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# PREVALENCE OF HARD TICKS INFESTING CATTLE IN LAFIA, NASARAWA STATE, NORTH CENTRAL NIGERIA

*Adejoh, V. A.[1], Pam V. A.[1], Uzoigwe, N. R.[1], Naphtali, R. S.[2], Yohanna, J. A.[1], Pam, R. G.[1], Ombugadu, A.[1], Pam, D. D.[3] and Dogo, K. S.[1]

[1]Department of Zoology, Faculty of Science, Federal University Lafia, P. M. B. 146, Lafia, Nasarawa, Nigeria.
[2]Department of Zoology, Modibbo Adama University of Science and Technology, P. M. B. 2076, Yola, Adamawa State, Nigeria.
[3]Department of Zoology, Faculty of Natural Sciences, University of Jos, P. M. B. 2084, Jos, Plateau State, Nigeria.

*Corresponding Email: adejohvictor511@gmail.com

**ABSTRACT:** Ticks are major impediments to animal production and health in the Sub-Saharan Africa, including Nigeria. This research investigated ticks infestation in locally grazed commercial cattle at Shinge Livestock Market in Lafia, Nasarawa State, North Central Nigeria. 200 cattle were randomly examined for ticks. Ticks were collected using blunt forceps so as not to damage their mouthparts. Out of the 200 cattle examined, 112(56.0%) were infested which spread across 61(55.5%) cows and 51(45.5%) bulls. The infestation of ticks in relation to bulls and cows showed no significant difference (P = 0.2301). A total of 1,152 ticks were collected from all cattle examined. *Rhipicephalus (Boophilus) decoloratus* 948(62.3%) was the most abundant species infesting cattle breeds followed by *Amblyomma variegatum* 383(25.2%), then *Hyalomma rufipes* 184(12.1%), while *Rhipicephalus sanguineus* 7(0.5%) was the least tick species encountered. There was a very high significant difference (P = 0.0001053) in abundance between tick species. The udder and inguinal region 451(29.6%) was most infested of all predilection sites. Thus, there was a very high significant difference (P = 0.00001) in ticks infestation rate in relation to predilection sites. Overall, the findings showed that ticks are common arthropod pest among cattle present in the market. It is therefore recommended that intensive farming practices be employed to reduce cattle and tick contact.

**Keywords:** Cattle, Hard Ticks, Lafia, Prevalence

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## INTRODUCTION

Ticks are hematophagous non-host specific ectoparasites (Guglielmone *et al.,* 2010). The important families of ticks present in the tropics and sub-tropics include the Ixodidae (hard ticks) and the Argasidae (soft ticks) ticks which are known to transmit a greater variety of infectious agents than any other arthropod group (Walker *et al.,* 2003; Goddard, 2008; Guglielmone *et al.,* 2010).

Nigeria has a cattle population of approximately 19.5 million heads, 80% of which are prevalent in the North Central region (Audu, 2016). The nomadic (extensive) system of grazing (Awogbade, 1979) exposes cattle to tick infestation by at least four genera of ticks (*Rhipicephalus, Hyalomma, Boophilus, Amblyomma*) (Lorusso *et al.,* 2013) which are endemic in Nigeria and are known to transmit various important tick borne diseases of cattle which may be transmitted to man through effective tick bites (Ikpeze *et al.,* 2015). It has been observed that unrestricted grazing escalates and encourages tick-host contact and possibly result to high prevalence of tick infestation among cattle (Ayana *et al.,* 2013).

Besides infecting livestock with various parasites and other pathogens (Gwakisa*, et al.,* 2001), ticks cause anaemia and loss of young animals due to abortion, reduced milk production, weakness and immunosuppression (Edlow, 2008). Ticks also damage the hides and skin of cattle thus causing significant economic loss to the cattle owners. Tick-bites in humans could result in tick-borne infectious diseases, e.g., human babesiosis (Ikpeze *et al*., 2007) and severe toxic conditions such as paralysis and toxicosis, irritation and allergy (Jongejan & Uilenberg, 2004).

The inability to effectively control ticks and tick-borne diseases is a factor that limits livestock production. The worldwide economic loss due to tick infestation and the additional burden of protecting livestock against ticks and tick-borne diseases is estimated to be in the billions of dollars annually (Randolph, 2005). This study is therefore aimed at determining the prevalence of hard ticks in Lafia with special reference to their site of attachment and tick borne parasites in tick haemolymph. This study would aid in early detection of infection.

## MATERIALS AND METHODS

### Study Area

Nasarawa State lies in the Sub-humid zone of Central Nigeria and lies between Latitude 8˚0′ and 9˚20′N and longitude 7˚20′ and 9˚36′E. Lafia is the capital city of Nasarawa State and the largest town in Nasarawa State. It has a modern central market and other markets. The Shinge Livestock Market is where cattle, sheep and goats are sold along with food, grains and other wares.

### Sample Collection

Two hundred (200) commercial cattle of different breeds, gender and ages were randomly screened for tick infestation from August 2017 to January, 2018. Cattle were selected at equal intervals, sampling one out of every three animals (i.e. first animal sampled, second and third not sampled, fourth animal sampled). The dentition score method developed for Zebu cattle under low plane nutrition (Kikule, 1953) and information obtained from cattle owners aided in cattle age estimation. The ages was recorded as; calf (0-6 months), juvenile or yearling (6-24 months) and adult (above 24 months) (Lorusso *et al.*, 2013).

### Collection of Tick Samples from Cattle

The selected cattle were thoroughly examined for ticks. All ticks found were carefully removed using forceps while ensuring there is no damage on the structure and mouthparts of the ticks (Mohammed, 1974; James-Rugu, 2000). Ticks were collected from different parts of the cattle body including the head, neck, udder and inguinal region, dewlap, abdomen, ear, anus escutcheon, legs, groin, back, side and tail. All stages of ticks including the larvae, nymphs and adults present at each site were collected. When present the various developmental stages of tick were equally collected.

All ticks collected from a particular site of the body were put in a clean specimen bottle and labeled against the site of collection. The ticks were then taken to the Zoology Department Laboratory at Federal University Lafia for identification.

### Tick Identification

The morphology of the ticks was studied in the laboratory using dissecting and compound microscopes. Identification of the different species of the ticks was accomplished with the help of the anatomical and morphological characteristics as described by Morel *et al.* (1989) and Walker *et al*. (2003).

### Data Analysis

Data obtained were analyzed using R Console software (Version 3.2.2). Proportions of infestation rate of tick load in relation to species of ticks and gender was compared using Pearson's Chi-square test. One-way analysis of variance (ANOVA) was used to compare the mean tick load in relation to cattle ages. The P-values $< 0.05$ were considered statistically significant.

## RESULTS

### Prevalence of Tick Infestation in Relation to Different Cattle Breed and Gender

Two hundred (200) cattle which spread across five breeds were randomly examined for ticks of which 112(56.0%) were tick infested (Table 1). The infestation rate of ticks on screened cows was 54.5% (61) while 45.5% (51) of bulls were infested. The difference in the infestation between the bulls and cows was not significant ($\chi^2$ = 1.44, df = 1, P = 0.2301).

**Table 1: Prevalence of Tick Infestation in Relation to Different Cattle Breed and Gender**

| Cattle Breed | No. Exam. (%) | Total No. Infested (%) | Bull | | | Cow | | |
|---|---|---|---|---|---|---|---|---|
| | | | No. Exam. (%) | No. Infested (%) | No. of Ticks Collected (%) | No. Exam. (%) | No. Infested (%) | No. of Ticks Collected (%) |
| **Bokolo** | 13 | 9(69.2) | 6 | 4(7.8) | 84(13.3) | 7 | 5(8.2) | 44(4.9) |
| **Bororo** | 5 | 3(60) | 2 | 2(4.0) | 45(7.1) | 3 | 1(1.6) | 3(0.3) |
| **Bunaji** | 171 | 92(53.8) | 83 | 41(80.4) | 443(70.1) | 88 | 51(83.6) | 803(90.2) |
| **Gudali** | 1 | 1(100) | 0 | 0(0.0) | 0(0) | 1 | 1(1.6) | 7(0.8) |
| **Wagumeri** | 10 | 7(70) | 7 | 4(7.8) | 60(9.5) | 3 | 3(5.0) | 33(3.7) |
| **Total** | **200** | **112** | **98** | **51** | **632** | **102** | **61** | **890** |
| **(%)** | | **(56)** | | **(45.5)** | **(41.5)** | | **(54.5)** | **(58.5)** |

$\chi^2$ = 1.44, df = 1, P = 0.2301

**Prevalence of Tick Infestation on Cattle according to Age**

Of the 200 cattle sampled, calves were 46(23.0%), Juvenile (yearlings) were 59(29.5%) while adult cattle were 95(47.5%) (Table 2). However, tick infestation in relation to age of cattle showed no significant difference ($F_{198}$ = 0.1173, Adjusted $R^2$ = -0.004456, P = 0.7324).

**Table 2: Prevalence of Tick Infestation on Cattle according to Age**

| Cattle Age | No. Exam. | No. Infested (%) | Mean ± S.E |
|---|---|---|---|
| Calf | 46 | 26(23.2) | 6.8±2.1 |
| Juvenile | 59 | 30(26.8) | 8.4±2.3 |
| Adult | 95 | 56(50.0) | 7.5±1.2 |
| **Total** | **200** | **112(56.0)** | |

$F_{198}$ = 0.1173, Adjusted $R^2$ = -0.004456, P = 0.7324

**Prevalence of Tick Species in Relation to Cattle Breed**

A total of 1,522 ticks were collected from cattle breeds examined. The Bunaji breed 1,246(81.9%) was most infested while the Gudali breed 7(0.5%) was least infested with ticks (Table 3). There was no significant difference ($F_{195}$ = 0.1617, Adjusted $R^2$ = -0.01714, P = 0.9574) in tick infestation in relation to cattle breeds.

Plate 1 showed the four tick species identified. *Rhipicephalus (Boophilus) decoloratus* 948 (62.3%) was the most abundant tick species found on the cattle breeds while *Rhipicephalus sanguineus* 7(0.5%) had the least number of infesting ticks (Table 2). Tick abundance across species showed a very high significant difference ($\chi^2$ = 86.233, df = 3, P = 0.00001).

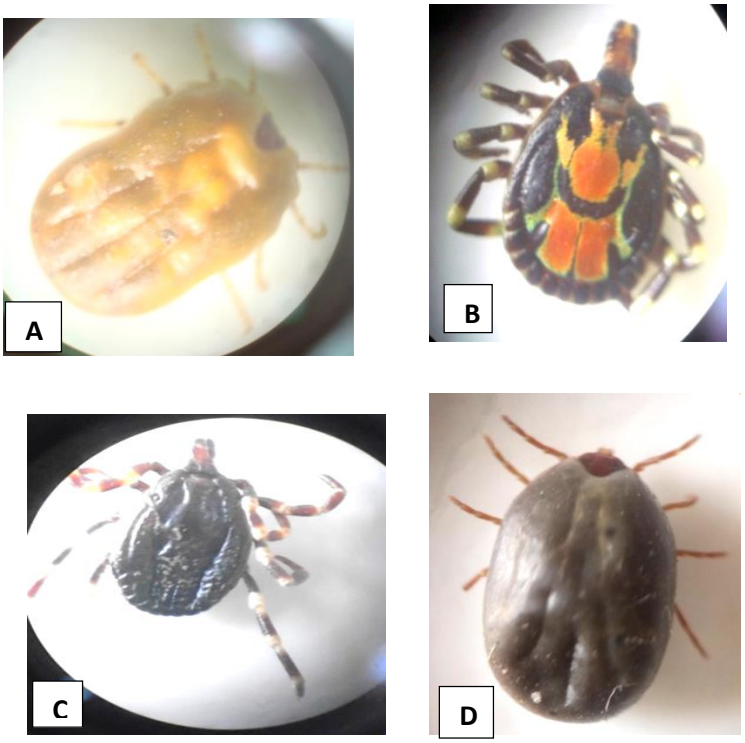


**Plate1: A:** *Rhipicephalus (Boophilus) decoloratus* **B:** *Amblyomma variegatum* **C:** *Hyalomma rufipes* **D:** *Rhipicephalus sanguineus* (x100 magnification)

**Developmental Stages of Ticks Infesting Cattle Breeds**

Adult females had the highest pooled abundance of ticks 907(59.6%) infesting cattle breeds. This was followed by adult males 424(27.9%) and the nymphs 134(8.8%), while the larval stage had the least tick load of 57(3.8%) (Table 3). Overall, there was a very high significant difference ($\chi^2$ =1168.2, df = 3, P = 0.0001) in pooled abundance of tick load in relation to developmental stages infesting cattle breeds.

**Table 3: Prevalence of Tick Species in Relation to Cattle Breed**

| Breed | Tick Species | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ***Hyalomma rufipes*** | | | | | ***Rhipicephalus (Boophilus) decoloratus*** | | | | | ***Amblyomma variegatum*** | | | | | ***Rhipicephalus sanguineus*** | | | |
| | **L** | **N** | **M** | **F** | **Total (%)** | **L** | **N** | **M** | **F** | **Total (%)** | **L** | **N** | **M** | **F** | **Total** | **L** | **N** | **M** | **F** |
| Bokolo | 0 | 0 | 0 | 8 | **8 (4.3)** | 6 | 12 | 3 | 62 | **83 (8.8)** | 0 | 0 | 28 | 9 | **37 (10.0)** | 0 | 0 | 0 | 0 |
| Bororo | 0 | 0 | 0 | 11 | **11 (6.0)** | 0 | 0 | 0 | 6 | **6 (0.6)** | 0 | 0 | 21 | 10 | **31 (8.1)** | 0 | 0 | 0 | 0 |
| Bunaji | 1 | 6 | 5 | 149 | **161 (87.5)** | 48 | 102 | 8 | 633 | **791 (83.4)** | 0 | 4 | 180 | 103 | **287 (75.0)** | 0 | 0 | 0 | 7 |
| Gudali | 0 | 0 | 0 | 0 | **0 (0.0)** | 1 | 0 | 0 | 5 | **6 (0.6)** | 0 | 0 | 1 | 0 | **1 (0.3)** | 0 | 0 | 0 | 0 |
| Wagumeri | 0 | 0 | 0 | 4 | **4 (2.3)** | 1 | 10 | 0 | 51 | **62 (6.5)** | 0 | 0 | 11 | 16 | **27 (7.0)** | 0 | 0 | 0 | 0 |
| **Total (%)** | **1 (0.5)** | **6 (3.3)** | **5 (2.7)** | **172 (93.5)** | **184** | **56 (6.0)** | **124 (13.1)** | **11 (1.2)** | **757 (79.9)** | **948** | **0 (0.0)** | **4 (1)** | **241 (63)** | **138 (36)** | **383** | **0 (0.0)** | **0 (0.0)** | **0 (0.0)** | **7 (100)** |
| **Grand Total (%)** | | **184 (12.1)** | | | | | **948 (62.3)** | | | | | **383 (25.2)** | | | | | **7(0.5)** | | |
| $\chi^2$ | | 460.48 | | | | | 1548.5 | | | | | 422.65 | | | | | 21 | | |
| df | | 3 | | | | | 3 | | | | | 3 | | | | | 3 | | |
| P | | 0.0001 | | | | | 0.0001 | | | | | 0.0001 | | | | | 0.0001053 | | |

Key: L = Larvae; N = Nymph; M = Adult Male; F = Adult Female

**Comparison of Burden of Tick Developmental Stage in Relation to Tick Species**

**Larval Stage:** *Rhipicephalus (Boophilus) decoloratus* had the highest larval tick load 56(98.2%), while *Hyalomma rufipes* 1(1.8%) had the least larval load (Table 4). Therefore, there was a very high significant difference ($\chi^2$ =163.14, df= 3, P = 0.0001) in tick load of larvae between tick species infesting cattle breeds.

**Nymph Stage**: *Rhipicephalus (Boophilus) decoloratus* had the highest nymph tick load 124(92.5%), while *Amblyomma variegatum* 4(3.0%) had the least nymph load. It was observed that *Rhipicephalus sanguineus* nymphs were not seen on the animals (Table 4). Therefore, there was a very high significant difference ($\chi^2$ =326.54, df = 3, P = 0.0001) in tick load of nymphs between tick species infesting cattle breeds.

**Adult Male:** *Amblyomma variegaatum* had the highest adult male tick load 241(56.8%), while *Rhipicephalus (Boophilus) decoloratus* had the least adult male tick load 11(2.6%). *Rhipicephalus sanguineus* 0(0.0%) had no adult male tick occurrence (Table 4). Therefore, there was a very high significant difference ($\chi^2$ =404.17, df = 3, P = 0.0001) in tick load of adult males among tick species infesting cattle breeds.

**Adult Female:** *Rhipicephalus (Boophilus) decoloratus* 757(83.5%) had the highest adult female tick load, *Hyalomma rufipes* 5(0.6%) had the least adult female tick load (Table 4). Therefore, there was a very high significant difference ($\chi^2$ =1704.5, df = 3, P = 0.0001) in tick load of adult females between tick species infesting cattle breeds.

**Table 4: Comparison of Burden of Tick Developmental Stages in Relation to Tick Species**

| Tick Species | Developmental Stages | | | | |
|---|---|---|---|---|---|
| | **L** | **N** | **M** | **F** | **Grand Total** |
| *Hyalomma rufipes* | 1(1.8) | 6(4.5) | 5(0.6) | 172(40.6) | 184 (12.1) |
| *Rhipicephalus (Boophilus) decoloratus* | 56(98.2) | 124(92.5) | 11(2.6) | 757(83.5) | 948 (62.3) |
| *Amblyomma variegatum* | 0(0) | 4(3.0) | 241(56.8) | 138(15.2) | 383 (25.2) |
| *Rhipicephalus sanguineus* | 0(0) | 0(0) | 0(0) | 7(0.8) | 7(0.5) |
| **Total (%)** | **57(3.7)** | **134(8.8)** | **424(27.9)** | **907(59.6)** | **1,522** |
| **Grand Total** | | | **1,522** | | |
| $\chi^2$ | 163.14 | 326.54 | 404.17 | 1704.5 | |
| df | 3 | 3 | 3 | 3 | |
| P | 0.0001 | 0.0001 | 0.0001 | 0.0001 | |

Key: L = Larvae; N = Nymph; M = Adult Male; F = Adult Female

**Comparison of Burden of Tick Developmental Stage in Relation to Tick Species**

**Larval stage:** *Rhipicephalus (Boophilus) decoloratus* had the highest larval tick load 56(98.2%), while *Hyalomma rufipes* 1(1.8%) had the least larval load (Table 5). Therefore, there was a very high significant difference ($\chi^2$ =163.14, df= 3, P = 0.0001) in tick load of larvae between tick species infesting cattle breeds.

**Nymph Stage:** *Rhipicephalus (Boophilus) decoloratus* had the highest nymph tick load 124(92.5%), while *Amblyomma variegatum* 4(3.0%) had the least nymph load (Table 5). Therefore, there was a very high significant difference ($\chi^2$ =326.54, df = 3, P = 0.0001) in tick load of nymphs between tick species infesting cattle breeds.

**Adult Male:** *Amblyomma variegaatum* had the highest adult male tick load 241(56.8%), while *Rhipicephalus (Boophilus) decoloratus* had the least adult male tick load 11(2.6%) (Table 5). Therefore, there was a very high significant difference ($\chi^2$ =404.17, df = 3, P = 0.0001) in tick load of adult males among tick species infesting cattle breeds.

**Adult Female:** It was observed from the animals that *Rhipicephalus (Boophilus) decoloratus* 757(83.5%) had the highest adult female tick load. *Hyalomma rufipes* 5(0.6%) had the least adult female tick load (Table 4). Therefore, there was a very high significant difference ($\chi^2$ =1704.5, df = 3, P = 0.0001) in tick load of adult females between tick species infesting cattle breeds.

**Table 5: Comparison of Burden of Tick Developmental Stages in Relation to Tick Species**

| Tick Species | Developmental Stages | | | | |
|---|---|---|---|---|---|
| | **L** | **N** | **M** | **F** | **Grand Total** |
| *Hyalomma rufipes* | 1(1.8) | 6(4.5) | 5(0.6) | 172(40.6) | 184 (12.1) |
| *Rhipicephalus (Boophilus) decoloratus* | 56(98.2) | 124(92.5) | 11(2.6) | 757(83.5) | 948 (62.3) |
| *Amblyomma variegatum* | 0(0) | 4(3.0) | 241(56.8) | 138(15.2) | 383 (25.2) |
| *Rhipicephalus sanguineus* | 0(0) | 0(0) | 0(0) | 7(0.8) | 7 (0.5) |
| **Total (%)** | **57(3.7)** | **134(8.8)** | **424(27.9)** | **907(59.6)** | **1,522** |
| **Grand Total** | | | **1,522** | | |
| $\chi^2$ | 163.14 | 326.54 | 404.17 | 1704.5 | |
| df | 3 | 3 | 3 | 3 | |
| P | 0.0001 | 0.0001 | 0.0001 | 0.0001 | |

Key: L = Larvae; N = Nymph; M = Adult Male; F = Adult Female

**Tick Prevalence in Relation to Predilection Sites and Cattle Breed**

The predilection site most infested by ticks was the udder and inguinal region 451(29.6%), while the back was least infested 25(1.6%) (Table 6). Thus, there was a very high significant difference ($\chi^2$ = 1471.6, df = 12, P = 0.00001) in ticks infestation rate in relation to predilection sites.

**Table 6: Tick Prevalence in Relation to Predilection Sites and Cattle Breed**

| Predilection Sites | Cattle Breeds | | | | | Total (%) |
|---|---|---|---|---|---|---|
| | Bokolo | Bororo | Bunaji | Gudali | Wagumeri | |
| | No. of ticks (%) | No. of ticks (%) | No. of ticks (%) | No. of ticks (%) | No. of ticks (%) | |
| Head | 0(0) | 1(2) | 28(2.4) | 0(0) | 2(2.2) | **31(2.0)** |
| Neck | 5(4.1) | 0(0) | 47(3.8) | 0(0) | 4(4.3) | **56(3.7)** |
| Udder/Inguinal Region | 21(17.1) | 16(32.7) | 394(31.5) | 1(14.3) | 19(20.4) | **451(29.6)** |
| Dewlap | 5(4.1) | 0(0) | 60(4.8) | 0(0) | 18(19.4) | **83(5.5)** |
| Abdomen | 12(9.8) | 9(18.4) | 216(17.3) | 2(28.6) | 4(4.3) | **243(16.0)** |
| Ear | 10(8.1) | 3(6.1) | 49(3.9) | 0(0) | 9(9.7) | **71(4.7)** |
| Anal Region | 36(29.3) | 18(36.7) | 101(8.1) | 0(0) | 14(15.1) | **169(11.1)** |
| Eskutcheon | 3(2.4) | 0(0) | 39(3.1) | 2(28.6) | 2(2.2) | **46(4.0)** |
| Legs | 12(9.8) | 0(0) | 71(5.7) | 0(0) | 3(3.2) | **86(5.7)** |
| Groin | 4(3.3) | 1(2) | 161(12.9) | 0(0) | 4(4.3) | **170(11.2)** |
| Back | 6(4.9) | 0(0) | 16(1.3) | 0(0) | 3(3.2) | **25(1.6)** |
| Side | 6(4.9) | 1(2) | 41(3.3) | 2(28.6) | 7(7.5) | **57(3.7)** |
| Tail | 3(2.4) | 0(0) | 27(2.2) | 0(0) | 4(4.3) | **34(2.2)** |
| **Total** | **123(8.1)** | **49(3.2)** | **1250(82.1)** | **7(0.5)** | **93(6.1)** | **1,522** |

$\chi^2$ = 1471.6, df = 12, P = 0.00001

**Prevalence of Tick Species in Relation to Predilection Site**

With regards to the most infested predilection site (udder and inguinal region), *Amblyomma variegatum* 191(42.0%) had the highest tick load while *Rhipicephalus sanguineus* 1(0.2%) had the least tick load in that region (Table 7). Hence, infestation rate in the udder and inguinal region between tick species showed a very high significant difference ($\chi^2$ = 41.759, df = 3, P = 0.00001).

**Table 7: Tick Prevalence in Relation to Predilection Site**

| Predilection Sites | Tick Species | | | | Total (%) |
|---|---|---|---|---|---|
| | ***Hyalomma rufipes* (%)** | ***Rhipicephalus (Boophilus) decoloratus* (%)** | ***Amblyomma variegatum* (%)** | ***Rhipicephalus sanguineus* (%)** | |
| Head | 1(3.3) | 29(96.7) | 0(0) | 0(0) | **30(2.0)** |
| Neck | 2(4.0) | 47(92.2) | 2(4.0) | 0(0) | **51(3.4)** |
| Udder/Inguinal Region | 98(21.5) | 165(36.3) | 191(42.0) | 1(0.2) | **455(29.9)** |
| Dewlap | 4(4.3) | 84(90.3) | 5(5.4) | 0(0) | **93(6.1)** |
| Abdomen | 30(12.4) | 157(65.1) | 54(22.4) | 0(0) | **241(15.8)** |
| Ear | 4(6.6) | 55(90.2) | 2(3.3) | 0(0) | **61(4.0)** |
| Anal Region | 8(5.2) | 86(55.8) | 60(39.0) | 0(0) | **154(10.1)** |
| Eskutcheon | 0(0) | 59(88.1) | 6(9.0) | 2(3.0) | **67(4.4)** |
| Legs | 13(14.0) | 66(71.0) | 14(15.1) | 0(0) | **93(6.1)** |
| Groin | 20(12.4) | 94(58.4) | 43(26.7) | 4(2.5) | **161(10.6)** |
| Back | 2(8.3) | 20(83.3) | 2(8.3) | 0(0) | **24(1.6)** |
| Side | 2(2.9) | 66(94.3) | 2(2.9) | 0(0) | **70(4.6)** |
| Tail | 0(0) | 20(91.0) | 2(9.1) | 0(0) | **22(1.4)** |
| **Total (%)** | **184(12.1)** | **948(62.3)** | **383(25.2)** | **7(0.5)** | **1,522** |

$\chi^2 = 41.759$, df = 3, P = 0.00001

## DISCUSSION

### Prevalence of Tick Infestation in Relation to Different Cattle Breed and Gender

The 56% prevalence of tick infestation observed in this study shows that tick infestation is a major ectoparasite problem in the areas where the animals are reared. The high prevalence is also an indication of lack of adequate tick control measures by headers. It also shows the demerits of extensive cattle farming practice by cattle farmers.

This result conforms to that of James–Rugu and Jidaya (2004), Tongjura *et al.* (2012), Eyo *et al.* (2014), Musa *et al*. (2014) who reported a prevalence of 81.8%, 73.3%, 88.49% and 63.4% in different parts of Nigeria including Yobe, Keffi, Karu and Kokona, Nsukka, and Maiduguri respectively.

In parts of Africa Hassanain (1997) and Tadesse *et al.* (2012) equally recorded high prevalence (80.44% & 72.5%) of tick infestation in Egypt and Ethiopia respectively.

Although the cows had higher burden of infestation than the bulls, the variation was not significant. This suggests that the species of ticks encountered in this study show no gender preference. This finding agrees with that of Lorusso *et al.* (2013) and Musa *et al.* (2014) who reported lack of variation of tick loads in relation to gender of cattle in Bokkos, Mangu and Pankshin Local Government Areas of Plateau State, Central Nigeria and Maiduguri, Northeastern Nigeria. However, this result is in contrast to Ramadan *et al.* (2016) who observed a significant difference in tick load in relation to gender of cattle in three localities in Egypt. It also disagreed with the findings of Malann *et al*. (2016) who observed a significant difference in tick load in relation to gender of cattle in Abuja, Central Nigeria. Nevertheless, the difference in tick burden in bulls and cows in the present study could be due to odor difference. In the dipteran tsetse fly, ox urine odour is known to attract the flies (Spath, 1995). Ticks are also known to locate their host by odor; the cow urine odor may possibly be a factor for the observed higher infestation of cows.

### Prevalence of Tick Infestation on Cattle according to Age

There was no age preference in infestation as cattle of all ages were predisposed to infestation. The low tick burden observed in calves could be attributed to the constant grooming of caves by their respective dams (Fivaz & de Waal, 1993) and possibly the smaller body surface of younger animals compared to adults (Mooring *et al.,* 2000). The adults with their bigger and larger body surface areas provide more contact opportunities for tick attachment. More so, the low tick burden recorded in calves could equally be due to the practice of roping calves on the farms when the adults graze in the field. This reduces the time spent grazing in the open grasslands with their respective dams therefore reducing cattle and tick contact (Lorusso *et al.*, 2013).The significantly lower prevalence of tick infestation on calves compared to adults is in line with reported findings on indigenous cattle in Sudan (Jongejan *et al.,* 1987; Marufu *et al.,* 2011) and in Nigeria (Pukuma *et al.,* 2011).

**Prevalence of Tick Species in Relation to Cattle Breed**

The lack of variation in tick infestation in relation to cattle breed possibly suggests that ticks infesting cattle at the study site are not breed specific. This also suggests that none of these breeds was completely resistant to tick infestations as all the breeds were infested at varying levels. On the contrary, studies by Eyo *et al.* (2014), Musa *et al.* (2014), Turaki *et al.* (2016) and Qadeer *et al.* (2017) showed a variation of tick infestation in relation to cattle breeds in Eastern Nigeria Maiduguri, Borno State and Adamawa State respectively.

The high abundance of *Rhipicephalus (Boophilus*) *decoloratus* (62.3%) shows that it may be the most abundant tick specie in the field. This variation could be because Lafia seemingly provides an ideal environment which fosters the propagation of this particular specie as they prefer a warm climate (Maxime *et al.,* 2017), highland and sub-highlands which receive more than 800mm of rainfall annually (Pegram *et al.,* 1981). Also, being a boophilid and a one-host tick that entirely develop on cattle after the egg hatch, its population is expected to be relatively constant throughout the year in this setting thus presenting a persistent threat of bovine anaplasmosis and babesiosis (Iwuala & Okpala, 1978).

In Nigeria, this result agrees with that of James-Rugu and Jidayi (2004); Lorusso *et al.* (2013); Kemal and Tesfaye (2017) who reported variation in abundance of tick species infesting cattle and that *Rhipicephalus (Boophilus) decoloratus* (21.7%), (41.4%) and (84.64%) was the most abundant tick in their respective study areas. However, this result did not agree with that of Obadiah and Shekaro (2012), Malann *et al.* (2016) who reported that *Amblyomma* species (54.34%) was most recorded in their study.

The observed lower prevalence of *Amblyomma variegatum* in the present study could mainly be ascribed to the tick handpicking practice of the cattle farmers, carried out at least three times weekly (Pullan, 1980). Additionally, *Amblyomma variegatum* is a three host tick with a wide host range hence, at any given time it is possible for its population to dwindle on any host under study (Lorusso *et al.,* 2013).

**Prevalence in Predilection Sites in Relation to Cattle Breed**

As observed in this study and also reported by other workers *(*Spickett *et al*., 1989; Opara *et al.,* 2005; Muchenje *et al.,* 2008; Nady *et al*., 2014) ticks show a high tendency to attach on cattle udder and inguinal regions. This finding may be attributed to the highly vascularized, moist, warm and thin skin of the udder and inguinal regions which allows for easy tick attachment for adequate blood feeding.

This result is in agreement with Obadiah and Shekaro (2012) and Ikpeze *et al*. (2015) who observed variations in prevalence of ticks in relation to predilection sites. Although *Amblyomma variegatum* were generally found on almost all parts of the cattle body, they were observed to prefer the udder and inguinal region and groin to other predilection sites. This finding agrees with Moges *et al.* (2012) in Ethiopian cattle and also that of Ikpeze *et al.* (2015) in Nigeria.

**CONCLUSION**

This study showed the diversity of tick species found in cattle at Shinge Livestock Market Lafia, Nasarawa State. High tick infestation prevalence of 56% in cattle was recorded from the study site suggesting that ticks remain a major challenge to cattle in the field and the livestock industry. Four species of ticks was encountered in the study, they include; *Rhipicephalus (Boophilus) decoloratus, Hyalomma rufipes, Rhipicephalus sanguineus and Amblyomma variegatum* which are known to transmit various tick borne diseases to cattle.

**RECOMMENDATIONS**

The economic and health implications of these ectoparasites are enormous, deserving urgent attention by Government, policy makers and nongovernmental organizations to give the farmers better value for their livestock.In view of this the Government is urged to re-establish/introduce the old “dipping” system of tick control at strategic points to headers for easy access to de-tick their animals. Due to the high cost of acaricides and the risk of acaricide resistant ticks, research into phytoacaricides as alternatives should be encouraged.

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