SVU-IJVS-8(2), 30-36 Print ISSN: 2535-1826 Online ISSN: 2535-1877
Research Article Open Access

Prevalence of Tick Infestation and Its Associated Risk Factors in Small Ruminants Within Abuja, Nigeria

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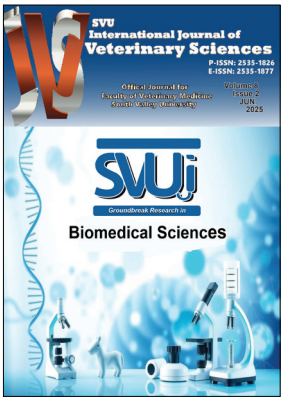
https://doi.org/ 10.21608/svu.2025.368871.1374

Submit Date: 2025-03-17; Revise Date:2025-04-16; Accept Date:2025-04-28



ABSTRACT

Ticks are ectoparasites that infest livestock, causing significant economic losses due to reduced productivity, mortality, and transmission of tick-borne diseases. Sheep and goats are particularly susceptible to tick infestations, which can have devastating consequences on their health and productivity. This study aimed to determine the prevalence of tick infestations in sheep and goats and identify associated risk factors in Abuja, Nigeria. A cross-sectional study was conducted in Abuja and environs, involving *50* sheep and *50* goats per area council visited. Ticks were collected from the animals. Data on animal characteristics, farm management practices, and environmental factors were collected from the owners. Using taxonomic keys created by Latif and Walker, every tick that was gathered was meticulously identified. The species that was most prevalent was Rhipicephalus sanguineus, *66.67* %, followed by Hyalomma marginatum, *20* %, and Amblyomma marmoreum was the least species encountered, *13.33* %. The overall prevalence of tick infestations in sheep and goats was *46*% and *44*%, respectively. The study revealed that animal age, breed, sex, and farm management practices were significant risk factors associated with tick infestations. This study demonstrates a high prevalence of tick infestations in sheep and goats in Abuja, Nigeria, with significant associations with animal characteristics and farm management practices. There was a significant difference in the prevalence of tick infestation in sheep compared to goats, with female sheep showing a higher rate of infestation than female goats. The findings highlight the need for effective tick control measures and integrated pest management strategies to reduce the burden of tick-borne diseases and improve livestock productivity in the study area. Thus, based on the authors' research and understanding, there has been no prior study conducted in this particular study area, making this investigation unique in its scope and significance.

Keywords: *Ectoparasites, Sheep, goats, Abuja, risk factors*

INTRODUCTION

Small ruminants are significantly affected by ticks, as these parasites impair their hosts' health and reduce their productivity. Ticks transmit various viruses, bacteria, and protozoa between animals (Maqbool et al., 2017). These microorganisms can cause diseases that are fatal or severely harmful to domestic animals and can even pose risks to human health. In tropical and subtropical regions, where warm climates promote the proliferation of various tick species, small ruminants are particularly vulnerable. Additionally, wild animal populations in warm environments serve as reservoirs for ticks and the infectious microorganisms that affect small ruminants. Livestock farmers employ various management techniques to control tick populations and related treatments to reduce infections in small

ruminants (Maqbool et al., 2017).

Ticks have been recognized as parasites of domestic animals since at least 400 B.C. Aristotle, in his famous work "Historia Animalium," described ticks as unpleasant parasites resembling grass (Bekker et al., 1837). Despite this early observation, detailed research on ticks did not begin until the latter half of the nineteenth century, when many parasitologists worldwide began exploring their taxonomy, prevalence, bionomics, and seasonal and geographical distribution (Maqbool et al., 2017).

Ticks belong to the phylum Arthropoda and the order Acarina. They are classified into three families: Argasidae, Ixodidae, and Nuttalliellidae. Among these, only the Ixodidae (hard ticks) and Argasidae (soft ticks) are relevant to veterinary medicine (Luqman et al., 2007). Ixodidae have a hard shield called the scutum, while Argasidae have a leathery cuticle on their dorsal surface. Further classification of Ixodidae is possible based on the number of hosts required to complete their life cycle, which includes the egg, larva, nymph, and adult stages. A total of 899 tick species parasitize vertebrates, which includes 185 species of Argasidae, 713 species of Ixodidae (Egbegi and Seidu, 2011). Ticks are considered the most economically significant ectoparasites of livestock in Sub-Saharan Africa, particularly in Nigeria, according to Lorusso et al. (2013). Their economic impact is closely related to their blood-feeding behavior, which exposes hosts to a wide range of pathogens that can cause tick-borne diseases (TBDs) directly or indirectly. Rajput et al. (2006) highlight that ticks can transmit diseases such as babesiosis, cowdriosis, theileriasis, and hemorrhagic fever. Additionally, tick feeding can lead to severe anemia, skin and hide damage, reduced milk production, and potentially fatal paralysis. Ticks also cause significant health concerns through extreme irritability, allergies, and toxicosis (Gebre et al., 2001).

Moreover, tick-borne diseases and conditions are transmitted through the bite of an infected tick. These include Alpha-gal syndrome (AGS), Lyme disease, Anaplasmosis, Ehrlichiosis, Babesiosis, Powassan (POW), Rocky Mountain spotted fever, and Tularemia. Ticks can be infected with bacteria, viruses, or parasites (Abd-Elrahman et al., 2025). Ticks can be carriers of various infectious pathogens, including Salmonella typhimurium in humans and animals, Pasteurella multocida, and Brucella abortus (Gebre et al., 2001; Abd-Elrahman et al., 2025). Therefore, this investigation examines a previously overlooked area of study, emphasizing its potential impact in the field, which necessitates focused research in this specific area.

MATERIALS AND METHODS

Study Area

The study was carried out in various farms and markets in 2 Area Councils (Gwagwalada and Kuje) of the Federal Capital Territory, FCT, Abuja, Nigeria. This is because these two areas have large animal farms and animal markets, and thus, a convenient method was adopted. The Federal Capital Territory is located geographically at the centre of Nigeria. It lies between latitudes 8°35" and 9°25" North; longitudes 6°45" and 7°45East of the Greenwich Meridian, with a land area of 8000 square kilometers. Having a Guinea Savannah type of season, annual rainfall ranging from 1100 to 1600 mm. There are two major types of seasons: dry season (November-April) and rainy season (May-October) per year. The maximum temperature is 37ºC and a minimum of 30ºC (Adekayi 2000; Balogun 2001). The present work was to determine the prevalence of tick infestation with associated risk factors on small ruminants in Gwagwalada and Kuje Area Council, Abuja, with a land mass of 11,824 hectares.

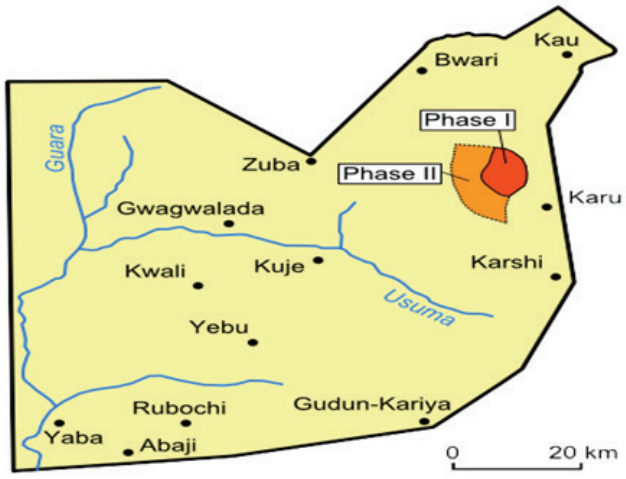


Figure 1: Map Showing sample collection areas in abuja, Nigeria

Study Design

The study was conducted from August to October 2024, as tick productivity peaked during these months due to favorable breeding weather. The research

involved visiting two farms and two markets in each of the previously mentioned area councils. The study involved visiting those identified places, taking note of the management systems, especially on the farms, relating to the owners, workers, and veterinarians, and physically observing small ruminants. Petri dish, Hand gloves, Forceps, 10 % Formaldehyde, Cotton wool, disinfectant (Chlorhexidine), and Paper tape were used.

Sample Size and Population

A total of 100 small ruminants, involving 50 sheep and 50 goats per area council visited, were sampled. We obtained these numbers by selecting only the ruminants that had ticks on them.

Sample collection

A total of fifty sheep and goats, aged between 1 and 3 years, were categorized as young, while those aged between 4 and 6 years were classified as old. These animals were randomly selected during the study period from August to October to assess the presence and infestation rate of ticks in the study area. The ticks observed on the body of the sheep and goats were gently removed using forceps collected ticks were preserved in a well-labeled glass petri dish containing 10 % formaldehyde and thereafter were transported to the Veterinary Parasitology Laboratory, University of Abuja, for identification. Identification of ticks was described according to the key of Estrada-Peña et al. (2006). Following a visual inspection of the distinguishing characteristics using a microscope.

Statistical Analysis

A percentage table was used to compare the proportions found in this investigation. The analysis's 95% confidence level and $p<0.05$ threshold for significant difference were established. The risk factor and the P value were calculated using the odds ratio.

RESULT

Out of the 50 sheep and 50 goats in the study, 46 sheep and 44 goats had a total of 150 ticks recovered from them. Three tick species, all belonging to the ixodidae family, were identified. The species that was most prevalent was Rhipicephalus sanguineus 100 (66.67 %), followed by Hyalomma marginatum 30 (20 %), and Amblyomma marmoreum was the least species encountered, 20(13.33 %) (Table 4). There is a strong association between the tick infestation and the different breeds (Uda, Yankasa, and Balami) of sheep (ChiSquare = 6, DF = 4, P = 0.1991). Similarly, there is a strong association between the tick infestation and the different breeds (Red Sokoto, Sahel, and the West African dwarf) of goats (ChiSquare = 6, DF = 4, P = 0.1991). Table 2, showed that male sheep had 0.3 times higher odds of tick infestation compared to female sheep (OR = 0.11, 95% CI [0.0012, 10.27], P = 0.34). Similarly, table 2 showed that male goats had 0.3 times higher odds of tick infestation compared to female goats (OR = 0.11, 95% CI [0.0012, 10.27], P = 0.34).

Table 3 showed that young sheep had 9 times higher odds of tick infestation compared to old sheep (OR = 9, 95% CI [0.09, 831.85], P = 0.34). Similarly, Table 3 showed that young goats had 9 times higher odds of tick infestation compared to old goats (OR = 0.11, 95% CI [0.0012, 10.27], P = 0.34).

There is a strong association between the tick infestation and the different breeds (Uda, Yankasa, and Balami) of sheep (ChiSquare = 6, DF = 4, P = 0.1991). Similarly, there is a strong association between the tick infestation and the different breeds (Red Sokoto, Sahel, and the West African dwarf) of goats (ChiSquare = 6, DF = 4, P = 0.1991).

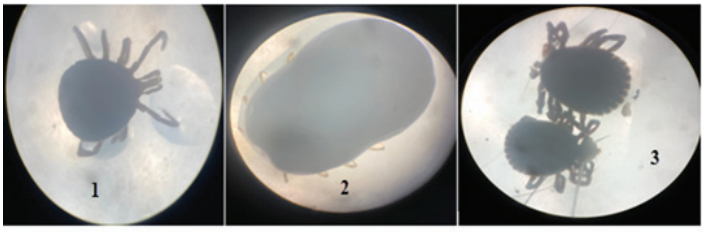


Figure 2: Showing the views of (1) Hyalomma marginatue, (2) Rhipicephalus sanguineus, (3) Amblyomia marmoreum

Table 1: Number of Ticks encountered in Sheep and Goats

Type of tick	No.	%
Rhipicephalus sanguineus	100	66.67
Hyalomma marginatum	30	20
Amblyomma marmoreum	20	13.33

Table 2: Infestation of Ixodid Ticks in Relation to Sex of Sheep and Goats

Sex of sheep	Number examined	Number with ticks	Total Number of Ticks	Ticks (%)
Male	20	16	40	41
Female	30	30	57	59
Total	50	46	97	100
Sex of goats	**Number**	**Number with ticks**	**Total number of ticks**	**Ticks (%)**
Male	25	23	16	30
Female	25	21	37	70
Total	50	44	53	100

Table 3: Infestation of Ixodid Ticks in Relation to Age of Sheep and Goats

Age of sheep	Number	Number with ticks	Total number of ticks	Percentage of ticks (%)
Young (1- 3 yrs)	35	30	55	57
Old (4-6yrs)	15	13	42	43
Total	50	43	97	100
Age of Goats	**Number examined**	**Number with ticks**	**Total number of ticks**	**Ticks (%)**
Young (1- 3 yrs)	25	25	33	62
Old (4- 6 yrs)	25	19	20	38
Total	50	43	97	100

Table 4: Infestation of Ixodid Ticks in Relation to Breed of Sheep and Goats

Breed of sheep	Number examined	Number with ticks	Total number of ticks	Ticks (%)
Uda	35	35	57	59
Yankasa	10	6	23	24
Balami	5	5	17	17
Total	50	46	97	100
Breed of Goats	**Number examined**	**Number with ticks**	**Total number of ticks**	**Ticks (%)**
Red Sokoto	25	20	32	60
Sahel	10	10	14	27
West African dwarf	15	14	7	13
Total	50	44	53	100

DISCUSSION

The study revealed that in Gwagwalada and Kuje the small ruminants examined were both male and female and were all infested with ticks. The prevalence of tick infestation was higher in female sheep than in their male counterparts. These findings are in accord with the findings of Ali et al. (2021) and Kivaria et al. (2012). Female goats exhibited a higher prevalence of tick infestation compared to male goats, a finding that aligns with the research conducted by Wall & Morgan in 2019. This increased susceptibility may result from poor management practices, including infrequent deworming and vaccination, inadequate nutrition and mineral supplementation, insufficient veterinary care, and a lack of monitoring for tick-borne diseases. These factors can significantly contribute to tick infestations in small ruminants, as reported by Wall & Morgan (2019).

The level of infestation can be exacerbated by certain risk factors, including poor pasture management practices such as overgrazing, inadequate pasture rotation, failure to remove weeds and debris from grazing areas, and improper vegetation management, as noted by Estrada-Peña and de la Fuente (2014). According to Abbas et al. (2020), several risk factors contribute to tick infestations, including inadequate tick control measures. This situation may arise from improper application of acaricides, failure to treat all animals within a flock, a lack of insect-repellent products, and insufficient monitoring for ticks. Moreover, the prevalence of ticks is further exacerbated by poorly maintained housing and fencing, which can be attributed to ineffective waste management, inadequate biosecurity measures, and a lack of regular cleaning and disinfection of living areas (Seixas et al., 2018).

The current study on the infestation of Ixodid ticks in sheep indicated that young sheep are more susceptible to tick infestations than adults. The findings showed a higher prevalence of tick infestations in young sheep compared to their adult counterparts. Similarly, in the present study, examining the infestation of Ixodid ticks in goats revealed that young goats are also more susceptible to tick infestations than adults. The results indicated that the level of infestation was higher in young goats when compared to adult goats.

The present study indicates that overgrazing or poor grazing management can lead to higher host density, which, in turn, can support a greater prevalence of tick populations, as noted by Ogden et al. (2019). Additionally, behaviors of small ruminants, such as grooming and resting, can impact the dynamics of tick infestations and a higher prevalence, as demonstrated by the research conducted by Estrada-Peña and de la Fuente (2014). Furthermore, excessive host density, as shown in this study, may promote tick dispersal, while larger flock sizes can lead to increased prevalence of tick infestations, as similarly reported by Dobson et al. (2011).

The current study on Ixodid tick infestation in sheep found that Uda sheep exhibited a higher prevalence of ticks compared to Yankasa and Balami sheep. Uda sheep had significantly higher rates of infestation than both the Yankasa and Balami breeds. This variation in prevalence may be due to the differing levels of susceptibility among the various sheep breeds (Estrada-Peña & de la Fuente, 2014).

In the current study, tick infection is found to be more prevalent in young animals, as reported by Wall and Morgan (2019). Additionally, this study reveals that tick infestations are more common in animals with underlying medical conditions, a finding that echoes the results of Abbas et al. (2020). Furthermore, the study indicates that vulnerability to tick infestations can be heightened by various risk factors, including stress, hunger, long or thick coats, poor grooming practices, and frequent exposure to tick habitats. These factors were also highlighted by Mattioli et al. (2000) in their research.

In the present study, those ruminants with an underlying disease state as risk factors indicated higher prevalence of tick infestations, and according to Rehman et al. (2017), certain breeds or genetic lines may exhibit a high sensitivity to infestation, thus resulting in higher prevalence. Tick infestation and feeding success are significantly influenced by the animal's immune responses, as reported by Ali et al. (2021).

The current study took place between August and November, a period that promotes tick breeding due to

favorable weather conditions. This finding is supported by Gray et al. (2009), who noted that ticks thrive in environments with abundant vegetation, leaf litter, weeds, and water sources such as ponds, streams, or moist soil. Additionally, Randolph (2004) indicated that tick prevalence tends to peak during periods of rainfall.

Furthermore, factors such as climate change could influence tick prevalence, abundance, distribution, and seasonal activity, as reported by Ogden et al. (2019). In this study, species such as Rhipicephalus sanguineus, Hyalomma marginatum, and Amblyomma marmoreum were identified, suggesting that their prevalence may be favored in wet soils. Furthermore, tick prevalence can vary depending on the type of soil, as noted by Gilbert (2010).

CONCLUSION

The results of this study indicated that the tick species Rhipicephalus sanguineus, Hyalomma marginatum, and Amblyomma marmoreum were prevalent on both sheep and goats in the Gwagwalada and Kuje regions. The study further revealed that the prevalence of tick infestation was higher in sheep compared to goats, with female sheep showing a higher rate of infestation than female goats. Among younger animals, young sheep exhibited the highest prevalence of ticks, while older goats had the lowest prevalence. Recommendations

Understanding the prevalence, risk factors, and control measures related to tick infestations is crucial for farm workers, farmers, and veterinarians. This knowledge is essential for the effective management and prevention of tick infestations through animal health programs.

To minimize the impact of ticks on small ruminant production, it is important to implement integrated control strategies. These strategies should include acaricide treatments, pasture management, and biological control methods.

Additionally, maintaining a high level of hygiene among farmers and all sellers of small ruminants in the market is vital. It is important to ensure that moisture levels are kept to a minimum, as excessive moisture can promote tick breeding.

AUTHORSHIP

The concept was developed and planned by Dr. Amina Ibrahim, the data was gathered by Aniebiet-Abasi Akanimo, who wrote the paper, and Professor Lawan Adamu reviewed the manuscript, evaluating and interpreting the data statistically.

FUNDING

This research received no grant from any funding agency.

ETHICAL STATEMENT

The Institutional Animal Care and Use Committee (IACUC) of the University of Abuja, Nigeria, authorized the study protocol before its start via the number SP003758, ensuring that it adhered to the standards of studies involving animals.

DECLARATION OF COMPETING INTEREST

No conflicting interest to declare.

ACKNOWLEDGEMENT

The authors would like to express their deep gratitude to the staff of the Department of Veterinary Medicine, Faculty of Veterinary Medicine, University of Abuja, Nigeria, and also animal owners in Abuja and its surroundings for their cooperation.

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