



Infestation of Ixodidae Ticks in Cattle: Prevalence and Associated Risk Factors in Ambo District, Western Ethiopia

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ABSTRACT

In Ethiopia, ticks cause serious economic loss particularly in ruminants. A cross sectional study was undertaken in Ambo district, Western Ethiopia from October, 2018 to June, 2019 with the major aim of estimating the prevalence, identifying the associated risk factors and the tick species of cattle in the area. From five purposively selected kebeles (the smallest administrative unit of Ethiopia) of the district, a total of 384 cattle were selected by systematic random sampling method. Adult Ixodid ticks were collected from different body parts of infested cattle, preserved in 10% formalin and transported to Ambo University Veterinary Parasitology Laboratory for stereomicroscopic identification to species level. Among 384 cattle examined, 201 (52.34%) cattle were infested with one or two tick species. Higher prevalence of tick infestation was recorded in Degele Gatira kebele (53.25%), followed by Abebe Doyo (50.65%), Gosu Kora (50.65%), Kisose Liban (50.65%) and Senkele Faris (56.59%). The study investigated three genera of Ixodid ticks namely *Rhipicephalus* (41.7%), *Boophilus* (0.8%) and *Amblyomma* (2.60%). Mixed infestations were common including *Rh. Boophilus* and *Amblyomma* 24(6.25%) and *Rh. Boophilus* and *Rhipicephalus* 4(1.04%). The study identified four species of ticks; namely *Rh. (Bo.) decoloratus* 109 (28.40%), *Rhipicephalus (Boophilus) annulatus* 43(11.20%), *Amblyomma vareigatum* 3(0.80%) and *Rhipicephalus evertsi evertsi* 11(2.90%). The difference in tick infestation was statistically insignificant ($P > 0.05$) between different age groups and kebeles but statistically significant ($P < 0.05$) among sex groups, breeds and different body condition scores ($P < 0.05$). In conclusion, this study indicated high prevalence of tick infestation and identified most important ticks that can transmit various livestock diseases. Proper tick eradication campaign should be conducted to decrease the tick burden in the study area, and concomitantly reduce tick-borne diseases and associated economic losses.

Research article

INTRODUCTION

Ethiopia has an enormous and diverse livestock population that plays an important role in the economy and livelihoods of farmers and pastoralists (Akande *et al.*, 2010). The country

has 65 million cattle, 40 million sheep, 51 million goats, 8 million camels and 49 million chickens. From the total cattle population, 97.8%, 1.9% and 0.3% cattle are indigenous, hybrid and exotic, respectively (CSA, 2020).

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Despite the large animal population, their productivity is low due to poor nutrition, reproduction insufficiency, management constraints and prevailing livestock diseases (Bekele *et al.*, 2010).

Parasitic diseases are among the major problems of domestic animals causing serious economic loss (Shiferaw, 2018). Ectoparasites are organisms which inhibits the skin or outgrowth of the skin of the host for various periods (Hopla *et al.*, 1994). In Ethiopia, Ectoparasites in ruminant causes serious economic losses to small holder farmers, the tanning industry and the country as a whole through mortality, decreased production, downgrading and rejection of skin and hide (Peter, 2005). Ectoparasites can live permanently on their host, or they may occupy the host's nest and immediate environment, and visit the body of the host periodically (Gross *et al.*, 2005). In either case, there is a close dependency on the host for various life sustaining resources (Gonzalez *et al.*, 2004). From the Ectoparasites, ticks are ranked as the most economically important arthropods in tropics including sub-Saharan Africa (Abdela, 2016).

Ticks have adverse effect on livestock in several ways and parasitize a wide range of vertebrate hosts and transmit a wide variety of pathogenic agents than any other group of arthropods (Oliver, 1989; Belew and Mekonnen, 2011). Ticks transmit protozoa, bacterial, rickettsial and viral diseases. Moreover, Ticks down grade hide and skins quality and reduce milk and wool production, reduce productivity and increase susceptibility to the other diseases (de Castro, 1997). Ticks can predispose animals to secondary attacks from other parasites such as screw worm flies and infection by pathogens

such as *Dermatophilos congolensis*, the causative agent of streptothricosis (Desta, 2010). There are various cattle tick-borne diseases in Ethiopia such as anaplasmosis, babesiosis, theileriosis (Mekonnen *et al.*, 1992) and streptothricosis (Surafel and Amsalu, 2019).

Despite the known or existing challenges and the prevalence of tick-related problems in Ethiopia, there is a clear and notable lack of documented information regarding the specific species and associated risk factors of ticks in cattle within the study area. Therefore, the current study was designed and implemented with the objectives of estimating the prevalence of tick infestation, identifying the existing species of ticks and assessing the potential risk factors associated with the occurrence of hard ticks (Ixoid) in cattle in Ambo district, western Ethiopia.

MATERIALS AND METHODS

Description of the study area

The study was conducted in five kebeles (The smallest administrative unit of Ethiopia) of Ambo district namely Degele Gatra, Abebe Doyo, Gosu Kora, Kisose Liben and Senkele Faris from October, 2018 to June, 2019. Ambo district has a total of 35 kebeles. The area is located at latitude and longitude of 8°59'N, 37° 51'E, respectively and an elevation of 2101m above sea level. Ambo has livestock populations of 145, 371 cattle, 50,152 sheep, 27, 026 goats, 9, 088 horses, 2, 914 donkeys and 256 mules. The area is characterized by bi-modal rainfall with mean annual rainfall of 1129mm per year and annual temperature ranging from 10 to 28°C (CSA, 2007; Firaol *et al.*, 2014) .

Study Design and Study population

A cross sectional study was conducted on a total of 384 cattle randomly selected from the population. The study populations were includes both local and exotic breeds of cattle with different ages, sex and body condition cores. Out of the 35 kebeles found in the district, five kebeles were selected purposively for their accessibility and large cattle population. The age of the cattle was estimated based on the description given by Nicholson and Butterworth (1996), and then categorized as young (≤ 1 year), adult (1-3 years) and old (≥ 3 years). Similarly, based on their body condition scores, the cattle were classified as good, medium and poor.

Sample Size Determination and Sampling Method

The minimum sample size required for this study was determined according to the formula given by Thrusfield and Brown (2018). Accordingly, 95% confidence interval, 5% precision and 50% expected prevalence was used as there was no previous study conducted in the area.

$$N = \frac{Z^2 * Pexp(1 - Pexp)}{d^2}$$

Where, N= required sample size, Z= confidence interval (95%), Pexp= expected prevalence and d = desired absolute precision. Therefore, the computed sample size was 384.

Collection & laboratory examination of ticks

Animals' body was visually examined for tick infestation and adult ticks were collected by using universal bottle containing 10% formalin.

Each sample was correctly labeled (with age, sex, breed, Body condition and kebeles) and transported to Ambo University veterinary Parasitology Laboratory for identification to species level by using stereomicroscopic. Ticks identification was conducted following previous protocol described by Wall and Shearer (2001).

Data analysis

Data collected from the field and the laboratory were entered in to Microsoft Excel spread sheet and coded, and then analyzed using SPSS version 20. Descriptive statistics were used to know the prevalence of tick infestation, and association between the tick infestations and host risk factors (sex, age, breed, body condition score and kebeles) was assessed by Pearson Chi square test.

RESULTS

Out of 384 cattle examined, 201 (52.34%) were found infested with one or more ticks' species. There were statistically significant ($P < 0.05$) association between tick infestation and sex, breeds and body condition scores whereas it was statistically insignificant ($P > 0.05$) with age groups and kebeles (Table 1).

The study investigated three genera of adult Ixodid ticks; namely Rhipicephalus (41.7%), Boophilus (0.8%), Amblyomma (2.60%). Mixed infestations were common by Rhipicephalus (Boophilus) and Amblyomma 24(6.25%) and Rhipicephalus (Boophilus) and Rhipicephalus 4(1.04%) (Table 2).

Table 1: Relation between tick infestation and risk factors in Ambo district, western Ethiopia

Risk factors		Number examined	Prevalence n (%)	χ^2	p-value
Age	Young (1 year)	66	26(39.40)	1.3	0.515
	Adult (1-3 year)	195	107(54.90)		
	Old (>3 year)	123	63(51.22)		
Sex	Male	190	83(43.70)	11.3	0.001
	Female	194	118(60.62)		
Breed	Local	298	144(48.32)	8.6	0.003
	HF	86	57(66.30)		
BCS	Good	198	79(39.90)	51.2	0.000
	Medium	117	60(51.30)		
	Poor	69	62(89.60)		
Kebele	Degele Gatra	77	41(53.25)	0.838	0.933
	Abebe Doyo	77	39(50.65)		
	GosuKora	77	39(50.65)		
	KisoseLiben	77	39(50.65)		
	SenkeleFaris	76	43(56.60)		

Table 2: Distribution of tick genera in Ambo district, western Ethiopia from October 2018 to June 2019

Genus of ticks	Prevalence (%)
Amblyomma	3 (0.80)
Rhipicephalus (Boophilus)	160 (41.70)
Rhipicephalus	10 (2.60)
Amblyoma & Rhipicephalus (Boophilus)	24 (6.25)
Rhipicephalus (Boophilus) & Rhipicephalus	4 (1.04)
Total	201 (52.4)
Species	
<i>Rh. (B.) annulatus</i>	43 (11.20)
<i>Rh. (B.) decoloratus</i>	109 (28.40)
<i>A. variegatum</i>	3 (0.80)
<i>Rh. e. evertsi</i>	11 (2.90)
<i>Rh. (B.) annulatus</i> & <i>A. variegatum</i>	3 (0.80)
<i>Rh. (B.) annulatus</i> & <i>Rh. (B.) decoloratus</i>	6 (1.60)
<i>Rh. (B.) decoloratus</i> & <i>Rh. e. evertsi</i>	2(0.52)
<i>..Rh. (B.) decoloratus</i> & <i>A. variegatum</i>	21(5.50)
<i>Rh. (B.) annulatus</i> & <i>Rh. e. evertsi</i> .	3(0.80)

DISCUSSION

The overall prevalence of tick infestation (52.34%) recorded in the current study is comparable with previous report made by Tadele *et al.* (2018) (51.30%). However, it was far lower than the finding of Dabasa *et al.*

(2017) (98.20%) and higher than the report of 33.21% by Surafel and Amsalu (2019). According to Pegram *et al.* (1981), tick activities and prevalence in a given area are affected by rainfall, temperature, altitude and atmospheric relative humidity and management

system including the use of acaricide and other preventive measures, agro-climatic condition and other epidemiological factors.

Cross breed cattle were highly affected by tick infestation compared with local breed cattle. This finding was in line with the result of Belay and Enyew (2016). However, it disagrees with the report of Surafel and Amsalu (2019). The higher prevalence of tick infestation in cross and pure exotic breed animals might be attributed to preimmunity against ectoparasites, which often established through contacts with the parasites at the early stage of their life (Ahmed *et al.*, 2012).

The proportion of infestation was higher in adult and old animals as compared to young animals, which was most likely due to outdoor management and long distant mobilization of adult and old animals in search of feed and water as the result the chance of exposure to tick could be higher than that of younger animals (Sutherst and Maywald, 1983). In the current study, female cattle were more infested by tick (60.82%) than male cattle (54.90%). This finding was in line with the report of Shichibi *et al.* (2017) in Masha district. This could be partly explained by the high chance of physiological stress (pregnancy or lactation) which create favorable conditions to tick infestation and other external parasite infestations (Sutherst and Maywald, 1983).

Higher prevalence of tick infestation was recorded in thin cattle compared to medium and good body conditioned animals. This result was comparable with reports of Fanos *et al.* (2012) who conducted similar study in and around Mizan Teferi, Southwestern Ethiopia. However, it contradict with a study conducted in Gozamin Woreda, East Gojjam (Tadele *et al.*, 2018). Animals with poor body condition had reduced resistance to tick infestation, lack of enough body potential to build resistance and they exposed to any kind of diseases when grazing on the field (Manan *et al.*, 2007). On the other

possible scenario, the poor body condition observed in those cattle with tick infestation could be due to the effect of the parasite on the energy balance of the animal.

In this study *Rh. (B.) decoloratus* was most abundant tick species (28.40%). This result was in line with Wasihun and Doda (2013) who reported a prevalence of 30.63% for this tick from Humbo district. In contrast to Amante *et al.* (2014), the current finding was lower. The variations could be due to the difference in the geographic area, climate, altitude and season during tick collection. Furthermore, *Rh. evertsi* was the third abundant tick species (6.72%) of the total adult tick collected. This result was slightly in line with the report of Abebe *et al.* (2010) who conducted similar study in Somali region, Ethiopia.

CONCLUSION

Tick infestation is the common problem in the study area that occurs on every other animal. *Rhipicephalus (Boophilus) decoloratus* are the leading genus of ticks affecting mainly exotic and cross breed, female cattle with poor body condition of adult to old age in the study area. Although, the prevalence of ticks was high in the study area, proper policies and strategies are not yet in place to control ticks and other external parasites. Therefore, sustainable tick control program should be introduced in order minimize the prevalence to the lowest level so that tick borne diseases and other tick associated problems can be prevented.

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