



## PREVALENCE OF TICK AND ANAPLASMA INFESTATIONS IN RELATION TO SEX, AGE AND LOCATION OF BUNAJI CATTLE IN KADUNA STATE, NIGERIA

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### ABSTRACT

The study investigates the prevalence of ticks and anaplasma parasites in free-grazing Bunaji cattle of Ikara and Makarfi Local Government Areas, Kaduna State, Nigeria. Five herds of Bunaji cattle were selected from each Local Government Area, of which 200 animals were randomly selected. Blood samples from all the 200 cattle were obtained for isolation and identification of anaplasma parasites using microscopic technique. Packed Cell Volume (PCV) and Total Protein (TP) levels were also analyzed for each blood sample. Out of the 200 cattle examined, 77 (38.5%) were infested with ticks and a total of 368 ticks were collected. Four (4) genera of ticks were identified: *Amblyomma spp.* (37.8%), *Hyalomma spp.* (31.8%), *Rhipicephalus spp.* (13.6%), and *Boophilus spp.* (16.8%) were the genera identified. Anaplasma parasites were identified in only 4 cattle (2%) of the total sample and (5.2%) of the tick-infested cattle. The study revealed that male cattle had a significantly ( $P < 0.05$ ) higher prevalence (51.1%) than females with (34.6%). On the other hand, young cattle had a significantly ( $P < 0.05$ ) higher prevalence (53.8%) compared to adults (33.1%). A significant difference ( $P < 0.05$ ) was observed in the mean values of packed cell volume (PCV) between those positive for anaplasma parasite and those that were negative for the parasites, whereas, there was no Significant difference ( $P < 0.05$ ) in the values of total protein (TP) between those positive and those negative for anaplasma parasite. In conclusion, Male *Hyalomma species* recorded higher (36.2%) prevalence, while female *Amblyomma species* was found to be dominant (43.7%). It is recommended that, prophylactic and curative measures be emphasized on male and young cattle with 51.1% and 53.8% level of infestation respectively.

**Keywords:** Ticks, Anaplasma, Morphological, Identification, Tick-Borne, Diseases

### INTRODUCTION

Hard ticks are obligate hematophagous ectoparasites that depends on vertebrate hosts for survival and reproduction (Brites-Neto *et al.*, 2015). They attach to the skin of cattle, feed on their blood, and causes anemia, reduced weight gain, skin lesions, and cause secondary bacterial infections (De la Fuente *et al.*, 2017). Additionally, their ability to transmit various pathogens makes them a serious veterinary concern. Some the tick species commonly found on free-grazing cattle are *Rhipicephalus (Boophilus) microplus*, *Rhipicephalus annulatus*, and *Amblyomma variegatum*, which are all known to transmit *Anaplasma marginale*, the causative agent of bovine anaplasmosis (Scoles *et al.*, 2021). Bovine anaplasmosis is a serious disease caused by *Anaplasma marginale*, a Gram-negative, obligate intracellular bacterium that invades red blood cells, which leads to severe hemolytic anemia, fever, weakness, and in some cases, death (Rymaszewska and Grenda, 2020). The disease has a significant impact on the productivity of livestock by reducing milk yield, fertility rates, and overall growth performance (OIE, 2022). Transmission primarily occurs through tick bites, mechanical vectors such as biting flies, and contaminated veterinary instruments (Kocan *et al.*, 2015). Given that free-grazing cattle have higher exposure to tick-infested environments, they are at a higher risk of contracting and spreading the disease (Reye *et al.*, 2021).

Hard tick infestations and the pathogens associated with them are a global concern, particularly in regions where climate and pasture conditions favour tick multiplication (Estrada-Peña *et al.*, 2018). In sub-Saharan Africa, tick-borne diseases such as anaplasmosis are widespread, with



significant economic losses as a result of morbidity, mortality, and the cost of control measures (Githaka *et al.*, 2021). The distribution and abundance of hard tick species are greatly influenced by environmental factors, cattle movement, and host availability, necessitating periodic surveys to assess their prevalence and risk factors (Chitimia-Dobler *et al.*, 2020).

Hard ticks remain a significant challenge in free-grazing cattle farming, acting as vectors for *Anaplasma species* and contributing to widespread economic losses (Githaka *et al.*, 2023). Continuous research and surveillance are necessary to improve control strategies and improve cattle health (Kamani *et al.*, 2022). This study provides a basis for understanding the epidemiology of ticks and *Anaplasma* infections, emphasizing the need for integrated control measures.

## **MATERIALS AND METHODS**

### **Study Area**

This study was conducted in Ikara and Makarfi Local Government Areas (LGAs) of Kaduna State, Nigeria. Both LGAs are located in the northern part of the state (Ibrahim *et al.*, 2021) and they comprise of a stable and natural ecosystem in the Northern Guinea Savanna zone. Ikara is geographically position at approximate 11.17° N and 8.25°E while Makarfi LGA lies between latitude 11.22° N and longitude 7.85° E. The region has a similar climate to Ikara, with an average annual rainfall ranging between 600 mm and 1200 mm (Ibrahim *et al.*, 2021).

### **Study Design:**

To determine the distribution of tick species in the study area, a cross-sectional study design was used.

### **Sample Size Determination**

In estimating the sample size for this study, 87.5% prevalence obtained by Musa *et al.*, (2023) for tick infestation on cattle in White Fulani Cattle in Zaria and its Environs was adopted. The formula of Thrushfield (2007) was adopted for determining the sample size.

### **Data Collection:**

Ticks were collected from two (2) areas; Ikara and Makarfi Local Government Areas. In each Local Government Areas, 5 Fulani Settlement were selected, blood and all visible ticks were collected from 20 randomly selected cattle varying in age and sex, all belonging to the indigenous (*Bos indicus*) Bunaji breed. Age of the animals were estimated on the basis of the dentition score method, as validated for zebu cattle under a low-nutrition conditions by Mushonga *et al.*, (2020) and on information provided by the cattle owners. Two hundred (200) free-grazing cattle were studied during the month of September 2024.

Blood samples were collected from the jugular vein of the 200 animals. These samples were transported immediately to the Parasitology Laboratory in test tubes containing anticoagulant, ethylene diamine tetra-acetic acid (EDTA). The entire body surface of two hundred (200) free grazing Bunaji cattle was thoroughly examined. The collection was performed using blunt steel forceps, ticks were collected from different parts of the body including the neck/dewlap, eyes, ear, udder and external genitalia, inner thighs, under the tail/perineum and legs/interdigital spaces by using blunt steel forceps and hand gloves. Ticks from each animal were stored separately in vials containing 70% ethanol, labelled with information of the host (i.e., sample number, and sex), village, and date of sampling.

### **Morphological Identification:**

Both tick and anaplasma parasites identification was carried out in the Entomology Teaching and Research Laboratory of the Department of Veterinary Parasitology and Entomology, Faculty of Veterinary Medicine, Ahmadu Bello University, Zaria, Nigeria. Once in the laboratory, all collected ticks were counted and identified to the specie level using a stereomicroscope (up to 100× magnification) and was accomplished with the help of the morphological key by Walker *et al.* (2003). To identify anaplasma pathogen, thin blood smears were deposited on glass slides adopting the procedure as suggested in the manual of Tick Fever Research Center, DPI Queensland, Australia (Tick Fever Research Center, 1996). The blood samples on the slides were fixed in 100% methyl alcohol for



2 min. The slides were stained 10% solution of Giemsa's stain for five minutes then rinsed with distilled water.

### Statistical Analysis

The Data obtained were organized, edited and analyzed using statistical package for social science (SPSS) version 20. Means were separated using independent t-test. Results generated from the investigation were expressed using descriptive statistics and inferential statistics.

## RESULTS AND DISCUSSION

Table 1 depicts the prevalence of ticks in sex and age group of cattle along with their corresponding total. Out of the 200 free-grazing Bunaji cattle screened, 77 (38.5%) were tick infested while 123 (61.5%) were not tick infested. The total indicated that male animals are having the highest tick prevalence with (51.1%) infested. This result agrees with the reports of Opara and Ezech (2011) who reported that male cattle are more infested with ticks than female cattle. However, this result is not in agreement with the works of Asmaa *et al.* (2014), Rony *et al.* (2010) and Sarkar (2007) whose reported a significantly higher prevalence of ectoparasitic infestations in female than male cattle. Infestation rate was higher (53.85%) in younger animals aged  $\leq 3$  years and lower in adult animals (33.15%) aged  $> 3$  years (Table 1). This is in agreement with the works of Manan *et al.*, (2007), who discovered that resistance in the animals was building up as the animals grow up and the animals became more resistant and adoptable than in younger stage irrespective of the farm species.

**Table 1:** Ticks Species Prevalence in Relations to Sex and Age of the Cattle

Group	No. Examined (%)	No. Infested (%)	Prevalence %	X <sup>2</sup> Calculated	P-Value
<b>Sex</b>					
Male	47 (23.5)	24 (31.2)	51.1		
Female	153 (76.5)	53 (68.8)	34.6	1.07	0.03
<b>Age</b>					
Young ( $\leq 3$ yrs)	52 (26)	28 (36.4)	53.8		
Adult ( $\geq 3$ yrs)	148 (74)	49 (63.6)	33.1	9.83	0.0017
<b>Total</b>	<b>200</b>	<b>77</b>	<b>38.5</b>		

Significance level ( $\alpha$ ) = 0.05, X<sup>2</sup> Tabulated = 3.84, df = 1,

Table 2 Shows the common tick species infesting cattle in Ikara and Makarfi LGAs of Kaduna State. A total of 368 ticks were collected and of four genera *Amblyomma spp* (37.8%), *Hyalomma spp*. (31.8%), *Rhipicephalus spp*. (13.6%) and including the sub-genus *Rhipicephalus (Boophilus)* (16.8%%). This is not in agreement with a report by Musa *et al.* (2023) who reported a higher prevalence of *Rhipicephalus spp* (46.55%). The higher prevalence of *Amblyomma* observed in this study could be attributed to the current method of ivermectin administration by Fulani herders, which is predominantly through injection. This method may be less effective in controlling *Amblyomma* ticks compared to the previous practice of manual hand-picking, carried out up to 3 times a week during the wet season (Lorusso *et al.*, 2013; Musa *et al.*, 2023), which, although labour-intensive, specifically targeted the more conspicuous adult *Amblyomma* ticks on animals. Obadiah and Shekaro (2012) reported four species of ticks from Zaria Nigeria and showed that sub-genus *Rhipicephalus (Boophilus) spp* was predominant with prevalence rate of (22.5%) followed by *Amblyomma spp* (17.7%), *Hyalomma spp* (6.7%) and *Rhipicephalus spp* (3.3%).

**Table 2:** Common Tick Species Infesting Cattle in Ikara and Makarfi LGAs of Kaduna State

Ticks	Gender N (%)		
	Male	Female	Total
Hyalomma	76 (65)	41 (35)	<b>117</b>
Rhipicephalus	22 (44)	28 (56)	<b>50</b>
Amblyomma	70 (50.4)	69 (49.6)	<b>139</b>
Boophilus	42 (67.7)	20 (32.3%)	<b>62</b>
<b>Total</b>	<b>210 (57.1)</b>	<b>158 (42.9)</b>	<b>368</b>

Table 3 presents result of the prevalence of tick infestation and anaplasma parasites as observed under the microscope. A total of 200 cattle were infested with tick of which 4 (2%) of the total population were infested with *Anaplasma marginale*, indicating a 5.2% anaplasma infection rate in the 77 tick-infested cattle.

**Table 3:** Prevalence of Tick Infestation and Anaplasma Parasites in Examined Cattle

Parameter	Number of Cattle	Percentage %
Total Cattle Examined	200	100.0
Cattle Infested with Ticks	77	38.5
Cattle Positive for Anaplasma (total)	4	2.0
Cattle with Ticks and Anaplasma Parasite	4	5.2

Table 4 shows the descriptive and inferential statistics for the effect of Anaplasma parasites on Packed Cell Volume (PCV) and Total Protein (TP) levels in cattle, using the thin blood smear (TBS) diagnostic method. At a 0.05 level of significance, the PCV (%) of TBS-positive cattle was significantly lower than that of TBS-negative cattle. This suggests that Anaplasma infection is associated with reduced PCV levels, indicating anemia, which is consistent with previous findings by Kocan *et al.* (2003), who reported that *Anaplasma marginale* causes hemolytic anemia due to the destruction of erythrocytes. In contrast, the TP (g) values showed no significant difference ( $P < 0.05$ ) between TBS-positive and TBS-negative cattle. This suggests that Anaplasma infection may not significantly affect serum total protein levels, which aligns with the findings of Yeruham *et al.* (2003), who observed that while PCV levels significantly drop in Anaplasma-infected cattle, total protein concentrations often remain within the normal physiological range unless the infection is severe or prolonged.

**Table 4:** Comparison between TBS Positive and Negative Based on PCV (%) and TP (g)

Variable	TBS	N	Mean	SD	SEM	t-test value	P-value
PCV (%)	Yes	4	18.25	4.031	2.016	4.634	0.0001
	No	196	29.77	4.935	0.352		
TP (g)	Yes	4	6.75	1.578	0.789	0.157	0.876
	No	196	6.82	0.835	0.060		

Significance level ( $\alpha$ ) = 0.05. SD - standard deviation, SEM - standard error of mean, TBS – Tin Blood Smear, TP – Total Protein, PCV – Packed Cell Volume, N – Number of observations

## CONCLUSION AND RECOMMENDATION

From the findings of this study, the following conclusions were drawn:

- There is a higher tick prevalence in male (51.1%) and in the young cattle (53.8%) in the study area.
- Male *Hyalomma species* recorded higher (36.2%) prevalence, while female *Amblyomma species* was found to be dominant (43.7%).
- A tick prevalence of 38.5% was recorded among cattle in the study area.
- Out of the 200 Bunaji cattle examined, only 4 (2%) tested positive for Anaplasma infection, indicating a low prevalence within the study area, which may be attributed to





factors such as natural resistance or improved cattle management.

Based on the findings of this study, the following recommendations are made:

- i. Prophylactic and curative measures should be emphasized on male and young cattle with 51.1% and 53.8% tick prevalence respectively.
- ii. Further studies should be conducted to investigate the seasonal variations of tick infestations and the prevalence of other tick-borne pathogens in the region.

## REFERENCES

- Asmaa, N. M., ElBably, M. A., & Shokier, K. A. (2014). Studies on prevalence, risk indicators and control options for tick infestation in ruminants. *Beni-Suef University Journal of Basic and Applied Sciences*, **3**(1): 68–73.
- Brites-Neto, J., Duarte, K. M., & Martins, T. F. (2015). Tick-borne infections in cattle: A review. *Ticks and Tick-borne Diseases*, **6**(1): 1–9.
- Buba, A. & Yahaya, I. S. (2020). Health risk assessment of heavy metals accumulation in tomato irrigation farm at Kwadon, Gombe, Nigeria. *ATBU Journal of Science, Technology and Education*, **7**(2): 271–280.
- Chitimia-Dobler, L., Schaper, S., Rieß, R., & Król, N. (2020). Tick surveillance and prevalence of Anaplasma infections. *Parasites & Vectors*, **13**: 463–470.
- De la Fuente, J., Estrada-Peña, A., & Venzal, J. M. (2017). Overview of tick-borne diseases in cattle. *Journal of Veterinary Science*, **18**(2): 131–146.
- Estrada-Peña, A., Mihalca, A. D., & Petney, T. N. (2018). The ecology of tick-borne diseases. *Frontiers in Veterinary Science*, **5**, 120.
- Githaka, N., Konnai, S., Bishop, R., & Murata, S. (2023). Epidemiology of Anaplasma infections in Africa. *Journal of Tropical Medicine*, 2023, 120795.
- Githaka, N., Konnai, S., Bishop, R., & Murata, S. (2021). Epidemiology of Anaplasma infections in Africa. *Journal of Tropical Medicine*, **2**(1): 993–998.
- IBM Corp. (2011). *IBM SPSS Statistics for Windows* (Version 20.0) [Computer software]. IBM Corp.
- Ibrahim, W. H., Jimoh, A. I., & Owonubi, A. (2021). Growth and yield of groundnut (*Arachis hypogaea* L.) as affected by different phosphorus levels and plant densities in Northern Guinea Savanna of Nigeria. *International Journal of Agricultural Policy and Research*, **9**(11): 171–178.
- Kamani, J., Baneth, G., Mumcuoglu, K. Y. & Harrus, S. (2022). Molecular detection and characterization of tick-borne pathogens. *Ticks and Tick-borne Diseases*, **11**(1): 151–164.
- Kocan, K. M., de la Fuente, J., Guglielmone, A. A., & Melendez, R. D. (2003). Antigens and alternatives for control of *Anaplasma marginale* infection in cattle. *Clinical Microbiology Reviews*, **16**(4): 698–712.
- Lorusso, V., Picozzi, K., de Bronsvort, B. M., Majekodunmi, A., Dongkum, C. & Balak, G. (2013). Oxide ticks of traditionally managed cattle in Central Nigeria: Where *Rhipicephalus* (Boophilus) microplus does not dare (yet?). *Parasites & Vectors*, **6**: 171–181.
- Manan, A. B. K., Khan, Z., & Avais, M. (2007). Prevalence and identification of ixodid tick genera in goats and sheep in Lahore, Pakistan. *Journal of Animal and Plant Sciences*, **17**(1–2): 1–3.
- Musa, R. (2023). Molecular detection of *Anaplasma phagocytophilum* in Ixodid ticks infecting White Fulani cattle in Zaria and its environs, Kaduna State, Nigeria. *Sahel Journal of Veterinary Science*, **20**(2): 249–256.
- Obadijah, H. I., & Shekaro, A. (2012). A survey of tick infestation in cattle in Zaria abattoir. *Nigerian Journal of Veterinary Advances*, **2**(2): 81–87.
- OIE (World Organisation for Animal Health). (2022). Bovine anaplasmosis. Retrieved from [www.oie.int](http://www.oie.int).



- Opara, M. N., & Ezech, N. O. (2011). Ixodid ticks of cattle in Borno and Yobe States of Northeast Nigeria: Breeds and coat colour preference. *Animal Research International*, **8**(1): 1359–1365.
- Rony, S. A., Mondal, M. H., Begum, N., Islam, M. A., & Affroze, S. (2010). Epidemiology of ectoparasitic infestations in cattle at Bhawal Forest area, Gazipur. *Bangladesh Journal of Veterinary Medicine*, **8**(1): 27–33.
- Reye, A. L., Arinze, J., & Hübschen, J. M. (2021). Tick-borne pathogens in free-ranging cattle. *Parasites & Vectors*, **14**: 86-91.
- Sajid, M. S. (2007). *Epidemiology, acaricidal resistance of tick population infesting domestic ruminants* (Ph.D. thesis). University of Agriculture, Faisalabad, Pakistan.
- Sarkar, M. (2007). *Epidemiology and pathology of ectoparasitic infestation in Black Bengal goats in Bangladesh* (M.Sc. thesis). Department of Parasitology, Bangladesh Agricultural University, Mymensingh.
- Scoles, G. A., Broce, A. B., & Ueti, M. W. (2021). Transmission of *Anaplasma marginale* by ticks and mechanical vectors. *Veterinary Parasitology*, **295**, 109453.
- Tick Fever Research Center. (1996). *Manual of the Tick Fever Research Center*. DPI Queensland, Australia.
- Thrusfield, M. (2007). *Veterinary epidemiology* (3rd ed.). Oxford: Blackwell Science Ltd.
- Walker, A. R. (2003). *Ticks of domestic animals in Africa: A guide to identification of species*. Edinburgh, UK: Bioscience Reports.
- Yeruham, I., Perl, S., Braverman, Y., & Chacham, G. (2003). *Anaplasma* infection in beef cattle: Clinical and hematological observations. *Revue de Médecine Vétérinaire*, **154**(8–9): 577–581.