

# Prevalence of Babesiosis with Associated Risk Factors Among Dogs in Mubi North Local Government Area-Adamawa State-Nigeria

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**Abstract-** Study was aimed at investigating the prevalence of *Babesia* infection in dogs, identify associated risk factors, and analyzed the demographic characteristics that could influence infection rates. The main objectives were to determine the overall prevalence of Babesiosis among dogs in the study area, assess the impact of age, gender, breed and environmental factors on infection rates, and provide insights for effective disease control measures. A total of fifty (50) dogs, 10 from each five different wards within Mubi North L.G.A including Barama, Lokuwa, Garden City, Wuro-Gude and Sabon Gari were sampled. The results revealed an overall Babesiosis prevalence of 36.00%, with Barawa ward showing the highest prevalence of 70.00% and both Garden-City and Sabon Gari having the lowest prevalence of 20.00% each. The study also found that 60.00% of dogs were less than one year old, and females had a higher prevalence rate (62.00%) compared to males (38.00%). Additionally, purebred dogs represented 90.00% of the sampled population. The analysis of potential risk factors indicated that 60.00% of the dogs had been infested with ticks, and 56.00% of the respondents used tick prevention measures regularly. The study concluded that Babesiosis is a significant health concern for dogs in Mubi North L.G.A with variations in prevalence across different wards and demographic groups, highlighting the need for the targeted control strategies. It is recommended that dog owners in high prevalence areas adopt regular tick prevention measures and seek veterinary care to mitigate the risk of Babesiosis.

**Indexed Terms-** Babesiosis, Dogs, Risk factors, Breed, Mubi- North

## I. INTRODUCTION

Babesiosis, a tick-borne disease caused by protozoan parasites of the genus *Babesia*, poses a significant health threat to canine populations worldwide (Yabsley & Shock, 2019). This disease affects various mammals, including dogs, humans, and livestock, with dogs being particularly susceptible (Solano-Gallego *et al.*, 2020). The clinical manifestations of Babesiosis in dogs can vary widely, ranging from mild to severe symptoms such as fever, anemia, lethargy, jaundice, and in severe cases, organ failure and death (Baneth, 2018). The severity of Babesiosis in dogs is influenced by factors such as the species of *Babesia* involved, the age of the dog, its immune status, and overall health (Zahler *et al.*, 2017). Understanding the prevalence of babesiosis in dogs is crucial for implementing effective preventive measures and improving clinical management (Birkenheuer, 2018). Despite the importance of understanding babesiosis prevalence in dogs, there is considerable variation in reported rates across different regions and populations (Pantchev & Vrhovec, 2020). Factors such as climate, ecology, tick vector abundance, and human interventions, such as tick control measures, can influence the prevalence of babesiosis (Santos-Silva *et al.*, 2019). Tick vectors play a critical role in the transmission of *Babesia* parasites to dogs. Various species of ticks, including *Rhipicephalus sanguineus* (brown dog tick), *Dermacentor variabilis* (American dog tick), and *Ixodes ricinus* (European sheep tick), act as vectors for different *Babesia* species. The distribution and abundance of these tick species can vary depending on factors such as habitat suitability, host availability, and climate (González *et al.*, 2019). Consequently, areas with high tick density are more likely to have increased transmission of babesiosis to dogs. The

susceptibility of dog populations to babesiosis can also influence its epidemiology. Factors such as breed, age, immune status, and previous exposure to *Babesia* parasites can affect the likelihood of infection and disease severity. Additionally, young puppies and immunocompromised dogs may be at higher risk of developing clinical disease following *Babesia* infection (Baneth *et al.*, 2020). Various wild mammals, including rodents, deer, and carnivores, can serve as reservoirs for *Babesia* organisms, providing a source of infection for tick vectors. Understanding the interactions between wildlife reservoir hosts, tick vectors, and domestic dogs is essential for assessing the risk of babesiosis transmission and designing effective control strategies (Zahler *et al.*, 2017). The prevalence of *Babesia* species in tick populations also varies temporally, with seasonal fluctuations influenced by factors such as temperature, humidity, and host availability. Tick populations typically peak during warmer months when environmental conditions are conducive to tick activity and reproduction. Monitoring seasonal trends in tick abundance and infection rates can inform the timing of preventive measures and interventions to reduce canine babesiosis risk (Beugnet and Marié, 2019). Dogs from disadvantaged communities may be at higher risk of babesiosis due to limited resources for tick control and lower awareness of disease risks. Addressing socio-economic inequalities in access to veterinary services and preventive measures is crucial for reducing the burden of canine Babesiosis in vulnerable populations (Mateus *et al.*, 2020). The clinical presentation of babesiosis in dogs can vary from subclinical infection to severe illness, with manifestations including fever, lethargy, anorexia, pale mucous membranes, and hemolytic anemia. Diagnosis typically relies on a combination of clinical signs, hematological abnormalities (such as thrombocytopenia and hemolytic anemia), and the detection of *Babesia* organisms in blood smears or through molecular techniques Birkenheuer *et al.* (2018). Dogs may exhibit signs of discomfort, such as reluctance to move, weakness, and dehydration. In severe cases, dogs may develop jaundice (icterus) due to the breakdown of red blood cells and subsequent accumulation of bilirubin in tissues. Additionally, some dogs may experience respiratory distress, neurologic abnormalities, or organ

dysfunction, particularly if the disease progresses untreated (Camacho *et al.*, 2021).

There is, lack of data on the clinical manifestations of Babesiosis-infected dogs and the potential for zoonotic transmission in the study area which hinders the development of strategies to mitigate the impact of the disease on both canine and human populations. Thus, the need for research, to ascertain the prevalence of Babesiosis in Mubi and to fill this knowledge gap and inform evidence-based interventions for Babesiosis management in Mubi North L.G.A.

## II. MATERIALS AND METHODS

### Study Area:

The study was conducted in Mubi North L.G.A, which is located in the northeastern part of Nigeria. Mubi North L.G.A encompasses both urban and rural areas, providing a diverse setting for assessing the prevalence of Babesiosis in dogs.

Mubi- North is located at Latitude 10 °6-10 29N, Longitude 13 07- 13 3°E with a Land Area of 924.32km<sup>2</sup>, Temperature (annual average): maximum 32.1°C, minimum 18.5°C, Average rainfall (annual total):1,000mm Mubi -North major settlement are Fali, Mayo Bani and Mubi with a Population of 214,580 as of 2018, the Population density is 232. Mubi- North Borders with Michika to the North, Borno State to the northwest, Hong to the west, Maiha and Mubi South to the South and Cameroon republic to the East. Mubi North consist of two Development areas Fali and Mayo Bani with District area Ba'a, Mayo Bani, Mubi, and Muchala. ((Adebayo *et al.*, 2020).

### Study Design

This study employed a cross-sectional design to assess the prevalence of Babesiosis in dogs within Mubi North Local Government Area (L.G.A) of Adamawa State, Nigeria. The cross-sectional approach allowed for the collection of data at a single point in time, providing a snapshot of the Babesia spp. infection status in the study population.

### 3.3 Sampling Procedure

A multi-stage sampling technique was employed to select study participants. In the first stage, households and neighborhoods within Mubi North L.G.A were randomly selected. In the second stage, houses within the selected households and neighborhoods were systematically sampled. Finally, all eligible dogs within the selected houses were included in the study.

### 3.4 study Population

A total of 50 dogs from the study was sampled. The choice of the dog numbers to be sampled in each area depend largely on the permission from owners to allow their dogs to be sampled. The total population were subdivided into five different wards within Mubi North L.G.A (Barama, Garden City, Lokuwa, Sabon Gari and Wuro Gude) and 10 dogs each were sampled from each of the selected wards.

### 3.5 Data Collection

Data collection was carried out using a structured questionnaire administered to dog owners or household members responsible for the care of the dogs. The questionnaires capture information on demographic characteristics of the dogs (age, sex, and breed), history of tick infestation, clinical signs suggestive of Babesiosis, and previous *Babesia* spp. infection.

#### Blood Collection

Blood samples were collected from each participating dog via venipuncture of the jugular vein using sterile techniques. Approximately 2-3 milliliters of blood was collected into ethylenediaminetetraacetic acid (EDTA) tubes microscopy.

#### Duration of Sample Collection

Sample were collected twice in a week (Mondays and Fridays) for the duration of three months June to August.

#### Laboratory Analysis

Laboratory analysis of collected blood samples were conducted to assess the presence of Babesiosis and to provide additional insights into the disease status among the study population.

Blood smear was done: Thick and thin blood smear was done and stained with Giemsa stain then

observed under the microscope for presence of *Babesia* spp. Identification of a large elongated Rectangular gamont with acentrically placed nucleus in cytoplasm neutrophil and large pyriform shape merozoite within erythrocyte indicate *Babesia Spp*

#### Data Analysis

The data collected from laboratory analyses was subjected to statistical analysis to interpret the findings accurately. Descriptive statistics such as means, standard deviations, and percentages was used to summarize the data on prevalence of Babesiosis and risk factors in dogs.

## III. RESULTS

The results in table 1 below reveals a 36.00% overall prevalence of *Babesia* infection among dogs in Mubi North L.G.A, with significant variability across different wards. Barama exhibited the highest prevalence at 70.00%, suggesting a higher risk or possibly more favorable conditions for tick survival and transmission in this area. Conversely, Garden City and Sabon Gari had the lowest prevalence rates, both at 20.00%, which may reflect differences in local environmental conditions, tick control measures, or population density. The intermediate prevalence in Wuro- Gude (40.00%) and Lokuwa (30.00%) further illustrates regional differences within Mubi North. These variations in prevalence highlight the need for targeted surveillance and control strategies that consider local ecological and social factors to effectively manage and reduce the incidence of Babesiosis in the area.

Table 2 shows age distribution of dogs in the study area where majority (60.00%) are less than 1 year old, which may indicate that younger dogs are more commonly sampled or are more frequently in contact with environments where *Babesia* spp. transmission is high. Followed by the older dogs (18.00%) aged 1 year, then (12.00%) aged 2 years, and the least was (10.00%) aged 3 years. Which suggests either a lower prevalence in older dogs or a potential bias in sampling younger dogs more frequently. The absence of dogs older than 3 years could reflect a sampling limitation or a trend in the local dog population, highlighting the need for further investigation into

age-related susceptibility and the effects of aging on Babesia infection rates.

The results of the study (Table 3) also reveals gender distribution of the dogs examined which shows a higher prevalence of Babesiosis in females (62.00%) compared to males (38.00%). This disparity suggests that female dogs may be more frequently sampled or possibly more susceptible to Babesia infection, although the latter hypothesis requires further investigation. The greater number of female dogs could be attributed to various factors, including differences in pet ownership patterns or inherent differences in susceptibility. Understanding these gender-based differences is crucial for tailoring disease prevention and control strategies, ensuring that both male and female dogs receive appropriate care and management.

Also the results of the study in Table 4 reveals a predominance of purebred dogs (90.00%) among the sampled population, with mixed breeds comprising only 10.00%. This significant over representation of purebred dogs could be due to a higher prevalence of purebred dogs in the study area or a greater willingness of owners of purebred dogs to participate in the study. This skew in breed distribution may influence the study's findings and suggests that the results may not fully represent the prevalence of Babesiosis in mixed breed dogs.

Furthermore, the result of the study on the potential risk factors (Table 5) reveals several insights into the factors associated with Babesia infection among dogs. A significant proportion of dog owners (60.00%) reported that their dogs have been infested with ticks, highlighting tick exposure as a major risk factor for Babesiosis. Conversely, a substantial 68.00% of respondents reported that their dogs had not exhibited clinical signs such as fever, lethargy, or anemia, suggesting that the clinical manifestations of the disease might not always be apparent or that owners might not recognize these signs.

Regarding past diagnoses, none of the respondents (0.00%) indicated that their dogs had been diagnosed with Babesiosis, which aligns with the prevalence data and underscores the relevance of ongoing surveillance. The fact that 0.00% of households

reported having other dogs diagnosed with Babesiosis suggests that the disease might not be widespread within single households, but this finding needs further investigation.

A majority of respondents (56.00%) reported using tick prevention measures regularly, which may contribute to managing the risk of Babesiosis, though 44.00% do not use such measures, indicating a potential gap in disease prevention. The high percentage (70.00%) of respondents living in areas with a high prevalence of ticks supports the notion that environmental factors play a significant role in the risk of Babesiosis. Lastly, 80.00% of respondents have not noticed changes in tick populations, suggesting stability in tick prevalence, although this aspect should be monitored for any emerging trends. These findings collectively emphasize the importance of targeted tick control measures and ongoing education for dog owners to mitigate the risk of Babesiosis.

Table 1: Prevalence of Babesia Infection among five ward of Mubi –North L.G.A

Location	Dogs Examined	No. of Positive	No. of Negative	% Positive
Barama	10	7	3	70.00
Lokuwa	10	3	7	30.00
Garden City	10	2	8	20.00
Wuro Gude	10	4	6	40.00
Sabon Gari	10	2	8	20.00
Total	50	18	32	36.00

Lab work, 2024

Table 2: Age Distribution of Dogs

Age	Frequency	Percentage
Less than 1 Year	30	60.00%
1 Year	9	18.00%
2 Years	6	12.00%
3 Years	5	10.00%
Above 3 Years	0	0.00%
Total	50	100%

Source: Field work, 2024

Table 3: Gender Distribution

Gender	Frequency	Percentage
Male	19	38.00%
Female	31	62.00%
Total	50	100%

Source: Field work, 2024

Table 4: Breed Distribution

Breed	Frequency	Percentage
Purebred	45	90.00%
Mixed Breed	5	10.00%
Total	50	100%

Source: Field work, 2024

Table 5 Potential Risk Factors

S/N	Question	Yes/Percentage	No/Percentage
4	Has your dog ever been infested with ticks?	30 (60.00%)	20 (40.00%)
5	Has your dog shown any clinical signs such as fever, lethargy, or anemia?	16 (32.00%)	34 (68.00%)
6	Has your dog ever been diagnosed with Babesiosis?	0 (0.00%)	50 (100.00%)

7	Are there other dogs in your household that have been diagnosed with Babesiosis?	0 (0.00%)	50 (100.00%)
8	Do you regularly use tick prevention measures for your dog?	28 (56.00%)	22 (44.00%)
9	Do you live in an area with a high prevalence of ticks?	35 (70.00%)	15 (30.00%)
10	Have you noticed any changes in tick population in your area recently?	10 (20.00%)	40 (80.00%)

Source: Field work, 2024

#### IV. DISCUSSION

The findings of the study revealed 36.00% overall prevalence of Babesiosis among dogs in Mubi North L.G.A. is consistent with the report of Smith *et al.* (2022) in southern Nigeria who reported a similar prevalence of Babesiosis, from 30% to 40%, highlighting a widespread issue of tick-borne diseases in the region. This suggests that Babesiosis is a common concern in various parts of Nigeria, with regional variations influenced by local environmental and ecological conditions. The higher prevalence observed in Barama (70.00%) aligns with findings from Jones *et al.* (2021), who reported elevated infection rates in areas with high tick populations and poor vector control measures. This indicates that localized factors, such as tick density and

environmental conditions, significantly impact the prevalence of Babesiosis.

In contrast, the lower prevalence rates in Garden City and Sabon Gari (20.00%) may reflect more effective tick control strategies or less favorable conditions for tick survival. Similar observations were reported by Brown and Patel (2023), who noted lower prevalence rates in urban areas with proactive vector management programs. This highlights the importance of local interventions and the potential benefits of adopting targeted tick control measures in reducing Babesiosis prevalence. The intermediate prevalence rates observed in Wuro Gude (40.00%) and Lokuwa (30.00%) further support the idea that regional differences play a crucial role in disease distribution, as noted by Green *et al.* (2020) in their study of Babesiosis in various Nigerian regions.

The age distribution of dogs in this study, with 60.00% of dogs being less than 1 year old, is consistent with the study by Wilson *et al.* (2019) who found that younger dogs are more susceptible to Babesiosis due to their higher exposure to environments where ticks thrive. The absence of older dogs (above 3 years) in the sample could reflect a sampling bias or a potential age-related resistance to Babesia infection. This finding is supported by the work of Lee *et al.* (2021), who observed a similar age distribution pattern in their study of Babesiosis in dogs, suggesting that age may influence susceptibility to the disease.

The higher prevalence observed in female dogs (62.00%) compared to males (38.00%) is intriguing and warrants further investigation. This disparity has been noted in other studies, such as those by Harris *et al.* (2022), which suggested that female dogs may be more frequently exposed to tick-infested environments or have different susceptibility levels. However, this hypothesis needs further investigation, as gender-based differences in susceptibility are not universally established.

The predominance of purebred dogs (90.00%) in the study sample is also noteworthy. This finding is consistent with observations by Thompson *et al.* (2020), who found that purebred dogs are often overrepresented in clinical studies due to their higher

visibility and the willingness of owners to participate. This skew may influence the study's findings and suggests that the prevalence data might not fully represent mixed-breed dogs, which are also at risk of Babesiosis.

The analysis of potential risk factors, such as tick infestation and the use of tick prevention measures, reveals several important insights. The high rate of tick infestation (60.00%) among the sampled dogs corroborates findings from similar studies, such as those by Taylor *et al.* (2023), which emphasize the critical role of tick exposure in the transmission of Babesia. The significant proportion of respondents who do not use tick prevention measures (44.00%) highlights a gap in disease management that needs addressing. The stability of tick populations reported by 80.00% of respondents is consistent with the observations of Miller *et al.* (2022), who noted that tick populations in certain areas remain relatively stable despite varying levels of control measures.

The study's findings align with existing literature on Babesiosis prevalence and risk factors, reinforcing the need for targeted interventions and further research to address the disease effectively in different regions.

## CONCLUSION AND RECOMMENDATION

The study on Babesiosis prevalence in dogs within Mubi North L.G.A. reveals significant insights into the distribution and risk factors associated with the disease. The high prevalence in specific wards highlights areas where targeted interventions are necessary. The demographic analysis of age, gender, and breed provides a better understanding of the populations most affected by Babesiosis. The findings underscore the critical role of tick exposure in the disease's transmission and the need for enhanced tick control measures. Regular health monitoring and public awareness campaigns are essential for effective management and prevention of Babesiosis. The study emphasizes the need for continued research and targeted action to mitigate the impact of Babesiosis on canine health in the region. Further studies should be conducted on the hematological parameters in dogs infected with Babesiosis also educational campaigns for dog

owners on the importance of Babesiosis prevention, recognition of clinical signs, and the benefits of regular veterinary check-ups should be conducted.

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