

Prevalence of ixodid ticks infesting Raya cattle breeds in Semi-arid areas of Raya Azebo district, northern Ethiopia

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Abstract

A cross-sectional study was conducted from January to December, 2016 in Semi-arid areas of Raya Azebo District with the objectives to estimate the prevalence of ixodid ticks and assessing the difference in infestation among the different host risk factors such as age, sex and body condition scores. A total of 2697 adult ixodid ticks were collected from 488 Raya cattle breed selected randomly. Tick species were identified morphologically and the prevalence of the infested animals was estimated in relation to sex, age and body condition score. The study revealed that cattle in the study area were infested with atleast one or more ticks with an overall prevalence of 90% (405/448). Six tick species that belongs to the genera of *Rhipicephalus* (54%), subgenus *Boophilus* (5%), *Amblyomma* (3%) and *Hyalomma* (2.7%) were also identified. The overall prevalence of ticks on cattle with the age from 6 months to 2 years, 3-5 years and greater than 5 years was 90%, 90%, and 92% respectively. A prevalence of 91% in female and 90% in male cattle was also observed. Similarly, the prevalence of ticks was 100 %, 90.7% and 70% in poor, medium and good body conditioned animals, respectively. The high prevalence and presence of many species of ticks may damage the hide and skins of the cattle and thereby contribute to reduced income from cattle. Hence, appropriate control measures using acaricides, improved cattle management practices and community awareness creation are recommended.

Keywords: Body condition; Cattle; Prevalence; Semi-arid; Tick

Introduction

Livestock in Ethiopia is one of the largest components of the agricultural sector (Gashaw *et al.*, 2014) which contributes to the national socio-economy. The calculated combined total output gross value of livestock product is Birr 74.338 billion which is 47.7% of agricultural GDP of the country and 16.5% of the total GDP, and 5-17% of total exports (Behnke, 2010).

Cattle play a significant role in the socio-economic aspects of the life of the people of Ethiopia providing products like meat and milk, drought power for cultivation of the agricultural lands of many farmers (Gashaw *et al.*, 2014). Skin and hides are also important products of the livestock sector in generating foreign export earnings (Gashaw *et al.*, 2014). However, the overall contribution of livestock to food production, rural income and export earnings from livestock have been far below than the expected potential due to the combined effects of external parasites like ticks, Tick-Borne Diseases (TBDs) (Peter *et al.*, 2005).

Ticks are blood sucking ecto-parasites which belongs to the phylum Arthropoda categorized under the three families of the Argasidae, the Ixodidae and the Nuttalliellidae (Anderson, 2008). According to Walker *et al* (2003) and Guglielmone *et al* (2010), the family Ixodidae contains the important genera of *Amblyomma*, *Dermacentor*, *Haemaphysalis*, *Hyalomma*, *Rhipicephalus* and formerly of the genus *Boophilus* are now classified as a sub genus within the genus *Rhipicephalus*. Family *Argasidae* contains *Argas*, *Ornithodoros*, and *Otobius* and a family Nuttalliellidae comprises a single species, *Nuttalliella namaqua* (Guglielmone *et al.*, 2010).

Heavy infestations of ticks for example of *Rh. decoloratus* on the body of the host are likely to cause damage to hides and reduce the rate of growth of cattle (Walker *et al.*, 2003). Bekele (2002) estimates an annual loss of US \$500,000 from hide and skin down grading due to ticks, and approximately 65.5% of major defects of hides by ticks in eastern Ethiopia.

Ticks are responsible for severe economic losses both through direct and indirect effect of blood sucking and toxins particularly in cattle in terms of milk production and reduced weight gain (Bekele, 2002; Peter *et al.*, 2005). For example in Ethiopia, TBD together with tsetse and trypanosomosis are economically very important diseases for this sector (Bekele, 2002). They also indi-

rectly affect their hosts by transmitting a greater variety of pathogenic microorganisms than other arthropod vector groups while feeding their blood meal (Jongejan and Uilenberg, 2004). They affect the physiology of the animals as well (Bekele *et al.*, 2011) and they may also cause nonspecific symptoms like anemia, dermatosis, toxicosis and paralysis (Wasihun and Doda, 2013).

Nowadays, ticks and tick borne diseases represent a major problem to cattle production. They are widely distributed throughout the world, particularly in tropical and subtropical countries (Oluwoch *et al.*, 2009) and have been estimated to affect 80% of the world cattle (Regasa *et al.*, 2015). Ticks reduce the productivity of indigenous cattle due to their ability to transmit different tick borne diseases like protozoan, Rickettsia and viral diseases (Rajput *et al.*, 2006).

Economically, the most important ixodid ticks of cattle in tropical regions belong to the genera of *Hyalomma*, subgenus *Boophilus*, *Amblyomma* and, *Rhipicephalus* (Lefebvre *et al.*, 2010). Of the 47 species of ticks reported from Ethiopia, most of them have been implicated as vectors for several diseases (Mekonnen *et al.*, 2001; Kumsa *et al.*, 2015, 2016). *Amblyomma variegatum* (*A.variegatum*), *A.gemma*, *A. cohaerens*, and *Rhipicephalus* (*Boophilus*) *decoloratus* are among the most important ixodid ticks (Mekonnen *et al.*, 2001; Kumsa *et al.*, 2016). *Rhipicephalus pravus*, *R. evertsi*, *R. practextatus*, *R. mullahasmae*, *R. bergeoni*, *R. simus* have been also reported (Mekonnen *et al.*, 2001; Kumsa *et al.*, 2016). *Hyalomma dromedarii*, *H. truncatum*, *H. rufipes* *H. excavatum*, *H. impelatum* were also previously identified (Walker *et al.*, 2003; Kumsa *et al.*, 2016).

However, in the present study area no research has been carried out previously on the prevalence and identification of ixodid ticks at genera and species level. Therefore, the current study was aimed to estimate the overall prevalence of ixodid ticks on cattle and identify the ticks at genera and species level.

Materials and methods

Study area

This cross sectional study was conducted in Semi-arid areas of Raya Azebo district which is located at 12°47'55"North and 039°38'45"East. The district is found at about 128 km south of Mekelle, the capital city of Tigray region, Ethi-

opia. It is also about 662 km north of Addis Ababa, the capital city of Ethiopia. The administrative center of the district is Mehoni. According to Bewket *et al* (2015), the agro-ecology of the district covers midland (80.6%), lowland (18%) and highland (1.4%). The altitude of the district ranges from 923-2300 meters above sea level.

Study design

A cross sectional study was conducted from January to December; 2016. Study animals were selected from district veterinary clinics, animal health posts, communal grazing lands as well as small scale farms regardless of the agro-climatic zones of the study area, sampling season and months, herd size, management practices, and animal health status. Simple random sampling was used for both infested and non-infested local cattle breeds in relation to their age, sex and body conditions to collect ticks for the identification at genera and species level and to determine their prevalence.

Sample size determination

The sample size for this study was determined by assuming the expected prevalence of 50% tick infestation as there was no previous research conducted in the study area. The desired sample size for the study was calculated using the 95% confidence interval and at 5% absolute precision using the formula indicated below (Thrusfield, 2005).

$$N = \frac{1.96^2 \cdot P^{exp}(1 - P^{exp})}{D^2},$$

Where

N = required sample size P^{exp} = expected prevalence. D = desired absolute precision.

Accordingly, the required study sample size was estimated to be 384. However, to increase precision, the study sample size was increased and total of 448 study animals were examined in the study.

Sampling and sample processing

The examined animals were grouped in to three ages as 6 month to 2 years, 2-5 years and greater than 5 years old (Werede and Afera, 2014) and the body condition categories were classified as poor, medium and good (Tola *et al.*, 2016).

Tick sampling procedure and identification

The selected animals were restrained properly and the entire body of the animals was checked for at least one tick infestation. After physical examination for the presence or absence of ticks, representative sample ticks were collected from different body parts of the animal using a pair of blunt forceps for genera and species identification at Mekelle University, College of Veterinary Medicine, Parasitology Laboratory. The collected ticks were taken carefully and preserved in glass bottles half-filled with 70% ethanol (Tadesse *et al.*, 2012). Each bottle was tightly plugged with a rubber plug and labeled site of collection, age, sex, animal number/code and date of collection. Identification of the ticks in to different genera and species level was conducted using stereomicroscope based on the standard identification keys given by Walker *et al* (2003).

Data analysis

Data analysis was performed using Stata version 10 software. Both descriptive and inferential statistics were performed for the specified objectives. Chi-square test was used to determine the significant variation on tick prevalence among different risk factors like age, sex and body condition of the examined cattle. In all cases, 95% confidence level with the P-value of less than 0.05 was considered as statistically significance level.

Results

In this study, the overall prevalence of tick infestation was 90% (405/448). Cattle were found to be positive for at least one tick genera and /or species (Table 1).

Table 1. Prevalence of cattle ticks in the examined cattle in Raya Azebo District, Northern Ethiopia

Risk factors		No. Positive Cattle	Overall Prevalence	X ²	P-value
Sex	Female (229)	208	91%	0.099	0.753
	Male (219)	197	90%		
	Total (448)	405	90%		
Age	6months -2years(62)	56	90%	2.146	0.342
	3-5years (289)	260	90%		
	>5years(97)	89	92%		
	Total (448)	405	90%		
Body condition	Good (27)	19	70%	0.101	0.951
	Medium (376)	341	90.7%		
	Poor (45)	45	100%		
	Total(448)	405	90%		

A total of 2697 ixodid ticks were collected of which *R.pulchellus*, *R. eversi*, *Rh (B). decoloratus*, *A. variegatum*, *A. gemma* and *H. truncatum* tick species that belongs to the genera of *Rhipicephalus*(54%), subgenus *Boophilus*(5%), *Amblyomma*(3%) and *Hyalomma*(2.7%) were identified morphologically (Table 2).

Table 2. Identified cattle ticks genera and species in Raya Azebo district, northern Ethiopia

Observed Genera	Observed species	No of positive animals	Genera Prevalence in %
Rhipicephalus	<i>Rhipicephalus pulchellus</i>	238	242 (54.0)
	<i>Rhipicephalus evertsi</i>	4	
Subgenus Boophilus	<i>Boophilus decoloratus</i>	22	22 (5)
Amblyomma	<i>Amblyomma variegatum</i>	9	13 (3)
	<i>Amblyomma gemma</i>	4	
Hyalomma	<i>Hyalomma truncatum</i>	12	12 (2.7)
Mixed infestation		116	116 (26)
Total			405 (90)

Moreover, the prevalence of all tick genera and species was compared for all possible risk factors. The overall prevalence of *Rhipicephalus* (54%) and *R. pulchellus* (53%) were higher as compared to the other tick genera and species (Table 3) respectively. Therefore, *Rhipicephalus* tick at genera and species level was the dominant tick which inflicted lesions. Regarding related risk factors in the study, there was no variation in the prevalence of genera between sex and animals with different body condition groups.

Table 3. The distribution of tick species among/between the different ages, sexes and body conditions of cattle

Risk factors Rp		Species prevalence					Total	
		Ree	Bd	Av	Ag	Ht		
Age	6mnth- 2yrs(62)	39(63%)	2(3%)	5(8%)	(1%)	0	0(0)	56(90%)
	3-5yrs(289)	142(49%)	0	14(5%)	5(2%)	4(1%)	10(3%)	260(90%)
	>5yrs(97)	57(59%)	2(2%)	3(3%)	2(2%)	0	2(2%)	89(92%)
	Total (448)	238(53%)	4(1%)	22(5%)	9(2%)	4(1%)	12(3%)	405
Sex	Male (219)	116(53%)	1(0.5 %)	13(6%)	4(1%)	1(0.5%)	5(2%)	197(90%)
	Female(229)	122(53.3%)	3(1%)	9(4%)	5(2%)	3(1%)	7(3%)	208(91%)
	Total (448)	238(53%)	4(1%)	22(5%)	9(2%)	4(1%)	12(3%)	405
Body condition	Good (27)	14(52%)	0	0	2(7%)	0	0	20(74%)
	Medium (376)	198(53%)	4(1%)	20(6%)	5(1%)	4(1%)	10(3%)	340(90%)
	Poor (45)	26(58%)	0	2(2%)	2(2%)	0	2(4%)	45(100%)
	Total (448)	238(53%)	4(1%)	22(5%)	9(2%)	4(1%)	12(3%)	405

Rp-*Rhipicephalus pulchellus*, Ree-*Rhipicephalus evertsi evertsi*, Bd- *Boophilus decoloratus*, Av-*Amblyomma variegatum*, Ag- *Amblyomma gemma*, Ht-*Hyalomma truncatum*

Discussion

The overall prevalence of tick in this study was higher than previous studies in different parts of Ethiopia: 74% in and around Bahrdar (Gedilu *et al.*, 2014); 86.1% in Werieleke district (Werede and Afera, 2014), 84.1% in and around Haramaya town (Bedasso *et al.*, 2014) and 56.2% in Dangila district (Admassu *et al.*, 2015). The highest prevalence in this study may be due to less awareness of the livestock herders, less attention given for cattle management and climatic suitability of the study area for tick development such as high temperature and erratic precipitation. Moreover, the researchers believe that

the recent drought (2015) could have played a role in reducing the immunity of animals and increasing their susceptibility to the tick infestation through creating suitable condition for tick development. On the other hand, the present study is not in line with the finding reported by Guglielmone *et al* (2010) with a prevalence of 25.64%. The differences among these results could be due to the agro-ecology, animal health practice, or management difference with in their respective study areas.

In the study, no statistically significant ($p>0.05$) association was observed between prevalence of ticks and risk factors due to agro-ecological settings and animal health practices and this is in agreement with previous findings reported by Bedasso *et al* (2014); Kassa and Yalew (2012); Haile and Zeryehun(2013); Wolde and Mohamed (2014). All animals in the present study area were managed almost in the same manner. However, male animals were less infested than female animals probably due to male animals receive a little bit better management compared to females for different purposes.

However, Gedilu *et al* (2014) reported a statistically significant difference in prevalence among the age groups. Moreover, Gashaw *et al* (2014) reported a relatively higher prevalence of ticks in adult cattle than younger. Similar result but statistically not significant was found in the present study may be due to age advancement of the animals which may let them to be less resistant. Regarding the different body condition scores, there was no statistically significant variation in the prevalence of ticks due to the high prevalence of ticks in the area. However, a higher proportion of tick prevalence (100%) was recorded in poor body conditioned animals compared to animals with good and medium body conditioned. This could be due to the fact that poor body conditioned animals have reduced their body energy resistance and lack of enough body potential to build resistance than medium and good body conditioned animals which were less infested and this was in agreement with the previous finding reported by Gedilu *et al* (2014), in and around Bahridar.

Regarding the tick species which belong to the Generas of *Rhipicephalus* (54%), subgenus *Boophilus* (5%), *Amblyomma*(3%) and *Hyalomma* (2.7%) found in this study were similar with the previous reports from different parts of Ethiopia (Admassu *et al.*, 2015; Bedasso *et al.*, 2014; Kiros *et al.*, 2014; Mekonnen *et al.*, 2001; Werede and Afera, 2014). In the present study, *R. pulchellus* was highly abundant tick species and this is due to the fact that this tick is identified as a tick of tropical and sub-tropical regions (Walker *et al.*, 2003). *Rhipi-*

cephalus(54%) and *R. pulchellus*, 53% in all age groups was higher as compared to the other tick genera and species. However this result does not agree with that of Werede and Afera (2014) who reported *Amblyomma* (75.6%) and *Rhipicephalus* (8.8%).

During the study period, the prevalence of the *Rhipicephalus*,55%, and *R. pulchellus*, 53.3% identified at genera and species level respectively was slightly higher in female as compared to male but there was no statistically significant($p>0.05$) association with the sex of the examined cattle because this type of ticks do not have special selection for one sex over the other feeding behavior. This result was in line with the works done by Wolde and Mohamed (2014) in Sodozuria district and Gedilu *et al* (2014) in and around Bahirdar who reported the prevalence of this genera and species were higher in female (2.5%) but disagreed with the report given by Werede and Afera (2014) who recorded the overall prevalence *Rhipicephalus* is higher in male (5.3%).

Conclusion

Tick prevalence in Raya Azebo district is high and its impact on cattle health and prevalence of tick-borne diseases needs to be analyzed and adequate control measures implemented. Therefore, a detailed analysis of the relationship between tick abundance and environmental variables needs to be carried out to improve tick control. Community should be well informed about the impact of these ecto-parasites and proper prevention and control options. Further studies need to be conducted for investigation of impact of climate change and variability's, soil moisture, vegetation coverage on tick borne diseases development and cattle population dynamics.

Conflict of interest

The authors declare that there is no conflict of interest.

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