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Research Paper

Prevalence of bovine tick infestation and its associated risk factors in wayu tuka district western ethiopia

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ABSTRACT

Ticks are harmful blood-sucking ectoparasites that are widespread across the world but are more economically significant in tropical and subtropical regions. To determine the prevalence of tick infestation in cattle, a cross-sectional study was carried out in the Wayu Tuka district from October 2022 to July 2023. Three study villages were purposefully chosen, and from this chosen kebele, the study populations were chosen using simple random selection techniques. Ticks were identified by their features under a stereomicroscope. In the current study, adult ticks were collected from 384 local and cross breed cattle and examined, of which 108 (28.1%) were infested with different genera of ticks. Ticks were recorded across the study sites, with the highest and lowest prevalences of 29.9%, 27.0%, and 26.7% in Gida Abalo, Gute Badiya, and Bonaya Molo, respectively. No significant difference in prevalence was observed between the three PAs. The major tick genera identified by this study were Amblyomma variegatum, Rhipicephalus (Boophilus) decoloratus, Amblyomma coherence, and Rhipicephalus evertsi evertsi, with prevalence's of 17 (15.74%), 20 (18.51%), 11 (10.18%), and 5 (4.63%), respectively. There was statistical significance ($p<0.05$) between the body conditions of cattle and tick infestations in the study area. The highest prevalence of tick infestations, 53 (41.1%), was found in animals with poor body conditions, while a low prevalence of 24 (20.7%) was recorded in animals with good body conditions. On the other hand, a statistically significant difference was not observed between the age and sex of animals in the current study area ($p>0.05$). In general, the results of the present study reveal that there was a high tick infestation in the study area. Therefore, appropriate control measures should be implemented.

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1. INTRODUCTION

Ticks are without a doubt the most commercially significant ectoparasite of livestock on a global basis. There are more than 850 species of ticks in three tick families—the Nuttalliellidae, the Ixodidae, and the Argasidae-across the globe [1]. Hard ticks have evolved long feeding times that make it easier to transmit bacteria to animals. They also ingested a lot of blood from their hosts, which can cause skin damage, inflammation, and discomfort, as well as tick paralysis. Ethiopia has the largest animal population in Africa, with about 44.3 million cattle, 46.9 million sheep and goats, more than 1.0 million camels, 4.5 million horses, and 40.0 million chickens. The livestock business in this nation has been significantly boosting its economy and still holds promise for fostering further economic expansion [2]. Livestock farming continues to be essential for Ethiopia's resource-constrained smallholder farmers as a source of milk, meat, skin, dung, and traction force [3]. Livestock contributes to the national economy through being used for the production of meat, skin, and skin products, especially in terms of foreign exchange earnings [4]. The output and poor health of animals brought on by disease have severely limited the potential of the livestock industry [5]. Today, parasitism poses a serious obstacle to the development and utilization of animal resources. Ectoparasites in ruminants in Ethiopia cause enormous economic losses to small-holder farmers, the tanning industry, and the country as a whole through animal mortality, lower output, degradation, and rejection of skin and hide [6].

Despite being common throughout the world, ticks are dangerous blood-sucking ectoparasites that are more economically relevant in tropical and subtropical areas. Ticks affect hosts both directly and indirectly. Examples of direct harm include blood loss, damage to hides and skins, opportunities for secondary infections, toxin production, and paralysis. Through decreased fertility, mortality, anemia, and productivity, ticks indirectly cause economic loss. They not only spread illnesses but also greatly reduce the production of meat and milk and increase a person's susceptibility to other diseases. It might possibly cause skin rejection in tanning facilities [7]. Ticks, although being members of the Ixodidae insect family, are a major contributor to the spread of many bacterial, viral, and protozoan illnesses that harm humans, domestic animals, and wild animals. Both developed and developing countries struggle with tick infestations. The health of domestic animals in Africa is estimated to be most affected by about seven genera of ticks. The main tick genera found in Ethiopia, according to [8], include Ambylomma, subgenus Rhipicephalus (Boophilus), Haemaphysalis, Hyalomma, and Rhipicephalus. Ticks also cause myiasis and dermatophilosis in calves, injure hides and skin, emit poisons, and ingest blood. Additionally, they hinder body weight gain and milk production and create fresh entryways for pathogens [9].

Due of the parasites' interactions with their hosts, particularly climate management and production, effective susceptible tick control strategies in grazing animals depend on understanding their epidemiology. On the other hand, due to inadequate infrastructure, human resources, and economic development, underdeveloped countries like Ethiopia lack such competence [10]. Through extensive investigations and field tests, a large body of ecological and epidemiological knowledge has been accumulated in several nations. Consequently, the following objectives were set for the study:

- To estimate the prevalence of cattle tick infestations in Wayu Tuka district.
- To evaluate the associated risk factor for tick infestations of cattle in Wayu Tuka district, western Ethiopia.

2. METHODOLOGY

2.1 Description of Study Area

The investigation was carried out in the Wayu Tuka area of the Oromia Regional State's East Wallaga Zone in western Ethiopia Figure 1. Wayu Tuka is situated in the western region of Ethiopia, 324 kilometers from Finfine, the nation's capital. The district comprises 10 rural kebele and 2 town kebele. Wayu Tuka district is located between 8^0, 20' North latitude and 34^0 45' East longitudes. The district has a total land area of 45,339,300 km2 [11]. There are two distinct rainy seasons in the area: the spring rainy season (April to May) and the summer rainy season (June to November). 26°C was the temperature in the research area, and 1400–2600 ml of rain fell there. The overall livestock population in the Wayu Tuka area is estimated to be 268660, with cattle accounting for around 99558 of that total, sheep for 32805, goat for 20851, chickens for 100,272, horses for 7780, donkeys for 6308, and mules for 1086 (WTAO, 2022) [12].

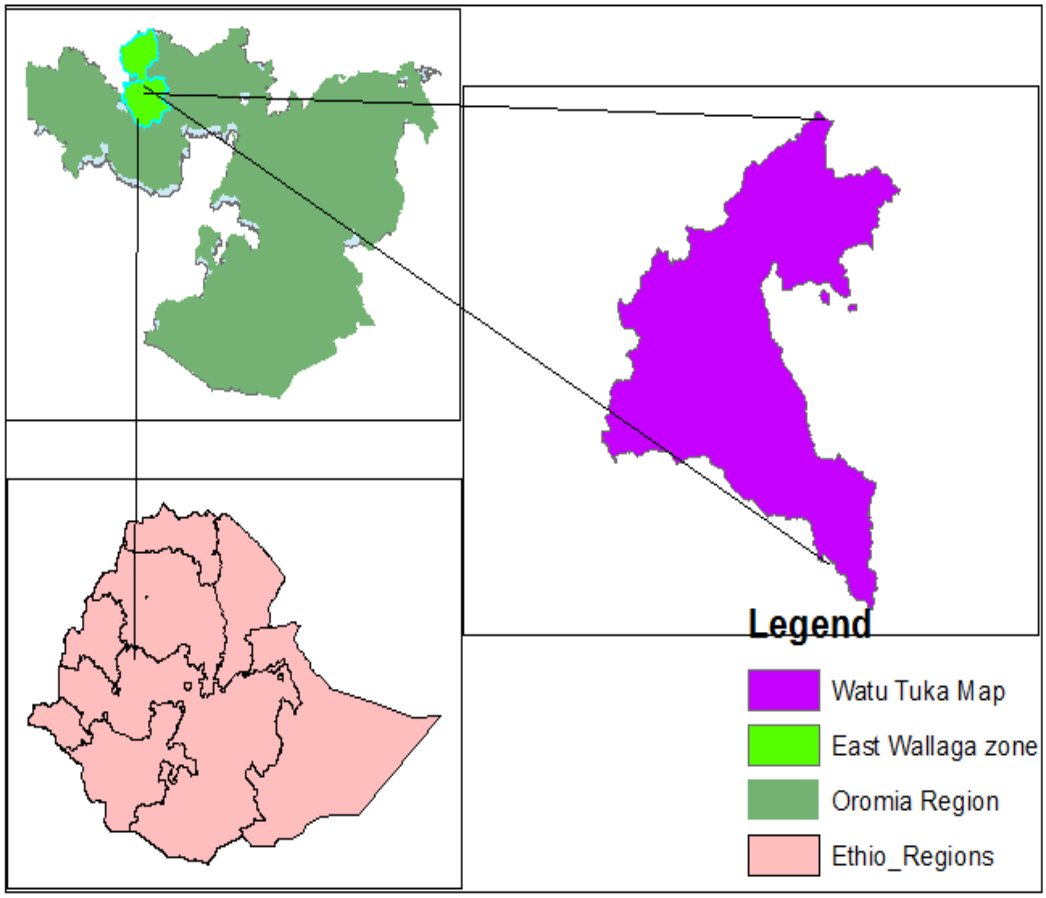

Figure 1. Map of Study Area

2.2 Study Population

In this particular study, cattle of various ages, physical states, and sexes served as the study animals. Cattle owned by individual farmers and managed rigorously were included in the study population and checked for tick infestations and the presence of external parasites. According to their dentition, animals were classified as young, adults, or old depending on their age [13]. Cattle were classified as young if they were under a year old, adults if they were between 1-3 years old, and old if they were beyond 3 years old.

2.3 Study Design

A cross-sectional study was carried out to ascertain the prevalence of tick genera in cattle in the Wayu Tuka district.

2.4 Sample Size and Sampling Method

T The formula given by Thrusfield (2007) was used to calculate the sample size.

$$n = (1.96)^2 \frac{Pxep\ (1-P_{xep})}{d^2}$$

Where n is the required sample size.

P_{exp} = expected prevalence and

d = desired absolute precision.

The sample size was 384 because there had never been a prior study. Random sampling techniques were employed to choose the sample from the entire research population.

2.5 Study Techniques

Sample Collection: Samples were taken from all selected animals that had not received any acaricide treatment within a month of the commencement of the current investigation. Each animal was given a visual inspection, and the cattle had their complete bodies checked for ticks, not just a single one. After the selected animals were restrained, some apparent ticks were removed from the body on the cattle's opposite side [14]. Ticks were recovered by soaking the ticks and the surrounding skin in alcohol to remove embedded living ticks. Using thumb forceps, the mouthpieces were carefully watched to make sure they wouldn't fall out throughout the traction. The ticks were last collected in vials containing 70% ethyl alcohol in order to preserve them [15].

2.6 Identification of Ticks

Common bottles containing 70% ethyl alcohol were used to safely transport ticks collected from selected animals to the Wallaga University Parasitological Veterinary Laboratory. Then, in the lab, they were widely identified up to the genus level and by their physical traits at the species level using stereomicroscopy [16]. Ticks were divided into several species based on their morphology and distinguishing characteristics, such as the scutum's form, the color of the legs, the body, the coxae, and the ventral plates. In the lab, the sample ticks were put on Petri plates and examined using a stereomicroscope to identify them down to the species level. Props, an identification key, and color prints of numerous tick species were used as reference materials [17].

2.7 Data Management and Analysis

All field data was saved in Microsoft Excel spreadsheets, and the study data was coded. The frequency and percentage of both the dependent and independent variables were calculated using descriptive statistics. The percentage of infected animals relative to the total number of animals investigated was used to calculate the prevalence. To examine the relationships between different variables, Pearson's chi-square (X2) and logistic regression were also used. A P-value of less than 5% and a confidence interval level of 95% were considered significant for statistical analysis [18].

3. RESULTS AND DISCUSSION

3.1 Overall Prevalence of Tick Infestations in Cattles

In total, the 384 cattle evaluated throughout the study period had a 28.1% prevalence of tick infestations, with 108 animals testing positive. 108 animals tested positive for the presence of four tick species: Amblyomma variegatum, Rhipicephalus (Boophilus) decoloratus, Amblyomma coherence, and Rhipicephalus evertsi evertsi. Mixed infections were discovered throughout our examination Table 1.

Table 1. Cattle Tick Prevalence in the Species in the Wayu Tuka Distric

Species	No of Animals Positive
Amblyomma variegatum	17(15.74%)
Rhipicephalus (Boophilus) decoloratus	20(18.51%)
Amblyomma coherence Rhipicephalus evertsi evertsi Mixed Infestations	11(10.18%) 5(4.63%) 55(50.92%)
Total	108

3.2 Prevalence of Tick Infestations on the Basis of the Study Area PAs

384 cattle were inspected during the study period, of which 122 came from the Gute Badiya kebele, 105 from Bonaya Molo, and 157 from the Gida Abalo kebele in the Leka Dullacha district. Tick prevalence was noted at all research locations, with Gida Abalo, Gute Badiya, and Bonaya Molo having the greatest and lowest prevalences of 29.9%, 27.0%, and 26.7%, respectively. Between the three PAs, there was no discernible difference in prevalence Table 2.

Table 2. Tick Infestation Rates in Various Locations and Pas in the Wayu Tuka District

PAs/Site	No. Examined	No. Positive	Prevalence	X^2		P-value
Gute Badiya	122	33	27.0%	0.435		0.804
Bonayya Molo	105	28	26.7%			
Gida Abalo	157	47	29.9%			
Total	384	108	28.1%			

3.3 Prevalence of Tick Infestations in Both Sexes

From the 384 cattle that were investigated for the current study, 187 were male and 197 were female. In terms of sex category, male animals had a greater prevalence (29.9%) than female animals (26.4%), but the difference was not statistically significant (P > 0.05) Table 3.

Table 3. Prevalence of Tick Infestations in Different Sex Groups

Parameters	Category	No. Examined	No. Positive	Prevalence	P-value
Sex	Male	187	56	29.9	0.255
	Female	197	52	26.4	
Total		384	108	28.1%	
X^2= 0.598					

3.4 Prevalence of Tick Infestations in Different Body Condition Scores of Animals

A body condition score was evaluated in cattle living in similar habitats and under similar management methods to examine the impact of tick infestations on causing debilitation, which is a clinical sign of tick infestations. In this study, tick infestations were more common in animals with poor body condition (53%) than in animals with good body condition (24%). According to Table 4, the difference was statistically significant (p<0.05).

Table 4. Prevalence of Tick Infestations in Different Body Condition Groups

Parameters	Category	No. Examined	No. Positive	Prevalence	P-value
Body Condition	Good	116	24	20.7%	0.00
	Medium	139	31	22.3%	
	Poor	129	53	41.1%	
Total		384	108	28.1%	
X^2= 1.223					

3.5 Prevalence of Tick Infestations Infection in Different Age Groups

The difference in infection rate among the age groups was not statistically significant ($p > 0.05$), but the prevalence of tick infestations in different age groups shows that the highest prevalence (30.2%) was recorded in animals 1 year of age, 1-3 years of age, and >3 years of age, with prevalences of 61 (30.0%) and 28 (23.7%), respectively.

Table 5. Prevalence of Tick Infestations in Different Age Groups

Parameters	Category	No. Examined	No. Positive	Prevalence	P-value
Age	Young	63	19	30.0	0.443
	Adult	203	61	30.2	
	Old	118	28	23.7	
Total		384	108	28.1%	
$X^2 = 1.629$					

3.6 Prevalence of Tick Infestations in Different Breeds of Animals

In this study, crossbred animals had the highest prevalence of tick infestations (29.8%), whereas local cattle breeds had the lowest prevalence (28.0%). Between the two animal breeds, there was no discernible difference in infection ($p > 0.05$) Table 6.

Table 6. Prevalence of Tick Infestations in Different Breeds of Animals

Parameters	Category	No. Examined	No. Positive	Prevalence	P-value
Breeds	Local	357	100	28.0	0.505
	Cross	27	8	29.8	
Total		384	8	2.08%	
$X^2 = 0.033$					

3.7 Discussion

The main tick species that infect cattle in the Wayu Tuka district were identified in this study, along with the prevalence of tick infection in cattle. In addition, the association between a number of risk factors and the frequency of tick infection in cattle was assessed. Ticks were shown to be a common cow ectoparasite in the study area, according to the current analysis. According to the current study, 108 ticks, or 28.1% of all ticks, were identified on each bovine that was examined during the study period. According to [19], [20], who reported tick infestation rates of 33.21% and 16.00%, respectively, in the Benchi Maji Zone and Haramaya District in the Southern Nations and Nationalities of Ethiopia, the prevalence of tick infestation in cattle was comparable between the current study and those studies. [21] found a higher prevalence (89.40%) in the Western Amhara Region compared to these study. changes in the research's seasons, sample size, agroclimate conditions, management, and social awareness of the necessity to care for cattle in the study locations may cause such changes in prevalence. The tick was recognized at the species and genus levels. Amblyomma variegatum, Rhipicephalus (Boophilus) decoloratus, Amblyomma coherence, and Rhipicephalus evertsi evertsi were the four tick species detected; their percentages were 17 (15.74%), 20 (18.51%), 11, 10, and 5 (4.63%), respectively. Rhipicephalus (Boophilus) decoloratus had the highest prevalence, which is comparable to [22] findings of 55.9%, 5.3, and 3.85 for Amblyomma, Hyalomma, and Boophilus, respectively, in eastern Amara. Amblyoma, on the other hand, is comparable to Endale's (2006) findings of 31.4% prevalence in the ambo region. Seasonal variations, geographical location, and collecting times could all contribute to this. The prevalence of the genus 20 (18.51%) for Boophilus was higher than that of [23], [24], and Endale (2006), which discovered prevalence rates of 2.6%, 5.4%, 5.3, and.14% in sedamo in and around Mekele, eastern Amhara, and the abo area of Ethiopia, respectively. Location may play a role in this. The rates in the studies done by [25] and Endale (2006), however, are lower, at 53.9% and 54.5%, respectively. Additionally, the aim of this investigation was to see if there was any relationship between the risk factors

and the prevalence of cattle tick infection. It was discovered that the prevalence of tick infestation in cattle varied generally with different risk factors. According to research, the incidence of tick infestation in cattle varies depending on the animals' physical health. It was discovered to be 41.1% and 20.7% in animals with low and good physical health, respectively. A comparison of various animal body states and the prevalence of tick infestation in cattle were made. In terms of the prevalence of tick infestation, statistical analysis revealed a highly significant difference (p 0.001) between cattle with two different body condition ratings. This conclusion was consistent with the findings of [26] who conducted fieldwork in the Asella Arsi zone and nearby places. [27] Speculate that this might be the case because animals with medium body scores are more prone to illnesses when they graze outside, while animals with bad body conditions are kept at home since they are unable to go far distances. However, whether they are housed indoors or out, well-fed animals are remarkably resistant to illnesses.

Depending on the age group, the prevalence of tick infection in cattle varies; it was discovered to be 30.0%, 30.2%, and 23.7% in animals aged less than a year, 1-3 years, and over 3 years, respectively. It was also evaluated whether there is a relationship between the incidence of tick infestation in cattle and the age groups of the animals. ($p > 0.05$) There was no statistically significant change. Compared to young animals, adult animals demonstrated a higher prevalence of tick infections. The higher percentage of mature cattle discovered in this study is also comparable with those discovered by [28]. Depending on the age group, the prevalence of tick infection in cattle varies; it was discovered to be 30.0%, 30.2%, and 23.7% in animals aged less than a year, 1-3 years, and over 3 years, respectively. It was also evaluated whether there is a relationship between the incidence of tick infestation in cattle and the age groups of the animals. ($p > 0.05$) There was no statistically significant change. Compared to young animals, adult animals demonstrated a higher prevalence of tick infections. The higher percentage of mature cattle discovered in this study is also comparable with those discovered by [29].

4. CONCLUSION

In order to ascertain their range, four ixodid tick species from the Amblyomma and Rhipicephalus tick genera-R. decoloratus, A. variegatum, R. evertsi everts, and A. cohaerens-were examined. Because of its long mouth section, A. variegatum causes the most harm to hides and skins, rendering the product worthless on the global market if the infestation is considerable. Rhipicephalus evertsi evertsi was the least common tick species in our study, whereas R. decoloratus was the most numerous and widely distributed. The primary risk factor linked to the prevalence of tick infestations in the current study area was a characteristic of an animal's body. Statistics could not show any correlation between the prevalence of tick infections and the age, sex, breeds, or villages of the animals. The following recommendation was given in light of the foregoing concluding remarks:

- Before and after the rainy season, pastures should be treated, and animals should be treated as well.
- Various groups of cattle producers in the research region should be made aware of routine tick species investigations and their control strategies.
- Further studies with a larger sample size and a wider geographical coverage of the area should be conducted by the other researchers.

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Author Contributions Statement

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Dr. Melaku Guteta Fite	✓	✓	✓	✓		✓		✓	✓	✓	✓		✓	

C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

Conflict of Interest Statement

The authors declare that there are no conflicts of interest regarding the publication of this paper.

Informed Consent

All participants were informed about the purpose of the study, and their voluntary consent was obtained prior to data collection.

Ethical Approval

The study was conducted in compliance with the ethical principles outlined in the Declaration of Helsinki and approved by the relevant institutional authorities.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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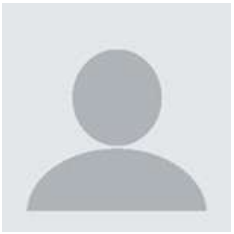

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