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Prevalence, Identification and Associated Risk Factor of Bovine Tick Infestation in and around Bahir Dar, Ethiopia

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ABSTRACT

A cross sectional study was conducted from October 2021 to September 2022 in and around Bahir Dar, to determine the prevalence of the tick infestation and identify the tick species in cattle. The aim of the study to determine the prevalence and associated risk factors, identification of tick species and characterize tick infestation of cattle in the study area. Ticks had a significant effect on the production and economic losses in the livestock industries by creating critical animal health problem especial for sub saran and saran countries. A systematic random sampling technique was used to select 800 animals while questionnaire interview of 100 cattle farmers for examined tick identification from which 77.67% of them were found infested with tick. A total of 1254 adult ticks were collected from half body part of infested cattle. As a whole five different species of ticks were identified in the present study. The species of ticks identified were *B. decelerates* (21.25%), *Amblyomma variegatum* (36.87%), *Hy. m. rufipes* (17.75 %), *R.e. eversi* (14.38%) and *A. coherence* (9.75 %. In general, for the sex, age and peasant association there was no statistically significant difference (p-value>0.05). However, in the prevalence of tick infestation among other risk factors such as age, breed, body condition, management there was statistically significant difference (p-value<0.05). All tick species distributed and attached different parts to the host. Since tick transmit tick borne diseases in addition causes severe damage to the hide and skin. As a result, effective tick control programs should be formulated and implemented in the national or regional level.

Keywords: Breed; Cattle; Ticks; Prevalence; Risk factor

INTRODUCTION

Livestock play a very important role in global food security providing about 12.9% calories and 27.9% protein through consumption of meat, milk, eggs and offal [1]. It is vital to the economy and livelihood of agro-pastoral communities as well as contributes to the reduction of household poverty in most African countries [2]. Ethiopia has different agro ecology zones that are suitable to host a very huge animal population [3]. It is believed to have the largest livestock population in Africa even if it comparable in the world. This livestock sector has been contributing considerable portion to the economy of the country and still promising to rally round the economic development of the country. Cattle plays a significant role in

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the socioeconomic life of the Ethiopian people and livestock industry represent the second largest income contributing to the GDP of the country which accounts for nearly 15% of the total GDP and about 40% of the agricultural GDP. Export their byproducts also have appreciable contribution to the foreign exchange earnings of the country accounting to about 15%and 70% of all export earnings and hide and skin are important components respectively [4]. These diseases cause high morbidity and mortality, decrease their byproducts, loss of draft power, and loss of financial resource through the institution of control measures [5]. Some of the infestation are Ticks which arachnids in the subclass of Acarina and are closely related to mites. Ticks are widely distributed throughout the world particularly in tropical and subtropical countries and cause a tremendous economic loss in livestock production.

Around 889 species of ticks in three major families namely the Ixodidae, Argasidae and Nuttalliellidae, relatively few are important to man and domestic animals. The family, Ixodidae (hard tick) is relatively large and comprises thirteen genera, among these genera *Amblyomma*, *Boophilus*, *Dermacentor*, *Hyalomma*, *Haemaphysalis*, *Ixodes* and *Rhipicephalus* contain species of veterinary and medical importance.

The most economically important genera of tick-borne haemoparasite infecting cattle in communal area are rickettsial diseases like anaplasmosis, ehrlichiosis and cowdrosisand from protozoal diseases like babesiosis, theileriosis and from bacterial disease Dermatophilosis [6]. In addition to transmitting certain protozoan, rickettsial and bacterial diseases, ticks also predispose animals to secondary bacterial infection. In addition to vector borne disease, tick damages hide and skin and interfere with meat and milk production. The current utilization of hides and skins in Ethiopia is estimated to be 45% for cattle hide, 75% goat skin, and 97% sheep skin with expected off take of 33, 35 and 7%for sheep, goats, and cattle, respectively. However, in recent years, this rank has been relegated to fifth level mainly because of rejection and down grading inflicted on hides and skin defects mainly due to infestation by external parasites.

The impacts caused by ticks initiated the development of control strategies which are different tick species are widely distributed in Ethiopia and a number of researches reported the distribution and abundance of tick species in different part of the country. *Amblyomma* tick is one of the most abundant tick genera in Ethiopia and has been reported in many parts of the country. *Rhipicephalus* is also reported to be predominant genera *Boophilus* and *Hyalomma* also have a significant role.

Although tick and Tick-Borne Diseases (TBDs) such as babesiosis, cowdrosis and anaplasmosis are reported in Ethiopia, east coast fever caused by *Theilaria parva* and its vector *Rhipicephalus appendiculatus* has not yet been reported by Solomon et al. Because diseases like east coast fever and its vector *Rhipicephalus appendiculatus* are found in the neighboring country, there will be a risk of introduction to Ethiopia and this necessitate the execution of cross sectional study surveys in different parts of the country.

Statement of Problem

Export of livestock and livestock by-products also have appreciable contribution to the foreign exchange earnings of the country accounting to about 15% and 70% of all export earnings, and hide and skin are important components respectively. However, in recent study report income gain from hide and skin become decline due to tick infestation. Tick is an important economic parasite that affects the livestock production and by-product. Therefore, the aim of the study to estimate the prevalence of bovine tick infestation in and around Bahir Dar, to determine the associated risk factors of bovine tick infestation and identify tick species.

MATERIALS AND METHODS

Study Area

The study was conducted in and around Bahir Dar, which is located at 11˚29′ N latitude, 37˚29′ E longitudes, at about 570 km North West of Addis Ababa. Bahir Dar Zuria has a livestock population of 152,772 animals (121,470 cattle, 14,322 sheep, 9,141 goats' 7,839 equines 36,666 poultry),(North Western Amhara region livestock population record, 2017).

Study Population

The population was local and cross breeds cattle with different sex, age and body condition that are localized in and around Bahir Dar. The age of the cattle was grouped into young (1-3 years), adult (3-7 years), and old (>8 years), while body condition score was employed after categorizing the animals into poor, medium, and good [7].

Study Design, Sampling Method and Sampling Size Determination

To estimate the prevalence and burden with their risk factor association of tick infestation and identification of it with their predilection site a cross sectional study conducted from October 2021 to September 2022 from Bahir Dar town. Random sampling techniques was used to determine prevalence and associated risk factors of bovine tick infestation. The selected animals were checked for any tick infestation and sample size was determined according to Thrush field as follows; by taking a 95% confidence interval, whenever 40.9% is the information on the expected prevalence of the disease in the area and 5% desired absolute precision, the sample size was calculated as follows:

$$n=\frac{1.962\times P\ exp\ (1-P\ exp)}{d^2}$$

Where,

n=Required sample size,

P exp=Expected prevalence (40.9%) and d=Desired absolute (0.05); n=371

Sample Collection

All visible attached adult ticks of all cattle were collected from body regions of neck, head, and groin, axillae, belly, back, dewlap, brisket, udder, tail and scrotum. Ticks were removed gently and carefully in a horizontal pull to the body surface by hand.

Laboratory Examination of Ticks

The ticks were collected from different body regions of the cattle. The collected ticks were preserved in universal bottle contained 10% formalin and labeled with the animal identification and predilection site, lesion inflicted, age, sex, and data of collection. The specimens were transported to the parasitology laboratory of the school of Animal science and veterinary medicine in Bahir Dar University for counting and identification. The collected ticks were identified using stereomicroscope and classified in to different species level based on size, mouthparts, color of the body, leg color, presence and absence of the eye. Furthermore, different morphology of ticks such as shape of scutum, leg color, body, coxae one, festoons and ventral plates were considered for species level identification according to Walker et al. [8].

Data Management and Analysis

Data collected from study sites was entered, checked and stored in a Microsoft excel spread sheet program and coded for analysis. Then data was analyzed by using STATA software version 14. Descriptive statistics was employed for summarizing the data regarding tick isolation, count and identification in cattle of different age, breed, sex, body condition, management, localized kebele [9]. *Chi-square* test was used to measure the association between prevalence of tick and their relevant factors like age, breed, sex, body condition, management. The result of this study was considered as statistically significant when P value is less than 0.05.

RESULTS AND DISCUSSION

Prevalence of tick infestation and association with different risk factors. The overall prevalence of tick infestation in and around Bahir Dar was 77.67% (**Table 1**).

Table 1: Prevalence of tick infestation and association with different risk factors.

Risk factor	Categories	No. of animal examined	Prevalence (%)	X^2	p-value
Age (years)	Young	124	103 (83)	3.5752	0.167
	Adult	148	109 (73.6)		
	Old	28	21 (75)		
Sex	Female	157	121 (77)	0.0676	0.795
	Male	143	112 (78.3)		
Breed	Local breed	249	200 (80)	5.9507	0.015
	Cross breed	51	33 (64.7)		
BCS	Poor condition	94	83 (88.2)	41.6864	0
	Medium condition	154	127 (82.46)		
	Good condition	52	23 (44.2)		
Management	Intensive system	17	3 (17.64)	38.6005	0
	Semi-intensive system	83	64 (72.73)		
	Extensive system	200	166 (83)		
Peasant sssociation	Zenzelima	116	88 (75.86)	0.4145	0.813
	Robet	77	60 (77.9)		
	Andassa	107	85 (79.43)		

This result was higher than the findings of Tiki and Addis around Holeta town with a prevalence of 25.64%, and Admassu et al., in Dangila district, North Western Ethiopia who reported a prevalence rate of 56.2%. However, Nigatu and Teshome in western Amhara and Tamirat et al., in Southern Ethiopia reported high prevalence of 89.4% and 88.54% respectively. The prevalence of tick infestation was recorded in younger cattle (80%) higher than older cattle (75%) (**Table 1**). There is no significant difference between age of animal's l (X^2=3.5752, P-value=0.167). Our result was supported by Hagos and Berihun in Werieleke Woreda, Tigray who reports high prevalence was scored in age of old animals (31.8%) than age of young (13.90%) animals. Similar study finding) in Humbo district, SNNP who reports there was insignificant association between ages [9]. This variation may due to different cattle management system (old animals graze over the field where the tick burden was abundant, while young animals confined to the indoor) and immunogenicity of cattle (young animals get immunity from colostrum of her mother to resist the building up of infestation).

In the case of genetic factors, the local breed (80%) higher than crossbreed (64.7%) (**Table 1**). In this study there is significantly different (X^2=5.9507, P-value=0.015) association were registered between the two breeds of animals [10]. The results of this study supported by Kassa and Yalew in and around Haramaya district, Eastern Ethiopia who reported that prevalence of tick infestation was significantly higher in local breed cattle (58.18%) than cross breed ones (10.55%), and Mideksa et al., in Dandi district, Western Shoa zone reports higher in local breed cattle (57.6%) as compared with cross breed cattle (11.20%). However, the present finding not in line with the findings of Tamiru and Abebaw in and around Asella town, South Western Ethiopia who reported that the prevalence of tick infestation was higher in the cross breeds than local breeds. This variation might be attributed to the currently existing modified animal husbandry practice where crossbreed or high yielding animals are kept most of the time indoor with semi-intensive care, whereas local breed cattle are kept under extensive farming system [11]. Therefore, the chance of occurrence in local breed cattle is greater than cross breeds. Furthermore, it can be assumed that it might be due to the farmer taking more care to cross breed than local cattle.

Regarding body condition score, highest prevalence of tick infestation was recorded in cattle with poor body condition (88.2%) than those with medium (82.46%) and good body condition (44.2%). Statistically significant different (x^2=41.6864, P-value=0.000) association was recorded in different body condition of animals (**Table 1**). This study agrees with the findings of Belay and Enyew in Wolaita Sodo, SNNP reports high prevalence of 94.8% in poor body condition than good body condition (36.2%) [12]. However, the present result not related with the findings of Hagos and Berihun in Werieleke Woreda, Tigray who reported that high prevalence of 71.00% in medium body condition than poor body condition (8.90%). This difference can be due to the fact that poor body conditioned animals had reduced resistance to tick infestation and lack of enough body potential to build resistance and they exposed to any kinds of disease when grazing on the field and medium body conditioned animals were free ranging and relatively resistance to disease so they become less infested than poor body conditioned cattle and well feed animals were very resistance to any kinds of disease when grazing on the field [13].

Cattle managed in extensive system (83%) had higher prevalence of tick infestation than those managed in intensive management system (17.64%), there was no significant difference (p-value>0.05) of tick infestation within three peasant association (**Table 3**). This result disagrees with the reports of Tamirat et al., in Saylem, Gesha and Masha districts, Southern Ethiopia who reported significant difference between different kebeles. This difference is due to similarities in agro-ecological setting and animal health practice in the study sites. Tick activity influenced by rainfall, temperature and atmospheric relative humidity and management system include use of acaricides and other preventive measures.

The difference in prevalence was found statistically insignificant between sex of cattle (P-value>0.05). However, in this study male animals were found slightly affected than females (in male 78.3% and in female 77%) with no statistical significance association (x^2=0.0676, P-value 0.795). This result is in line with findings of Jelalu et al., in Arbegona district, Southern Ethiopia who reports statistical insignificance (x^2=0.559 p-value=0.454) association between sex group and Tesfaheywet and Simeon in Bench Maji. However, it was in contrast with the reports of Bossena and Abdu in Assosa who reports difference in prevalence was found statistically significant between sex groups. This might be due to equal chances of male and female to tick infestation both in production as well as management condition. In general, for the sex, age and peasant association there was statistically insignificant difference (p-value>0.05, However for breed, body condition, management there was statistically significant difference (p-value<0.05) (**Table 1**).

Prevalence of Tick Species

The overall prevalence of different tick species identified in this study area (**Table 2**). Accordingly, the ticks five species were identified which are *A. variegatum*, *B. decoloratus*, *R. e. eversi*, *H. m. rufipes* and *A. coherence*.

Table 2: Prevalence of tick species in the study area.

Tick species	Tick count	Male to female ratio	Prevalence (%)
Amblyomma variegatum	295	v	36.87

B. decoloratus	170	21.25
R. e. eversi	115	14.38
H. m. rufipes	142	17.75
coherence	78	9.75
Total	800	100

During this study five species of ticks were identified. The identified species were *B. decoloratus* (21.25 %), A*mblyomma variegatum* (36.87 %), *Hy. m. rufipes* (17.75 %), *R. e. eversi* (14.38 %) and *A. coherence* (9.75 %). *Amblyomma variegatum* was found to be the most abundant tick species which accounts for 36.87% of the total examined cattle (**Table 2**). Our finding is in line with Assefa et al., in Horro Guduru, Western Ethiopia and Wasihun and Doda in Humbo district, SNNP who reported prevalence of 33.8% and 30.63% respectively. However, our result is lower than the finding of Alekaw at Metekel ranch who reported prevalence of 5.7%. But Desalegn et al., in Eastern Hararghe reported higher prevalence rate of 48.7%. These variations may be agro-ecology of the area, different cattle management, season of tick collection and endemicity of disease.

B. decoloratus was the second most abundant species of tick that have been collected and represented 21.25% of the total count. This finding is in agreement with that of Huruma et al., in and around Sebeta town and Wasihun and Doda in Humbo districts, SNNP, who reported prevalence rate of 25.00% and 25.42% respectively. This result is higher than previous result reported by Abebe et al., (4.2%) in two districts of Somali regional state (Fafem and Awubere), Nateneal et al., (6.5%) in Bedele districts, Oromia and Tamirat et al., (1.80%) in Southern Ethiopia. But this result is lower than the findings of Bedaso et al., inland around Haramaya town who reported 41%. This variation is due to the geographical location and altitude factors which govern the distribution of tick species in the area. This tick species is abundant in wetter highlands and sub-highlands receiving more than 800 mm annual rain fall.

Hy. marginatum rufipes was the third most abundant tick species which accounts for 17.75 % of the total count. Our finding was almost correlated with the findings of Birru et al., in Guba Koricha district, Western Hararghe who reported a prevalence rate of 11.8% and the findings of Abebe et al., in and around Dire Dawa, Eastern Ethiopia who reported 12.2%. But our finding disagrees with the lower findings of Belay and Enyew in Sude district, Arsi zone who scored lower prevalence of 5.44%. This variation may due to *Hy. m. rufipes* were widely distributed in the most arid tropical parts of Africa and in Ethiopia most often collected between 1000 and 2000 m.a.s.l and rare in western highland of areas.

R. e. eversi was the fourth most abundant tick species which accounts for 14.38% of the totalcount, which is comparable with the findings of Solomon et al. Hoogstral described its wide distribution through-out the Ethiopian faunal region. Pegram et al. reported that this species had not showed specific preference for a particular altitude, rainfall zones or seasons; and it is also known to convey tick paralysis in Harar Ethiopia.

A. coherence was the fifth least abundant tick species which accounts for 9.75% of the total count in the study area. This result is not correlated with the survey conducted by Seid in western Ethiopia, in which A. coherence was considered as the most prevalent tick species in Mezan Teferi, SNNP with a corresponding prevalence rate of 50.5%. On the contrary, this result is higher than the findings of Gedilu et al., Huruma et al., in and around Sebeta town (2.4%), Alemu et al., in North Western Ethiopia (5.21%) and Abdisa in Welmera district, Oromia (7.73%). The observation of high prevalence may be due to the persistence of humidity throughout the year in western Ethiopia that was favorable for this species. This difference can be attributed to the great susceptibility of A. coherence for losses of total body water which ultimately make it to perish rapidly when the humid protection is disrupted. The population of tick is influenced by climatic changes, which affect the rate of tick population on the ground, host resistance and natural enemies.

Distribution of Tick Species in Different Body Region of Cattle's

The most common tick attachment sites identified in this study were groin/hind, udder/scrotum and dewlap areas. In addition, ticks were also found in other sites such as belly neck, head, and back, Axillae or sternum, leg, anus or under tail (**Table 3**).

Table 3: Distribution of tick species in different body region of cattle's.

Site of attachment	*B. decoloratus*	*A. variegatum*	*R. e. eversi*	*H. m. rufipes*	*A. coherence*
Neck	33 (4.1)	5 (0.63)	4 (0.5)	24 (3)	
Head	35 (4.38)	20 (2.5)		23 (2.88)	4 (0.5)

Belly/Back	17 (2.13)	63 (7.87)	5 (0.63)	19 (2.38)	21 (2.61)
Axillae/Sternum	15 (1.88)	72 (9)	3 (0.38)	14 (1.75)	30 (3.75)
Groin/Hind leg	1 4 (1.75)	42 (5.25)	7 (0.88)	14 (1.75)	5 (0.63)
Anus/Under tail	4 (0.5)	66 (8.25)	93 (11.63)	4 (0.5)	6 (0.75)
Udder/Scrotum	16 (2)	27 (3.37)	3 (0.36)	6 (0.76)	9 (1.13)
Dewlap	36 (4.5)			38 (4.75)	3 (0.38)

The present study revealed that ticks select favorable site for their attachment on the body of cattle. Information on predilection sites of ticks is helpful in spraying individual animals since it gives a clue as to which part of the body requires more attention. In present study different predilection site of attachments by tick infestation was examined. The most preferred site o*, Rh. e. eversi*, Udder/ Scrotum (11.63 %), *A. variegatum* groin/hind leg (9%), *Hy. m. rufipes* dewlap (4.75%), *Rh. (Boophilus*) d*ecoloratus* were dewlap (4.5%) and head (4.38 % and *A. coherence*, Axillae/ Sternum (3.75) respectively. This result is almost collaborating with the findings of Nateneal et al., in Bedele district. Huruma et al., indicated that different ticks have different predilection sites on the host's body. The favorable predilection site for *B. decoloratus* was the lateral and ventral side of the animal. Stachurski stated that short hypostome ticks like *Rhipicephalus* (Boophilus) and *Hyalomma* species usually prefer upper body parts which includes nape of neck and margin of anus and under tail while long hypostome ticks like Amblyomma attaches to lower parts of the animal body.

CONCLUSION

The overall prevalence rate of ticks' infestation in the present study was 77.67%. Ticks have great economic impact to the livestock population either by directly affecting the health of animals besides aggravating the quality of their hide and skin or indirectly by transmitting a wide variety of Tick-Borne Diseases (TBD). The most important species of ticks abundantly identified in the study area were: *A. variegatum, B. decoloratus, Hy. M. rufipes, RH. eversi. eversi and A. coherens* in descending order. This study indicated that different species of tick affect the health of cattle and also damage teats, hide and skin and reduce productivity of animals. Different risk factors aggravate the infestation of tick which includes body condition, sex, breed, kebele and management of tick infestation. The present study revealed that there was insignificant difference between age, sex and kebele, while the rest have significantly difference association between them. These all are the impacts of tick infestation so to minimize tick impacts, appropriate and timely strategic control measures are necessary.

RECOMMENDATIONS

Therefore, based on the above conclusion; the following recommendations are forwarded:

- Research should be conducted on tick species and their epidemiology for the continuous understanding of improved control strategies.
- Awareness should be given to animal breeder on problem of ticks and TBD.
- Effective acaricides usage should follow to control tick species.
- Efforts should be made to introduce community based tick control strategies.
- Country wide effective tick control strategies should be designed.

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