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Original Research

Assessment on the Occurrence and Species of Ixoidaidae Ticks Infesting Cattle in Guto Gida District East Wollega Zone, Ethiopia

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Abstract

The purpose of this cross-sectional study was to identify the tick prevalence and risk factors among communally grazed cattle in the Guto Gida District in a subset of kebele from January to June of 2021. Three hundred and eighty-four animals were selected at random (using a lottery system). The coded data was loaded into Stata 14, a statistical program, for additional statistical analysis. The strength of the hypothesized risk variables was determined by conducting univariable and multivariable logistic regression analysis. Out of a total of 213 animals, 55.5% tested positive. A substantial variance (P<0.05) was noted when risk factors such age, physical condition score of cattle, and Keble were taken into account. Nevertheless, sex and breed did not show any statistically significant variations in prevalence (P>0.05).The tick species that were found to be most prevalent were: Amblyoma coherence (37.7% of the total), Amblyoma varigatum (25.4% of the total), Rhipecephalus (Bo)decoleratus (21.6% of the total), and Rhipicephalus evertsi (15.3% of the total). Ticks are endemic to animals, which means that they can reduce milk and meat quality as well as skin and hide quality. Tick-borne diseases can spread from host to host, and economic losses can result from tick burdens.

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INTRODUCTION

When looking at GDP ratios, or the state of the national economy, agriculture is a key factor. With an estimated 70 million cattle, Ethiopia is one of the most livestock-rich African nations (CSA, 2021). Using animals as a substitute for tractors is a common practice among Ethiopian farmers, who see it as a fantastic opportunity. Furthermore, cattle are crucial for many reasons, including food security, milk production, and generating foreign currency. Nonetheless, ticks impact almost 80% of Africa's cattle population (Minjauw and McLeod, 2003). According to Blate (2021a), in the Badewacho District of the Hadiya Zone, the incidence was 79.2%. Areka District, Wolaita Zone, with a prevalence of 71.6% (Babore et al., 2022).

Estrada-Pena (2001) and Dantas-Torres et al. (2012) both state that more species of hard ticks transmit tick-borne disease and put hosts at risk for other communicable diseases. Anaplasmosis, babesiosis,

theileriosis, and dermatophilosis were the most common tick-borne infections in cattle. The hard ticks Hyaloma and Amblyoma prey on swarms of animals every day. They inflict cuts, skin damage, and inflammation at the site of attachment; they also have long mouths. African tick bite fever, a newly recognized zoonosis, and cowdrosis, a disease caused by the bacterium Rickettsia, both infect Amblyoma species (Dahmani, et al., 2017; Cicculli et al., 2020). A medium-sized tick, called a Rhipicephalus evertsi, with red legs. Anaplasma marginale is the causal agent of bovine anaplasmosis in cattle, and this tick species was the principal vector for its transmission (Walker, 2003). Diseases transmitted by ticks typically manifest as fever, anemia, neurological problems, and occasionally mortality, all of which impact the lymphatic and blood cell systems.

Prevention of tick-borne diseases and control of tick populations are ongoing concerns. Based on studies carried out in several Ethiopian regions, it was predicted that ticks would be common; the following are some of the documented prevalences: The Dire Dawa Administration cow population had a prevalence of 63.02% according to Jemal et al. (2021), 74% according to Meaza et al. (2014), and 79.2% according to Blate (2021b) in the Shone District of the Hadiya Zone. Underdosage, which naturally leads to medication resistance, a lack of seasonal tick knowledge and strategic control, pasture management, communal grazing, and other variables all contribute to the difficulty of tick control in herds. The primary element influencing the disease that ticks transmit to the herd is the absence of understanding about tick status in relation to their species. Diseases transmitted by ticks can be more accurately diagnosed with the use of species identification. In the Guto Gida district of several PAs, there has been no recorded presence of bovine hard ticks in cattle populations. The study set out to do two things: first, determine the tick species prevalence in the study area; and second, identify the risk variables associated with bovine tick infection.

MATERIALS AND METHODS

Study Area and Population

It was in Ethiopia's Guto Gida District, specifically in the east Wollega Zone, that the study took place. Wayu Tuka forms its eastern boundary, Sasiga and Diga its western and northern boundaries, Gida Ayana and Gudaya Bila its southern boundary (Figure 1). Approximately 331 kilometers from Addis Ababa lies Nekemte, the main city of the zone and district. Located between 9˚5′ N and 36˚33′ E, this district's zone experiences a unimodal rainfall range of 1500mm to 2200mm. There were 143,149 cattle, 24,204 sheep, 24,316 goats, 10,388 horses, 10988 donkeys, 972 mules, and 92190 poultry in the district, with 26% being highland, 46.74% being midland, and 33% being lowland, respectively, according to the Office of Guto Gida Livestock and Agriculture (2022). (District Agricultural Bureau, 2022).

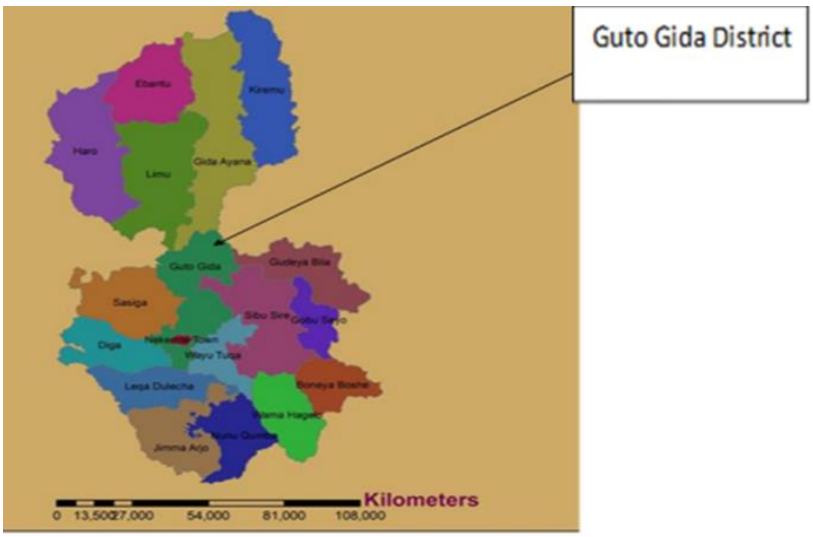

Figure 1. *Map of study area*

Sample Size Determination

According to Thrusfield (2018), the necessary sample size for this study was calculated by taking into account the following variables: expected prevalence (Pexp) = 0.5, significance level (Zα) = 1.96, prevalence (p) = 50%, N = necessary sample size, and d = desired absolute precision (0.05). So, in order to conduct this investigation, 384 animals were required.

$$N = \frac{za^2 Pexp(1-p)}{d^2}$$

Study Design and Sampling Methods

Estimating tick prevalence, identifying tick species, and measuring risk factors connected to tick infestation were the goals of a cross-sectional study that began in January 2021 and continued until June 2021. This study used a combination of simple random sampling and the lottery chance approach to choose animals; however, three kebeles were specifically chosen due to the area's very high livestock population and security concerns. According to Nicholson and Butterworth (1986), the age groupings were young (<1 year), adult (1-3 years), and old (> 3 years), and according to Thomas and Bailey (2021), the bodily appearance or condition score was ranked as good, medium, or poor. During the study period, a total of 157 animals were evaluated in Negasa kebele, 105 in Dune Kane kebele, and 122 in Abdata kebele.

Ticks collection, preservation, transportation and identification

Due to ethical considerations, the chosen animal was restrained without causing harm. Ticks were removed from attachment sites after a thorough examination of the animal's entire body for signs of infection. The ticks were thereafter preserved with 70% alcohol, coded, and placed in an individual universal bottle. Ticks were placed on Petridis, washed, dried, and examined under stereomicroscopy before being transported to the Veterinary Parasitology and Pathology Laboratory at Wollega University School of Veterinary Medicine for identification. Species level

identification was done using the keys provided by Walker et al. (2003).

Data Analysis

A Microsoft Excel spreadsheet was used to enter and code the gathered data. We summed up the descriptive statistics. The coded data was loaded into Stata 14, a statistical program, for additional statistical analysis. By dividing the total number of positive animals by the total sample size and then multiplying by 100, we were able to determine the overall prevalence of ticks. The strength of supposed risk factors was determined by conducting univariable and multivariable logistic regression analyses with independent variables (age, sex, kebele, and body condition score) and the existence of tick infestation (dependent variable). The Hosmer and Lemeshow tests were used to verify the model's fitness. In every instance, effects were deemed statistically significant if the p-value was lower than 5% (P<05).

RESULTS AND DISCUSSIONS

Prevalence of Ixoidaidae Tick of Cattle at Study Area

Out of 384 cattle that were investigated in this study, 109 (28.4%) were males and 104 (27.1%) were females. In all, 213 (55.5%) of the cattle tested positive for ticks, as shown in Table 1. According to Table 4, the tick species that were identified were Amblyoma varigatum, Amblyoma coeherence, Rhipicephalus (Bo) decoloratus, and Rhipicephalus evertsi evertsi. While females had a lower infestation rate of 27.1%, males had the highest prevalence of 28.4%. Tick infestation was highest in the juvenile age group (63.5%), then in the senior age group (55.2%), and finally in the adult age group (48.6%). Tick infestation had the greatest impact on animals with poor body condition (66.9%), medium body condition (56.4%), and good body condition (28.2%). In this study, the prevalence was found to vary significantly (P<0.05) when animals' age, physical condition score, and Keble were taken into account. Prevalence did not change significantly (P > 0.05) by sex or animal breed.

Risk factors: Out of 384 animals tested, 213 (55.5%) (n = 384) tested positive for ticks; 92% of the cattle were native breeds and 8% were hybrids. A correlation between the severity of the tick infestation and the animal's physical condition score was found. Cattle rated as poor in body condition (66.9% of the total) were the most severely impacted, followed by medium (56.4%) and good (28.1%).

Age: Statistical examination of the tick and its risk factor prevalence showed a significant difference (p<0.05) between the young (63.9%), elderly (55.2%), and adult (48.6%) groups of cattle, indicating that tick infestation was more common in these age groups.

Sex: The prevalence of tick infection was compared in male and female animals. Males made up 51.2% of the sample and females 48.8% (p > 0.05).

Breed: Approximately 92% of native breeds were tick-infested, while 8% were hybrids, according to the present study. However, there was no statistically significant difference seen across the breeds of animals (P > 0.05).

Body Condition Score: In the 384 animals that were examined, 71 had a good body condition score; 20 of these (28.2%) tested positive for tick infestation. 156 had a medium score; 88 of these (56.4% of the total) were infested. The remaining 157 cattle (or 66.9% of the total) had a poor score. The results show that tick infestation is substantially correlated with body condition score: animals in poor condition were more impacted than animals in medium condition and good condition [OR = 5.07, P = 0.01, compared to the other way around].

Table 1

The overall Bovine Hard Ticks Prevalence and Associated Risk Factors

Category	No of Examined	Prevalence (%)	OR[95% CI]	*P-value*
Kebele				
Abdeta	122	85 (69.7)	Ref	
Dune kane	105	49 (46.7)	0.39 (0.22 – 0.69)	0.02
Nagasa	157	79 (50.3)	0.38 (0.22 – 0.65)	0.01
Age				
Adult	80	39 (48.6)	Ref	
Young	74	47 (63.5)	0.46 (0.22 – 0.93)	0.03
Old	230	127 (55.2)	0.58 (0.31 – 1.05)	0.07
BCS				
Good	71	20 (28.2)	Ref	
Medium	156	88 (56.4)	3.34 (1.81 – 6.33)	0.01
Poor	157	105 (66.9)	5.07 (2.74 – 9.69)	0.01
Total	384	55.5		

OR= Odd Ratio; CI= Confidence Interval; BCS= Body Condition Score

Proportion of tick distribution between PAs

According to Table 2, out of 55.5% of the total prevalence, 39.9% were recorded as Abdeta kebele, 37.1% as Nagasa, and 23% as Dune kane kebele. Management, control techniques, and the delivery of veterinary clinics at each kebele may vary, which could explain why distinct kebeles arise.

Table 2

Proportion of Tick in Different Kebeles of Study Area

Kebele	No of Positive	Proportion (%)	OR (95% CI)	P- Value
Abdeta	85	39.9	Ref	
Dune Kane	49	23.0	0.38 (0.22 – 0.65)	0.02
Nagasa	79	37.1	0.44 (0.27 – 0.72)	0.01
Total	213	1.00		

Frequency of ticks

With 25.4% of the total ticks discovered to be Amblyoma varigatum, Rhipicephalus (Bo) decoloratus came in second with 21.6%, and Rhipicephalus evertsi came in third with 15.3%. An overview of all of these can be found in Table 3.

Table 3

Frequency of Tick Species in Study Area

Ticks species	Frequency	Percent
Rhipecephalus (Bo) decoloratus	79	21.6
Rhipicephalus evertsi evertsi	56	15.3
Amblyoma varigatum	93	25.4
Amblyoma coherence	138	37.7
Total	366	100

Proportion of Tick Prevalence between Breeds of Animals

Based on the data in the table below, it can be observed that indigenous breeds were more affected by tick infections (92% vs. 64%) than cross-breeds. No statistical difference was seen between the breed categories, as shown in Table 4.

Table 4

Proportion of Tick Prevalence between Breed

Breed	No of positive	Proportion (%)	OR(95% CI)	p-value
Cross	17	8.0		
Local	196	92.0	0.72 (0.31 – 1.58)	0.418
Total	213	1.00		

OR= Odd Ratio; CI= Confidence Interval

Proportion of tick prevalence in both sexes

Table 5 shows that there was no statistically significant difference between the sexes when it came to the prevalence of tick infection; however, male animals were slightly more infested than female animals.

Table 5

Tick proportion in both sexes

Sex	No of positive	Proportion (%)	OR(95%CI)	P-value
Female	104	48.8		
Male	109	51.2	125 (0.84 – 1.87)	0.279
Total	213	1.00		

OR= Odd Ratio; CI= Confidence Interval

RESULTS AND DISCUSSION

Through this investigation, we were able to identify the most common tick species infesting cattle in the Guto Gida district. Also, we looked at whether there was a correlation between certain risk factors and tick infestations in cattle. The total number of tick species afflicted by the animals included in this study was 213 (55.5%). Research by Tadasse and Sultan (2004), Jemal et al. (2021), Muhammad et al. (2023), Worku Belete and Solomon Mekuria (2023), and others found similar percentages in various regions of Ethiopia, including the South Omo zone of Selamago district, 65.8% in the Gondar area, 63.02% in Dire Dawa Administration, and 68.2% in Tadasse and Sultan's 2004 study.

This result is higher than previous studies on bovine hard ticks in Ethiopia, such as those by Fesseha and Mathewos (2020) and Fikru et al. (2015), which found a prevalence of 25.23 percent in Haramaya district and 42.22 percent in Hosanna district, respectively. The results reported by Alemu et al. (2014) in Northwest Ethiopia were 81.5%, while Maeza et al. (2014) in Bahir Dar were 75. So, this is lower than those researchers. 79.2% in the Badewacho District of the Hadiya Zone, as reported by Blate (2021a), and 71.6% in the Areka District of the Wolaita Zone, as reported by Babore et al. (2022). The agroecology of the research location and seasonal changes in the time of sample collection might explain this discrepancy. Tick activity is obviously influenced by precipitation, elevation, and humidity.

The tick species that were found in this study were as follows: Amblyomma coherence, which made up 37.7% of the ticks, Amblyoma varigatum, which was second most abundant at 25.4%, Rhipecephalus (Bo) decoleratus, which was third most abundant at 21.6%, and Rhipicephalus evertsi, which was fourth most abundant at 15.3%. This study's finding of a high prevalence of the Amblyomma genus is in line with previous research from the Sidama Zone in the Arbegona region (Kemal et al., 2016) that also revealed a high prevalence of the genus at the study location (34.9%). Similarly, Pawlos and Derese (2013) observed a 43.5% rate. That A. varigatum and A. cohearence were the two species found is in line with previous research by Ayalew et al. (2014). This result, however, was higher than that of studies done in Soddo, Zuria, by Getiso and Geinoro (2019) (17.5%), and Shiferaw (2012) (4.2%), which found that A. varigatum was the second most common tick species, with a prevalence of 25.4%, according to Getiso and Geinoro's (2019) report. These studies' results are comparable to the current ones. Pay close attention to this since the tick vector for the cowdriasis disease, caused by the bacterium Cowdria rumintium, is the tick (Pawlos and Derese, 2013). Changes in weather patterns may explain this variation since they have a major effect on tick ecology.

According to Taylor et al. (2015), tick distribution can be affected by changes in precipitation and temperature. During the study period, Rhipicephalus (Bo. decolaratus) was the third most frequent tick species at the site, with a frequency of 21.6%. While Getiso and Geinoro (2019) recorded a prevalence of 45.47 percent, this

finding was lower. The least frequent tick species, Rh. evertsi-evertsi, was found in 15.3 percent of cases. Getiso and Geinoro (2019) also discovered that 13.98% of the prevalence was recorded as third abundant, therefore our results are in agreement with theirs. So, it may be a vector for diseases including Babesia, Rickettsia, and Theleria (Kettle, 1995).

Tick infestation was more common in men (51.2%) than in females (48.0%) in this study, however there was no statistically significant difference between the sexes. Wasihun and Doda (2013) and Jemal et al. (2021) both came to similar conclusions about the prevalence of infestations in Dire Dawa, with the former finding that male animals were more affected than female animals. The constant movement of males seeking females is the cause of this variation.

Among the PAs at the study location, Abdeta Kebele (39.9%), Nagasa (37.1%), and Dune Kane (23%), were the most significantly affected ($p<0.05$). The extensive communal grazing area where animals stay all day may explain the high prevalence of Abdeta kebele. Inconsistent veterinary clinic delivery and poor pasture management during grazing could be to blame at this peasant association. This study found that the three body-conditioned cattle had different tick infestation prevalence rates ($P<0.05$). Compared to the medium-condition group (56.4% of animals) and the good-condition group (28.2% of animals), the animals in the poor-condition group were more severely impacted (66.9%). Research by Wallde and Mohamed (2014), Jemal et al. (2021), Morka Amante et al. (2014), Getachew Alemu et al. (2014), and Tamerat et al. (2015) has shown results that are similar to this one. One possible explanation is that ticks have a significant detrimental effect on animal performance, and weaker animals are more susceptible to pest infestations. Tick infection levels varied significantly between animal age groups, according to the present study.

CONCLUSIONS

Amblyoma coherence, Amblyoma varigatum, Rhipicephalus (Bo) decoleratus, and Rhipicephalus evertsi were the most common tick species infesting cattle in the Guto Gida district of the chosen kebeles. Among the most significant host risk factors were sex, age, breed, and biometric score. Tick prevalence was shown to be greater in areas where certain risk factors were present. Tick infestation in the study area warrants strategic tick control approaches, in addition to raising awareness about seasonal incidence, managing pastures, and ignorant communal grazing. The results of this current study will be useful in planning these strategies.

Ethical clearance

The Wollega University Research and Review Committee granted ethical clearance for this study under the reference WU/SVM/REC/20/03/671. The goals of the study were abandoned in accordance with suggestions for the highest standards of animal care. Before samples could be taken from their cattle, owners had to verbally consent in accordance with stringent hygienic regulations. The research ethics

and review committee at Wollega University School of Veterinary Medicine approved the oral informed consent procedure. Ticks were then removed from the cattle without endangering or stressing the animals, following their complete consent.

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DECLARATION

The authors declare that they have no conflicts of interest.

DATA AVAILABILITY STATEMENT

All data are available from the corresponding author upon request.

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