

Ovine Ixodid Ticks Infestation Prevalence in and Around Jimma Town, South West of Ethiopia

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Abstract: A cross-sectional study carried out from April 2021 to May 2022 in order to determine the prevalence of tick infestation and associated risk factors in Sheep in and around Jimma Town, South West of Ethiopia. Total of 384 Sheep of different age groups and body conditions were so selected, and 334 (86.98%) of them were harboring ticks. The high prevalence within age groups, sex and body condition score of animals showed statistically significant differences ($P < 0.05$) while statistical relationship between tick infestation and animal origin, insignificant ($p > 0.05$). High tick infestation rate recorded in sheep with adult of (88.5%) and old of (83.1%) than with young of (36.8%) age group. Similarly, high tick infestation of 89% noted in sheep with poor body condition while 87% & 74.8% of tick infestation verified in sheep with medium and good body condition, in that order. Five tick species, grouped under four genera, *Rhipicephalus evertsi*, *Hyalomma truncatum*, *Amblyomma variegatum*, *Rhipicephalus pulchellus* & *Rhipicephalus (Bophilus) decoloratus* of tick species identified along with the multi species of tick with 25.5%, 22.7%, 12.2%, 10.7%, 9.6% and 6.2% of prevalence, respectively. As an inference that ticks were the most important production and health problems for sheep in the study area. The ever-increasing threat of ovine ticks, so, warrants the systematic use of acaricides and the awareness of pet owners to prevent and control ticks, appositely.

Keywords: Ovine, Tick, Prevalence, Risk-Factors, Jimma, Ethiopia

1. Introduction

Ethiopia is believed to have the largest livestock population in Africa, approximately 53.99 million cattle, 25.5 million sheep and 24.06 million goats, 1.91 million horses, 6.75 million donkeys, 0.35 million mules, 0.92 million camels, 50.38 million poultry and 5.21 million beehives. Livestock production, in Ethiopia, represents a major asset among resource-poor smallholder farmers by providing milk, meat, skin, and manure and traction force [16].

The contribution of livestock to the national economy particularly with regard to foreign currency earnings is through exploration of live animal, meat and skin and hides [17]. Poor health and productivity of animal due to disease has considerably become the major obstacle to the potential of livestock industry [20]. Now a day parasitism represents a major obstacle to development and utilization of animal

resource.

In Ethiopia, ecto-parasites in ruminant cause serious economic losses to small holder farmers, the tanning industry and country as a whole through mortality of animals, decreased production, down grading and rejection of skin and hide [23]. From the ectoparasites, ticks ranked as the most economically important of livestock in tropics including sub-Saharan Africa [12].

Ticks are small, wingless ectoparasitic arachnid arthropods that are cosmopolitan and prevalent in warmer climates [19]. Ticks cause substantial losses in sheep production, in terms of diseases, reduced productivity and fertility and often death, and are economically the most important ecto-parasites of sheep [8]. As the research indicated that different ticks have different predilection sites on the host's body [13]. Ticks suck blood; damage hides and skins introduce toxins and predispose cattle to myiasis and dermatophilosis [12].

Furthermore, they reduce bodyweight gains and milk yield, in addition to creating sites for secondary invasion by pathogenic organisms [15]. More significantly, ticks transmit diseases from infected cattle to healthy ones. Ticks transmit greater variety of pathogenic microorganisms than any other arthropod vector group, and are among the most important vectors of diseases affecting animals [12, 31].

According to the research, ticks considered the most important to health of domestic animal in Africa comprise about seven genera [32]. Among these genera, the main tick genera found in Ethiopia include *Amblyomma*, subgenus *Rhipicephalus* (*Boophilus*), *Haemaphysalis*, *Hyalomma* and *Rhipicephalus*. The genus *Amblyomma* and *Rhipicephalus* are predominating in many parts of country, *Hyalomma* and subgenus *Rhipicephalus* (*Boophilus*) also have significant role [11].

Due to economic and veterinary importance of ticks, their control and transmission of tick born diseases remain challenge for the cattle industry of the world and it is a priority for many countries in tropical and subtropical regions [21]. In Ethiopia, there are about 47 species of ticks found on livestock and most of them have importance as vector and disease causing agent, have damaging effect on skin, and hide production [28].

How hard Researchers tried to report the distribution and abundance of tick species in different parts of the country, Ethiopia, but it has not been yet enough to have the countrywide distribution figures as well as their burden. In assembly, studies was hardly conducted on the prevalence of Ixodid Ticks in sheep and its associated risk factors in selected kebeles (PA) of the Jimma Town due to slight weight given to sheep ecto-parasites. The goal of this study, consequently, to determine the prevalence of tick infestation in Sheep and associated risk factors in and around Jimma Town, South West part of Ethiopia.

2. Materials and Methods

2.1. Study Area

The study was conducted in and around Jimma Town, Oromia Regional State, South West of Ethiopia. According to documented data, Jimma situated approximately at a distance of 352 km from Addis Ababa. The elevation of the area fall in between 1720 & 2110 m above sea level, and it is, geographically, located at 7°13' & 8°56' N latitude and 35°52' & 37°37'E longitude. The climatic condition of the area is 'midland', receives annual rainfall ranges from 1200 to 2000 mm. The area accompanied by short and long rainy seasons from November to April, and July to October with 12.1°C to 28°C annual mean temperature, respectively. The livestock population of the area is consisted of 2,016,823 (44.4%) Cattle, 288,411 (6.4%) Goats, 942,908 (20.8%) Sheep and 74,574 (1.6%) Horses, 49,489 (1.1%) Donkeys, 28,371 (0.6%) Mules and 1,139,735 (25.1%) Poultry [7]. The study animals were sheep population, which owned

by smallholder farmers under traditional management system.

2.2. Study Animals

Total of 384 sheep were randomly selected from deliberately selected five kebeles and each sheep, at grazing areas and watering point, examined for the presence ticks. Risk factors such as, sex, age, body condition score, and predilection sites recorded for each selected animals before clinical examination. Sheep of all age group and sex were also considered, and with age of animal classification method set, ages of sheep were, consequently, grouped into three categories namely young (0 up to 1 year), adult (2 up to 4 years) and old (above 4 years) [10].

2.3. Study Design

A Cross-sectional study, employed to assess and determine the prevalence of ticks, Ixodidae Ticks infestation of sheep and associated risk factors from April 2021 to May 2022 in and around Jimma Town. The origin of the animal, sex, age, body condition score of the research animals, and tick predilection sites help to determine the risk variables associated with the occurrence of tick infestation, recorded during data collection.

2.4. Sampling Technique and Sample Size Determination

Based on the population accessibility and their distribution preference, sheep were chosen from five kebeles namely Bossa Kito, Qoci Mandara, Frustale, Ifa-Bula and Sexoo Semero in and around Jimma Town using a simple random sampling technique. Since no previous research had been conducted on the prevalence and associated risk factors of Ixodidae ticks in sheep in the study area, the current study used a 50% expected prevalence, a 95% confidence level, and a 5% absolute precision. The overall number of animals to be included in the study calculated using a formula [30]. Accordingly, the sample size of 384 animals was determined.

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

Where: n = required sample size; P_{exp} = Expected prevalence and d = Desired absolute precision.

2.5. Methodology

2.5.1. Ticks Collection and Preservation

Ticks were collected successfully from sheep after being restrained using ropes, by physical handling. The skin of each selected sheep inspected for the presence of ticks followed by collection of all visible adult ticks with forceps and gloved handpicking through horizontal rotation to avoid damage to the tick mouthparts and harm to the host, in tagged universal bottle.

It was then preserved in 70% ethyl alcohol and 10% formalin before being sent to Jimma University Veterinary Laboratory for parasitological examination.

2.5.2. Lab Examination and Identification

Ticks from each container, placed on Petri dishes and inspected under a stereomicroscope, identified to genus and species level by using stereomicroscope, according to given standard identification keys [22, 32].

Ticks visualized grossly and classified to levels of different genera followed by species identification level in reference to their morphology and structures such as color of scutum and conscutum, leg color, body, coxae one, coxa four and ventral plates. During lab identification, sample put on Petri dish and the species identified by examining under stereomicroscope.

2.6. Data Analysis

Collected data coded and placed into a Microsoft Excel spreadsheet, which analyzed using STATA software of windows Version 16. Simple descriptive statistical tool used to analyze the prevalence and distribution of tick species. Tick infestation rate, calculated based on age groups and analyzed to distinguish existed different variables.

The *Pearson's chi-square (X^2)* test applied to test prevalence differences and degree of connection with the major risk factors with tick infestation rate among age groups, sex and body conditions. A statistically associated significance between variables defined at *p-value* and considered to exist if the computed *P-value* is less than 0.05 ($P < 0.05$), accordingly.

3. Results

3.1. Tick Prevalence and Distribution

From the total of 384 examined animals, 334 (86.98%) of sheep were found infested by ticks, indicating more than half of examined sheep harboring tick by the study area.

Tick infestation prevalence of 334 (86.98%) accordingly constituted the prevalence of Frustalie of 110 (26%), Ifa-Bula of 90 (21.4%), Qochi Mandara of 65 (15.4%), Bossa Kito of 71 (14.3%) and Sexo Semero of 48 (9.9%) kebele's (PA) tick infestation, in that order (Table 1).

Table 1. Tick Prevalence and distribution in five selected kebeles.

Origin (PA)	Examined Sheep	Positive Animal	Prevalence (%)
Bossa Kito	71 (18.5%)	55	14.3
Sexo Semero	48 (12.5%)	38	9.9
Frustalie	110 (28.6%)	100	26
Ifa-Bula	90 (23.4%)	82	21.4
Qochi Mandara	65 (16.9%)	59	15.4
Total	384 (100%)	334	86.98

3.2. Tick Genera and Species Distribution

From total of 334 (86.98%) examined animal for presence of tick infestation, about 1878 ticks, collected from different parts of the animal's body exposed for tick-infestation.

Accordingly, four Ixodidae tick genera which include *Rhipicephalus*, *Hyalomma*, *Amblyomma* and *Rhipicephalus* (*Boophilus*) with infestation rate of 648 (34.5%), 496 (26.4%), 442 (23.5%) and 292 (15.5%) altogether with five tick species were identified, respectively (Table 2).

Table 2. Tick genera and Species Distribution.

Genus	Tick genera (%)
<i>Rhipicephalus</i>	26.4% (496/1878)
<i>Hyalomma</i>	23.5% (442/1878)
<i>Amblyomma</i>	34.5% (648/1878)
<i>Rhipicephalus</i> (<i>Boophilus</i>)	15.5 % (292/1878)

Amongst four identified tick genera (*Amblyomma*, *Hyalomma*, *Rhipicephalus* (*Boophilus*) and *Hyalomma*), *R. evertsi evertsi*, *H. truncatum*, *A. varigatum*, *R. Pulchellus* and *R. (Boophilus) decoloratus* with prevalence distribution rate of 37 (25.5%), 24 (22.7%), 47 (12.2%), 98 (10.7%) and 41 (9.6%) recorded, respectively while about 87 (6.2%) prevalence rate distribution dominance accounted for *Multi Tick Species* (Table 3).

Table 3. Tck Species Distribution Dominance.

Tick species	N	Prevalence (%)
<i>R. evertsi evertsi</i>	49	37 (25.5)
<i>H. truncatum</i>	31	24 (22.7)
<i>A. varigatum</i>	66	47 (12.2)
<i>R. pulchellus</i>	103	98 (10.7)
<i>R. (Boophilus) decoloratus</i>	43	41 (9.6)
Multi Tick Species*	92	86 (6.2)
Total	384	334 (86.98)

* Tick of more than one Species (Multi Tick Species)

3.3. Associated Risk Factors

Out of 384 examined total animals, 134 (34.9%), 137 (35.7%) and 113 (29.4%) of sheep were in medium, poor and good body score conditions. Accordingly, 118 (30.7%), 119 (30.99%) and 97 (25.26%) (Prevalence) tick infestation rate recorded, in that order.

This finding has, moreover, revealed, more than half of sampled animals were female, comprising 223 (58.1%) while the remaining of 161 (41.9%) were male with prevalence (or infestation rate) of 51% and 36%, respectively (Table 4).

Tick prevalence differences among animal's age group, moreover, indicated the fact that a high tick infestation rate recorded in animal with adult age than in young and old age groups, relatively (Table 5).

These showed the fact that animal body condition has hardly played a significance role with regard to relation tick infestation as the animal in a poor body condition might probably would have less chance of exposure to tick infestation to animal with medium and good body conditions, relatively (Table 6).

Table 4. Prevalence and infestation rate differences of tick species per host sex.

Sex Category	N	Tick species infestation rate (prevalence in %)e) per Host Sex					
		<i>R. pulchellus</i>	<i>R. (B) decoloratus</i>	<i>R. evertsi evertsi</i>	<i>A. varigatum</i>	Multi species	<i>H. truncatum</i>
Female	223	11 (2.9)	22 (5.7)	25 (6.5)	25 (6.5)	59 (15)	54 (14)
Male	161	13 (3.4)	15 (3.9)	16 (4.2)	22 (5.7)	39 (10)	33 (8.6)
Total	384	24 (6.2)	37 (9.6)	41 (10.7)	47 (12.2)	98 (26)	87 (23)

Table 5. Tick species prevalence in relation host age.

Age Category	N	Tick species prevalence in (%) per animal's age category					
		<i>R. pulchellus</i>	<i>R.(B) decoloratu</i>	<i>R. evertsi evertsi</i>	<i>A. varigatum</i>	Multi species	<i>H. truncatum</i>
Young	39	2 (0.5)	6 (1.6)	6 (1.6)	4 (1.0)	7 (1.8)	11 (2.9)
Adult	211	16 (4.2)	15 (3.9)	26 (6.8)	26 (6.8)	53 (13.8)	44 (11.5)
Old	134	6 (1.6)	16 (4.2)	9 (2.3)	17 (17.0)	38 (9.9)	32 (8.3)
Total	384	24 (6.2)	37 (9.6)	41 (10.7)	47 (12.2)	98 (25.5)	87 (22.7)

Table 6. Ixoded tick prevalence in relation to Host factors.

Host Status		Ixoded Tick Infestation status Per Animal Tested				
Factors	Categories	N	Positive (%)	P value	Odd Ratio	95% CI
BSC	Medium	134	118 (30.7)	0.617	0.827	0.451 - 1.936
	Poor	137	119 (31.0)	0.856	0.935	0.447 - 1.913
	Good	113	97 (25.3)	-	-	-
	Total	384	334 (87.0)			
Age	Young	39	36 (9.4)	0.466	0.619	0.170 - 2.249
	Adult	211	180 (46.9)	0.461	1.277	0.667 - 2.443
	Old	134	118 (30.7)	-	-	-
	Total	384	342 (87.0)			
Sex	Female	223	196 (51.0)	0.584	0.846	0.4641 - 0.541
	Male	161	138 (36.0)	-	-	-
	Total	384	(87.0%)			..

NB: BSC = Body Score Condition; N = Animal Number; CI = Confidence Interval

4. Discussion

The current study revealed that tick infestation is still widespread and most significant external Parasites of ovine in the study area. In this study, 384 ovine examined and 1878 visible adult ticks collected from the body of sheep. The distribution and abundance of tick species infesting sheep in Ethiopia are vary from area to area. In the present study 334 (86.98%) of sheep were found to be infested by one or more species of ticks. Higher prevalence of tick infestation in the study area, observed.

This finding was comparable with the previous investigation conducted in Miesso district, Western Hararghe, who recorded a prevalence of 89.9 % in (sheep), in selected district of Fafen zone of Somalia regional state who recorded 81.7% in sheep and recorded 80.30% (sheep) in Bedelle district, Oromia Region, Ethiopia, in that order [2-3, 18]. Finding of this study showed moreover a higher Tick infestation prevalence compared to comparable works done, previously. Tick prevalence of 76.50% and 69.86% recorded in sheep in district of Beadle and Borana pastoral area, respectively [4, 9]. While prevalence of 40%, 41.8%and 22.2% recorded in sheep in selected districts of Tigray region, in and around Wolaita Sodo, in North East of Ethiopia, in that order [1, 25, 34].

The difference in the Prevalence might be due to the

geographical difference, and season of the study period, frequent exposure to the same communal grazing land that favored the frequent contact and management of animals. The high prevalence within age groups, sex and body condition score of animals showed statistically significant differences ($P < 0.05$), agreed with the finding conducted in Mizzen Teferi, and in and around Sude Woreda consistently [24, 6]. Whereas statistical relationship between tick infestation and animal origin, insignificant ($p > 0.05$), in divergence with the statement put in and around Gondar town but in agreement with the study conducted in selected district of Fafen zone of Somalia regional state and in and around dire dawa, eastern Ethiopia, compatibly [1, 18, 29].

The probable reason for this might probably could be for the reason that young animals grazing around home than adult and old. This in turn contribute to a minimum rate of exposure by tick since the number of ticks less around home as compared to animals graze in pasture mostly adult and old animals [21].

This is due to high infestation of tick result poor body condition due to consumption of high amount of blood and fluid by those ticks. The prevalence of tick infestation was higher in females (51%) than in males (36%). Although the exact cause of higher prevalence of tick infestation in female animals due to lactation period, during pregnancy, the female sheep may be immune-compromised and susceptible to ticks, and assumed that some hormonal influences may be

associated with this phenomenon [33]. In fact, higher level of prolactin and progesterone hormones could make the females more susceptible to any infection [14].

Moreover, production stress including pregnancy and lactation could have made the female animals more susceptible to infection. The principal tick species infesting small ruminants in the study area comprise *Amblyomma variegatum*, *R. (B) decoloratus*, *Rhipicephalus evertsi evertsi*, *Rhipicephalus pulchellus* and *Hyalomma truncatum*. *Rhipicephalus evertsi evertsi* was the most abundant tick species in the area. Where *Rhipicephalus evertsi evertsi* was the most abundant tick species in sheep at Fafen zone of Somalia regional state [18], also reported a similar finding. It is widely distributed and common on domestic livestock in Ethiopia [26].

This further indicated that tick in the study area lined with its wide spread occurrence in most parts of the country. *R. (B) decoloratus* was the least frequently encountered ticks during the study period. It prefers to infest sheep and goats, cattle and dogs. Ticks, in Ethiopia, mainly collected from sheep and though cattle may harbor quite large infestations in Oromia, Southern Nations Nationalities and Peoples, Afar and Gambella Regional States [26]. Either it occurs in arid and semi-arid areas and in woodland, bush land as well as grassland with trees or bushes present [12]. Fully engorged female tick drops off to the ground to lay eggs while male tend to remain on the host up to several months to continue feeding and mating with other females on the host before dropping off [27]. Ticks are the most important ectoparasites of livestock in tropical and sub-tropical areas, and are responsible for severe economic losses both through the direct effects of blood sucking and indirectly as vectors of pathogens and toxins. This study also confirms that ticks still big concern of ectoparasites and which pose significant challenges to small ruminant production and health of the study area. In this study, ticks species like *Rhipicephalus evertsi evertsi*, known to infest cattle, sheep and goats as well as wild herbivores [32]. Hence, the contribution of wildlife in the maintenance of ticks in the study area should acquire some attention as animals are under shared grazing in free-range conditions.

5. Conclusion and Recommendations

The prevalence of tick infestation in sheep in and around Jimma Town, very high. In the present study, five species of ixodid ticks grouped under four genera, identified. *Rhipicephalus evertsi evertsi*, *Hyalomma truncatum*, *Rhipicephalus pulchellus*, *Amblyomma variegatum* and *Rhipicephalus (Boophilus) decoloratus* were among the tick species identified in the study area. *Rhipicephalus evertsi evertsi* and *Amblyomma variegatum* were most abundantly identified tick species in study area. Ticks were highly prevalent in the study area due to inadequate veterinary services, favorable climatic conditions and poor awareness of owners on the impacts of tick infestations and lack of effective and planned control strategy in the study area. Since Tick are responsible for severe economic losses, practices

like appropriate pasture management in communal grazing area; local farmer awareness creation about tick control method; and initiation of further studies on epidemiological occurrence and the influence of environment must have to be encouraged by the area, pertinently.

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