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Identification and Prevalence of Ixodid Tick Species in Cattle in Masha District, Sheka Zone, Southern Ethiopia

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Abstract: A cross-sectional study was conducted from December 2019 to March 2020 in the Masha district to identify genera and determine the prevalence concerning host-related factors. Adult ixodid ticks were collected from 384 randomly selected cattle using forceps and preserved in separate bottles with 70% ethyl alcohol. The collected ticks were identified under stereomicroscope into tick genera based on their morphology. Out of the 384 cattle examined, 296 (77.1%) were found to be infested by one or more tick species. About 2015 ticks were collected and identified to genera and, three genera; namely *Ambylomma, Rhipicephalus* and *Hyalomma* of which *Rhipicephalus* was the most abundant tick genera comprising 94.01% of the total collection and the least abundant tick species was *Hyalomma* (33.3%). The association of the prevalence of tick infestation by different risk factors was assessed and found to be statistically significant between sex and body condition. However, it was statistically insignificant between the age group of animals. Male animals were significantly infested more than females, which was 41.7% and 35.4%, respectively. Medium and poor body condition animals were statistically significantly infested ticks than good body conditioned cattle, which were 30.7%, 37.2% and 9.1%, respectively. There was no statistically significant variation between the age groups, however, the adult age group was more infested than the young age group, which was 53.1% and 23.95%. Cattle kept among different kebeles in the Masha district (P>0.05%) have shown no statistically significant difference. It is strongly suggested that the need to implement community awareness together with the setting up of appropriate tick prevention and control strategies in the study area.

Key words: Cattle · Prevalence · Tick · Risk Factors · Masha District · Southern Ethiopia

INTRODUCTION

Ethiopia is one of the countries with the largest livestock population in Africa and livestock production plays a major role in the overall development of Ethiopia's agriculture, nevertheless, cattle productivity is low [1]. Factors contributing to low productivity include; improper management, diseases, nutritional deficiencies, harsh environment and genetic factors. Ethiopia has approximately 44.3 million cattle, 46.9 million small ruminants and more than one million camels that contribute to the economic welfare of the people by providing hide, power and traction for agricultural purposes, a source of manure fertilizer for increasing productivity and milk and meat for food as well as the major source of foreign currency [2]. Moreover, livestock helps as a source of security and supplementary cash income for rural agricultural households [3]. However, animal health problem is one of the major problems that are especially overwhelming during the outbreak of disease and prevalence, infestation of pest and vectors including tick [2].

Ticks and tick-borne diseases (TBD) are widely distributed throughout the world, particularly in tropical and subtropical countries, which causes tremendous economic importance in livestock production [4]. Ticks are one of cattle's most common and harmful blood-sucking ectoparasites worldwide. They are responsible for a wide range of livestock health problems in several countries of the world. They reduce cattle productivity, milk yield and skin, hide quality and increase susceptibility to other diseases [5]. Approximately 80% of the cattle population of the world are at risk of tick infestation and tick-borne diseases. In addition to sucking large volumes of blood, ticks inject pathogens such as viruses, bacteria, protozoa and toxins into their host [6].

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In Ethiopia, among the major parasitic diseases, ticks and tick-borne diseases rank third after trypanosomiasis and endoparasitism causing economic losses. Bekele [7] estimated an overall loss of US$ 500,000 from hide and skin downgrading as a result of ticks and approximately 65.5% of major defects of hides in Ethiopia are caused by ticks. In addition, De Castro [8] estimated that the annual global cost associated with tick and tick-borne diseases in cattle ranges between US$ 13.9 to 18.7 billion.

Since studies on tick fauna in Ethiopia began in early 19th centuries [9]; extensive surveys have been carried out on the distribution of ticks on livestock in different regions and more than 60 species of ticks infesting both domestic and wild animals have been recorded.

Investigating the population dynamics of ticks is essential to develop more cost-effective tick and tick-borne disease management and eradication programs. It was simple to develop an intervention that could be used to reduce tick load and avoid their occurrence, as well as the disease they are likely to spread if the common ticks are known to a given location with their preferred hosts [10] Despite the losses caused by tick infestation in Ethiopia and although many researchers have documented the distribution and abundance of different tick species across the country, livestock owners continue to face numerous challenge as a result of ixodid tick infestation, particularly in the Masha district. The current study was designed to estimate the prevalence of ixodid tick species and associated risk factors in the Masha district.

MATERIALS AND METHODS

Study Area: The study was conducted in Masha woreda, SNNPR, Ethiopia, starting from December 2019 to March 2020. Masha woreda is Located in the Sheka zone of the southern nations, nationalities and peoples Region. It is about 676 km from Addis Ababa and 950s km from southwest of Hawassa, the capital city of Southern Nations and Nationalities People's Region (SNNPR), at an elevation of 1600-2400 *m.a.s.l.* and receives 2000mm rainfall annually. It lies at 7°24° up to 7°52°-latitude north and 35°35°E longitude, covering an area of 1450 km^2 hectare of land. The mean annual rainfall and temperature of the area vary from (1800-2200mm) and 15°C-17°C respectively. Masha district has a population size of 42435 constituting 20,920 males and 21,515 females dwelling in the area and their livelihood depends on a mixed farming system. The topography of the Masha district is 10% midland and 90% highland [11]. The Livestock population of the Masha district is estimated to be 673,259 cattle, 762,589 sheep, 328,268 goats, 122,814 equine, 86 pigs and 986,258 poultry [12].

Study Population: The study animals were all age groups of cattle that were randomly selected from three Kebele's namely Gatimo, Shibo and Ateso in Masha district. For convenience, cattle were categorized under two age groups such as young (cattle of ≤1.5 years) and adult (cattle of >1.5 years) [13].

Study Design and Sampling Technique: A cross-sectional study was conducted to identify genera of ticks and to determine the prevalence of ticks within a group of ages, kebele's, body condition scores and sex from December 2019 to March 2020. The animals were selected using a simple random sampling technique from the study area for tick collection and identification from different body regions of the cattle.

Sample Size Determination: The desired sample size was determined by assuming a 50% expected prevalence of tick infestation at a 95% confidence interval and 5% absolute precision. Therefore, the relevant formula for the desired sample size was based on Thrusfield [14] would be:

$$N = \frac{1.96^2 \text{ pexp (1-Pexp)}}{d^2}$$

where
N = required sample size,
Pexp = expected prevalence,
d = absolute precision.
By substituting these values in the formula, the sample size should not be less than 384.

Tick Collection and Identification: During sampling, each animal was either restricted in a crash or laid down and then tick collection was done by using thumb forceps and manually without causing damage to the head and other body parts of the ticks. All visibly attached adult ticks were collected from different predilection sites (head/ear, neck/dewlap, belly, anogenital, udder, scrotum, brisket, back, tail, legs) of each animal following the procedure suggested by Kaiser[15]. Adult ticks were collected from half body region of the cattle at different kebeles of the site of collection and containing 70% ethanol. Each label includes locality, identification code attachment site and date of collection [16]. Afterward, ticks were transported

to Mizan Regional Veterinary Laboratory and counting, recording and identification of cattle tick genera using a hand lens and stereomicroscope took place within three days of collection.

Ticks were identified according to standard taxonomic identification procedures described by Okello-Onen *et al*. [17]. All tick genera identified were counted according to their predilection site on cattle half body: hence, the total number of any tick species and mean tick burden present on cattle was estimated. For analysis the half body tick counts were doubled to obtain whole body adult tick burden. All tick collected from different animals and body site were separately examined under a stereomicroscope. The collected tick was classified into different genera levels based on size, mouth part, the color of the body, leg color, presence and absence of the eye [16].

Data Management and Analysis: The collected data was recorded and coded in Microsoft Excel spreadsheets and analyzed by using Stata v. 13.0 for Windows (Stata Corp., USA). Prevalence was determined as the rate of number of infested animals and the total number of sampled animals. Associations between explanatory variables (age, sex, body condition score and area) and the outcome variable (infestation status with specific tick genera) were done using the chi-square (χ^2) test. In all analyses, all statistics were considered significant at $p < 0.05$.

RESULTS

The Overall Prevalence of Ticks: A total of 2015 ticks were collected from different body parts of tick-infested cattle. Out of the examined cattle, 296 (77.1%) were infested by ticks.

Table 1: Prevalence of identified tick genera

Tick genera	No. of infested animals	Prevalence (%)
Ambylomma spp.	240	62.5
Hyalomma spp.	128	33.3
Rhipicephalus spp.	361	94.01

Identification of Tick Genera: The genera of tick identifed during the study includes; *Rhipichephalus spp.(*94.01%), *Ambyloma spp.(*62.5%) and *Hyaloma spp.* (33.3) (Table 1).

Distribution of Ticks by Attachment Site: In present study, higher tick infestation was recorded in tail and anal area of animals' body followed by legs and abdomen whereas low infestation was recorded in area from shoulder to tail base (Figure 1).

Association of Tick Infestation with Different Epidemiological Risk Factors: Association of tick infestation with different epidemiological risk factors revealed a statistically significant difference ($p<0.05$) among body condition and sex of the examined cattle. However, the age of the animal and kebeles were not statistically significant (Table 2 below).

DISCUSSION

Tick species are widely distributed in Ethiopia and several researchers have reported on the distribution and abundance of ticks in various parts of the country [18]. In the current study, 296 of the 384 cattle examined during the study period were infested with one or more tick species, for an overall prevalence of 77.1%. This high prevalence of tick infestation demonstrated that ticks are widely distributed and the most important external parasite of cattle in the district. The high tick infestation in the area could be attributed to environmental factors such as humidity, which are conducive to tick survival, growth and reproduction [19].

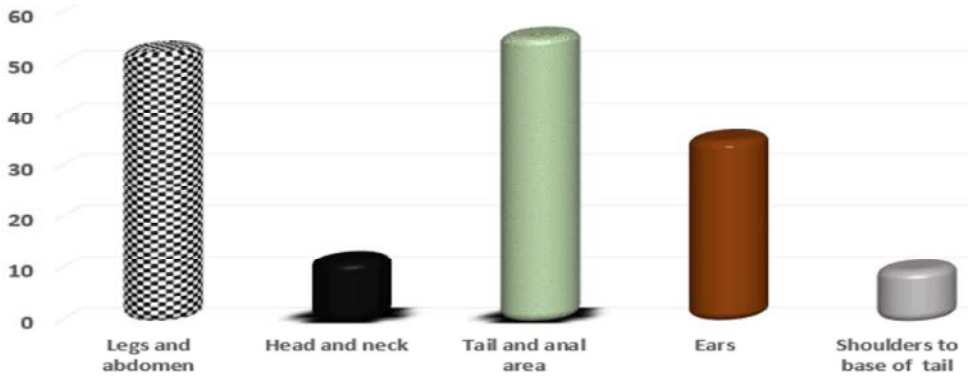

Fig. 1: Relative distribution of ticks in different body parts of cattle

Table 2: Association of tick infestation with different epidemiological risk factors

Risk Factors	No. examined	No. infested	Prevalence	χ^2	Significance
Body condition			9.6	0.008**	
Poor	169	118	30.7		
Medium	175	143	37.2		
Good	40	35	9.1		
Kebele				5.6	0.06
Gatimo	101	84	21.9		
Shibo	208	161	41.9		
Ateso	75	51	13.3		
Sex				4.69	0.03*
Male	196	160	41.7		
Female	188	136	35.4		
Age				0.28	0.59
Young	122	92	23.95		
Adult	262	204	53.1		
Total	384	296	77.1		

This current finding was consistent with the findings of 78.23% [20], 74% [21] and 82% [22] in Horo Guduru, Bahir Dar and Bedele district respectively. The highest prevalence in this study could be attributed to less awareness among livestock herders, less attention paid to cattle management and the study area's climatic suitability for tick development, such as high temperatures and erratic precipitation [19]. The current study, on the other hand, contradicts the findings of 25.6% in Holeta town [23] and 34.3% in Haramaya [24]. This difference could be attributed to differences in the agro-climatic conditions of the study areas, the season of sample collection and the study area's environment, which may not be conducive to its reproduction and survival [18].

The distribution and abundance of the most common tick species infesting cattle in Ethiopia vary greatly from one area to another. The current work revealed that the major genera of ticks infesting cattle in Masha district belong to four genera, namely *Rhipicephalus spp. (94.01%), Ambylomma spp. (62.5%)* and *Hyalomma spp.(33.3%)* in order of predominance. Reports of similar composition for the majority of these genera were indicated by previous studies [25- 28]. In this study, *Rhipicephalus spp*. was found to be the most abundant tick genera in the study area (66.4%) which was in agreement with the previous report from the Somali Regional State [28] and in Errer Valley of Eastern Ethiopia [25]. Morel [29] affirmed that the native distribution of *Rhipicephalus* in Ethiopia seems to be connected with middle-height dry savannas and steppes in association with Zebra and ruminants and it is widely distributed throughout Ethiopia. This tick species shows no apparent preference for particular altitudes, rainfall zones, or seasons [9].

Ambylomma spp. was the second most abundant (62.5%) and widely distributed tick genus in the study area. The finding was consistent with the findings of 60.1% and 65% from Asella [30] and Harmaya [31] respectively. However, the finding was higher than that of the 18.7% report from Bahir Dar [21] and lower than the 83.1% report from Jimma[32]. *Ambylomma* is the most prevalent and abundant tick on cattle where the climate is humid much of the year [9].

Hyalomma spp. was the least abundant tick identified with an overall prevalence rate of 33.3% which was in agreement with the record of 33.13% in Bahir Dar [21]. Contrary to these works, a very low prevalence rate (1.85%) in Holeta [33], 2.5% in Asella [30], 6.8% in the Somali region [28] and 7.8% in Haramaya [31] was reported. This tick species was collected from restricted areas of warm, moderately dry midlands between altitudes of 1800 to 1950 m.a.s.l. Hoogstraal [34] stated that a variety of factors such as density, interaction between tick genera, time and season determine the attachment of ticks.

Ticks are known to be distributed in different parts of the host body. In this study, ticks were collected from different parts of the animal and the rate of tick infestation differed from site to site. The predilection site mentioned in the result of this study was similar to those reported by other authors [17]. The predilection sites found in this study were also in line with the study conducted in Asella[35]. Factors such as host density, interaction between tick species, time and season [4] and inaccessibility for grooming determine the attachment site of ticks [36]. 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 [9].

Medium and poor body condition animals were statistically significantly (P< 0.05) infested by ticks than good body condition animals, which were 37.2%, 30.7%and 9.1%, respectively. This might be due to poor and medium-body conditioned animals having reduced resistance and being exposed to most kinds of diseases when grazing on the field. On the other hand, infestation shows no significant association among different kebeles of animal origin in the Masha district (P>0.05%). This may be due to similar agroecology of the study areas.

There was statistically significant association (P <0.05) in the infestation rate between sex groups, where higher infestation was recorded in males (41.7%) compared to females (35.4%). This variation may be associated with female animals, which were kept properly in the house with good management system for dairy purpose whereas male animals grazing on field all day may be exposed to tick infestation.

The proportion of tick infestation was slightly higher in adult (53.1%) cattle as compared to young cattle (23. 95%). However, there was no statistically significant association (P>0.05). This finding is in agreement with the report of Meaza *et al*. [21] who stated that a higher proportion in adults than the youngest.

CONCLUSION AND RECOMMENDATIONS

The present study showed that high prevalence of Ixodid tick species in the Masha district. The important tick genera investigated in this research were *Ambylomma, Rhipicephalus* and *Hyalomma* of which *Rhipicephalus* was the most abundant tick genera of the total collection and the least abundant tick species was *Hyalomma*. The limited scope of awareness regarding the impact of ticks, lack of adequate veterinary infrastructures for access by the community and absence of tick control strategy in the area are the most important factors accountable for the widespread existence of tick genera in the study area.

Based on the above conclusion, the following recommendations are forwarded:

- ✓ Application of acaricides inducing the tick population to a manageable level i.e. to the extent without affecting the enzootic stability.
- ✓ Creation of awareness among livestock owners on the potential effect of tick and tick-borne diseases.
- ✓ Improving the traditional management system in general and the nutritional status of their animals in particular should be made.

Data Availability: All the datasets generated or analyzed during this study are included in this manuscript.

Additional Points: We, the authors, declare that this research is original work, has not been submitted for publication anywhere and all sources of materials used for this research have been duly acknowledged.

Ethical Approval and Consent to Participate: Ethical clearance was obtained from the Research Ethics and Review Committee of Wolaita Sodo University. Informed consent was obtained from the participants through both written and verbal consent forms.

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