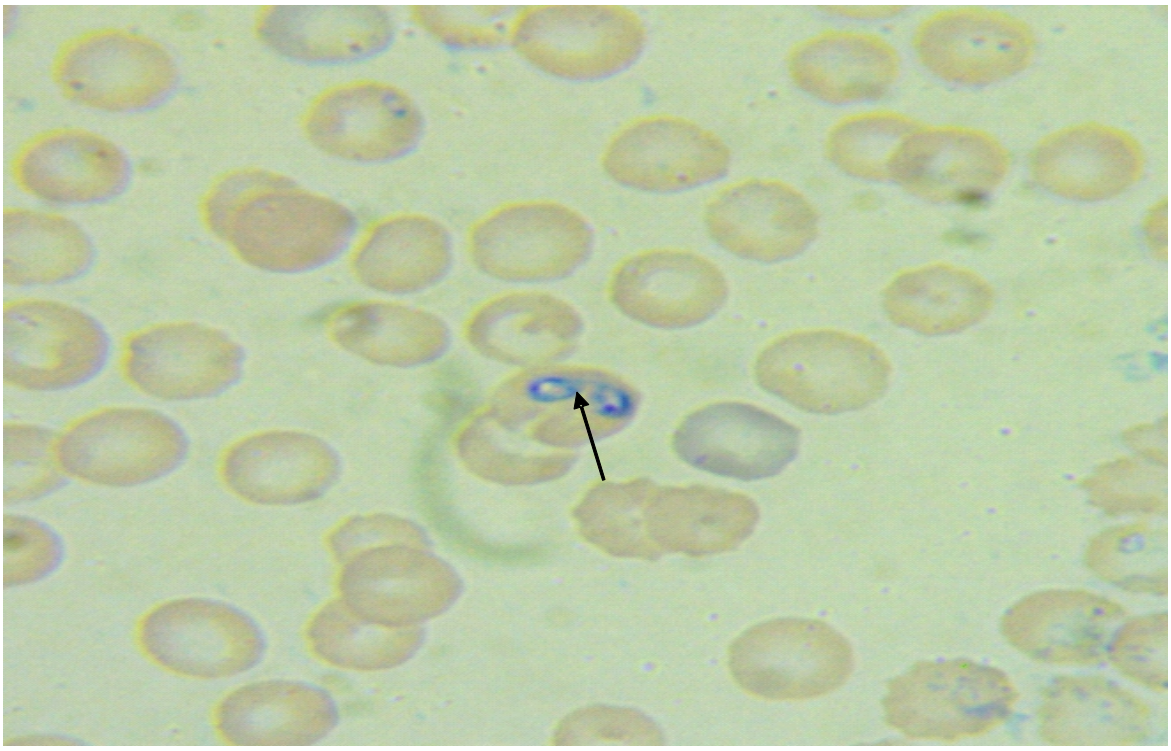

Figure 2: Microphotograph of the intra-erythrocytic parasite indicated by an arrow**.**

DISCUSSION

The findings of the present study, revealed an overall prevalence of 36 (12.8%) of *B. canis* in dogs from Jere Northeastern Nigeria. The prevalence of *B. canis* infection recorded in the current study was higher than that of Amuta *et al*. [20], Jegede *et al*. [13] and Takeet *et al*. [21] who reported 10.2%. 8.9% and 7.3% of *Babesia canis* infections in Makurdi, Gwagwalada and Abeokuta respectively. The reasons for the disparities in the prevalence could be probably due to geographical differences, duration and period of the study resulting to differences in tick availability, experimental design, season of the year employed in the studies.

The prevalence of *Babesia canis* infection recorded in the current study was lower than the reports of Okubanjo *et al*. [14], Daniel *et al*.[22] and Opara *et al*. [23], who recorded 17.3%, 18.6% and 57.1% prevalence of *Babesia canis* infection in Zaria, Jos and Gwagwalada respectively. These differences in prevalence could be due to possible transient parasitaemia seen in early, low or chronic *Babesia* infections.

In the present study, adult dogs appeared more prone to the infection than young dogs. The higher rate of *Babesia canis* infection in older dogs may probably be due to low maternal immunity/resistance associated with older dogs as well as frequent exposures to tick bites. Our findings agree with the previous works done by Hornok *et al*. [24] and Obetta *et al*. [18] that recorded higher prevalence of *Babesia* infection among older dogs than puppies but disagrees with report of Okubanjo *et al*. [14] who reported a higher prevalence in younger dogs than older dogs. Similarly, it concurred with the study carried out by Egege *et al*. [25] and Opara *et al*. [24].

The result of the present study also showed that male dogs were more susceptible to *Babesia* infection than the female dogs. The increased susceptibility of male dogs may be due to sex-linked genetic or hormonal influences of male dogs, environmental exposure such as increased and frequent roaming of male dogs in search of mates and establishing territories thereby picking the vectors. The present findings are in agreement with that of Mellanby *et al*. [26] and Daniel *et al*. [23], who reported higher rate of *Babesia* infections among male than the female dogs. The present study disagrees with some other studies of Omudu *et al*. [27], Okubanjo *et al*. [14], Jegede *et al*. [13] and Opara *et al*. [24] who reported that the prevalence of *Babesia* infection was higher in female than male dogs possibly due to sedentary nature of females especially during nursing of their offspring which predispose them to increased tick infestation.

In the current study, the findings showed that 7.5% prevalence of *B. canis* infection among Local breeds as compared to exotic (3.9%) and cross breed (1.4%) respectively. This might be due to non-chalant attitude of local dog owners towards routine checkups and medical needs of their dogs thereby predisposing them to increased infestation by the tick vector. The present report concurred with the report of Jegede *et al*. [13] who reported a higher prevalence of *B. canis* in local dogs than exotic but disagrees with the report of Ojo *et al*. [28] who reported higher prevalence in exotic breed of dogs.

In the present study, the result also showed higher prevalence of *B. canis* in outdoor and hunting dogs than in indoor dogs (confined dogs). This could be attributed to continuous

exposure of outdoor and hunting dogs to the parasite vectors than the indoor. This agrees with the findings of Obeta *et al*. [18] and Tinoco-Gracia *et al*. [29] who reported higher prevalence of blood parasites among outdoor (non-confined) dogs than in indoor dogs.

There was a higher prevalence of *B*. *canis* in dogs with tick infestation than in those without. The result is in agreement with the work of Jegede *et al*. [13] who reported higher prevalence of *B*. *canis* among dogs infested with ticks than those without tick infestation, and this indicate that ticks is responsible for the transmission of the parasite.

As regards to sample locations, the prevalence of *B*. *canis* infections recorded the highest prevalence of 3.5% among dogs from Shagari and Old Maiduguri wards in Jere Local Government Area respectively. Thus, showing variations in the distribution of *B*. *canis* infection, though not statistically significant. The differences observed might be due to the relative variations in the abundance of infected tick vectors and other risk factors such as management system.

Conclusion

The present study revealed that *B*. *canis* infection is prevalent 36 (12.8%) and endemic among dogs in Jere LGA of Borno State Nigeria. The present study also revealed that the prevalence of ticks infestation is higher in the adult dogs 21 (7.5%) compared to the young dogs. Furthermore, the prevalence of ticks infestation is higher among the male dogs 23(8.2%) as compared to their female counterparts. Additionally, the local breed had a higher prevalence 21 (7.5%) of ticks infestation as compared to the exotic and cross breeds. The outdoor dogs have a higher prevalence 22 (7.8%) compared to the indoor dogs. Hunting dogs divulged a higher prevalence 24 (8.5%) of ticks infestation as compared to the security and pets. Similarly, dogs with ticks have a higher prevalence of 24 (8.5%) as compared to those without. Finally, Shagari and Old Maiduguri wards have a higher prevalence of 10 (3.5%) each compared to University quarters, Bulumkutu and Custom areas. Therefore, responsible dog ownership, proper management practices such as adequate tick vector control and routine prophylaxis should be adopted to prevent the infection.

Competing Interests

Authors declared no competing interest in the publishing of this work.

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