International Journal of Advanced Research in Biological Sciences
ISSN: 2348-8069
www.ijarbs.com
DOI: 10.22192/ijarbs Coden: IJARQG (USA) Volume 8, Issue 8 -2021

Research Article

DOI: http://dx.doi.org/10.22192/ijarbs.2021.08.08.006

Infestation, Identification and Associated Risk Factors of Bovine Hard Ticks in and around Jimma Town, Ethiopia

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Abstract

Tick infestation is a common problem affecting large population of bovine worldwide: in Ethiopia bovine are commonly infected with different species of tick. The prevalence of tick and associated risk factors was studied in bovine in and around Jimma town. A cross-sectional study was conducted in and around Jimma town from from November, 2017 to April, 2018. Animals were randomly selected and examine for tick infestation and adult tick were manually collected from different body parts o infested animals, kept in universal bottle and preserved with 70% ethanol. The identification of ticks was performed using identification key through sterio-microscopic observation. Out of 384 cattle examined, 276 (71.9%) were found to be infested by ticks. Three genera; Amblyomma, Boophilus and Rhipicephalus with corresponding prevalence of 72.95%, 24.52% and 2.52% were identified. From different variables sex, age, breed and body condition, body condition and age were statistically significant with tick infestation ($p< 0.05$). But sex and breed were not statically significant with tick infestation ($p>0.05$). Relatively large numbers of animals are infested by Amblyomma followed by Boophilus and Rhipicephalus. The result of the present study indicated the tick infestation in the study area is above 70%. This suggests the tick infestation is a serious problem in this area which could contribute for reduction of animal productivity and quality of hide, as well as tick born diseases transmission.

Keywords: Bovine, Ethiopia, Hard Tick, Infestation, Jimma, Risk factors

Introduction

Ethiopia represents various climatic zones and livestock production systems in tropical Africa [1]. It has the largest number of livestock 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 bee hives [2] among livestock, cattle play a significant role in the socio-economic aspects of the life of the people of Ethiopia by contributing considerable portion to the economy of the country, and still promising to rally round the economic development of the country [2]. 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 [3].

In Ethiopia, livestock production remains crucial and represents a major asset among resource –poor small holder farmers by providing milk, meat, skin, manure and traction force [4]. Poor health and productivity of animal due to disease has considerably become the major stumbling block to the potential of livestock industry. Now a day's parasitism represents a major obstacle to development and utilization of animal resource. In Ethiopia ectoparasites in ruminant causes serious economic losses to small holder farmers, the

tanning industry and country at large through mortality of animals, decreased production, down grading and rejection on skin and hide. From the ectoparasites, ticks are ranked as the most economically important of livestock in tropics including sub-Saharan Africa. Ticks are small, wingless ectoparasitic arachinid arthropods that are cosmopolitan and prevalent in warmer climates [5]

Ticks are interesting largely because of their considerable veterinary importance [6] and have attracted a great deal of scientific attention due to their role as vectors of numerous pathogens [7]. Ticks are also a global problem and considered as a major obstacle in the health and livestock productivity that cause considerable economic losses of animals belong to the phylum Arthropoda. They are obligate, blood feeding ectoparasite of vertebrates, particularly mammals and birds. Ticks belong to three families Ixodidae, Arasidea and Nuteliedae. From those hard ticks, also known as ixodidae contain almost all the species of ticks of veterinary importance [8].

Ticks present three main dangers to their hosts; the physical damages from the bite itself other systemic effects of the tick's saliva and transmission of infectious diseases. Attachment of those hard ticks to the host causes irritation of the skin, with subsequent ulceration. When ticks attach themselves to the host in the first stage of feeding, they cut the skin with their mouthparts and cause damage to tissues and capillaries. Host reaction, such as mast cell degranulation leading to histamine release and inflammatory cell infiltration, further contribute to tissue damage. This tissue damage tends to be quite painful and may result in secondary bacterial infections. Ticks feed on the host's blood, and heavy infestation can also cause anemia. Presence of large number of ticks can leads to a significant loss of weight and irritation such that the affected animals become anorexic which may lead reduction in production [9].

Those hard ticks are important vectors of disease like babesiosis, anaplasmosis and erlichiosis in cattle [10]. They are known to exacerbate nonspecific disease symptoms like anemia, toxicosis and paralysis Ixodid (hard ticks) act as vectors for various blood parasites like Babesia, Theileria and Anaplasma infecting domestic livestock and wild animals in the majority of the world causing diseases of veterinary and economic importance [11]. Ixodid ticks are one of the most common and harmful blood sucking ectoparasite of cattle worldwide. They are responsible for a wide range of livestock health problem in several countries of the world. They reduce cattle productivity, milk yield and skin and hide quality and increase susceptibility to other disease [12].

Although different ticks species are distributed in different part of Ethiopia, hard tick species like Ambyloma, Hyaloma and Boophilus ticks are available in and around Jimma town [13]. The principal feature that differentiates Ixodid ticks is thedorsal scutum, a hard plate that covers the entire dorsal surface of the male but only the anterior third of the dorsal surface of the female. The hard ticks have a chitinous covering or scutum which extends over the whole dorsal surface of the male, but small area behind the head in larva, nymph or female. The mouth parts carried on the capitulum are anterior and visible from the dorsal surface other distinguishing features are a series of grooves on the scutum and body in some species [13].

Several factors like species, age, sex, and breed are highly conducive for tick infestation. The objective of this study was to determine prevalence of tick infestation and to identify tick genera and species and associated risk factors in and around Jimma town.

Materials and Methods

Description of the study area

The study was undertaken in and around Jimma town. Oromia Regional state, south-western Ethiopia from November 2017 to May 2018.Jimma town is located at 355 km south-western of Addis- ababa , lies at latitude of 7º41'N and longitude about 36º50'E atmospheric elevation ranging from 880 to 3360 meters above sea level [14]. The area is characterized by a humid tropical climate of heavy annual rainfall that ranges from 1200-2000 mm per year. About 70%of the total annual rainfall is received during rainy season which lasts from the end of May to early September. The mean annual maximum temperature ranges from 25º C- 30ºC and 7ºC- 12º C [15]. The livestock population of the area were about 2016823 cattle, 942908 sheep, 288411 goats, 74574 horses, 49489 donkey, 28371 mules, 1139735, poultry and 418831 bee hives [16].

Study population

The study population consists of cattle which were brought from different areas (i.e in and around Jimma

town) to Jimma university open air veterinary clinic and cattle kept under individual households.

Study design

A cross sectional study design was employed

Sample size determination

The sample size was calculated by using the formula given by [17] Thrusfield. (2005), with 95% confidence interval 5% desired absolute precision and 50% expected prevalence, on identification, infestation and associated risk factors. So that the sample size in the this study was calculated using the following formula

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

When: N= required sample size; Pexp= expected prevalence; d= desired absolute precision

Study Methodology (age and body condition determination)

The host related factors like age and body condition was classified according to the recommendation given in previous studies [18, 19]. Thus the age of the cattle was grouped into young (< 3 year)

Tick collection and Identification

Adult ticks at main body sites of cattle were collected using forceps and by hand. The collected ticks were preserved in 70% Ethanol. Date of collections, place of collections, body sites of collection (under tail, neck, brisket, scrotum, udder, ear & leg) and breed of host was recorded. Identification of ticks was performed within 10 days of collection.

The identification of tick was conducted in the parasitology laboratory, in Jimma University. Identification of ticks was conducted as described in previous study [20](Urquharh *et al*., 1996) under stereomicroscope by putting the tick on petri-dish and using rotating wire loop and also using reference manual; part, ornamentation, coaxa, Spur, the presence of festoon, punctuation distribution, leg coloration, posterior median strip arrangement, genital aperture and base of capituli used for identification of tick genera and species

Data Analysis and Management

Before the analysis of the data it was filtered and coded in the Microsoft Excel spreadsheet …. SPSS version 20 was used for the analysis.

Results

Prevalence

Out of the 384 animals examined, ticks were found on 276 animals giving a prevalence of 71.9% (table 1). Prevalence of tick infestation among male animals was (191/262)72.92%, while it was in female (85/122)69.67% with no significant difference (x^2=0.429; p>0.05). Similarly there was no significant difference in tick infestation rate among age group (x^2=9.235; p>0.05). Cattle with poor BCS showed significantly higher prevalence (x^2 =16.545; p<0.05) than cattle with good BCS (Table)

Table 1 prevalence of tick

No of animal Examined	No of animal Infested	Prevalence (%)
384	**276**	**71.9 %**

Table 2 prevalence of tick infestation on bovine in relation to risk factors

Risk Factors	Category	No of animal examined	No of animal positive	Prevalence (%)	x^2	p-value
Sex	Female	122	85	69.67%	0.429	0.31
	Male	262	191	72.9%		
Breed	Local	365	270	73.9%	16.0563	0.12
	Cross 19	6	31.6%			
Age	young	118	75	63.56%	9.235	0.010
	Adult	136	96	70.59%		
	old	130	105	80.77%		
Body Condition	Poor	157	129	82.2%	15.545	0.03
	Medium	89	63	70.8%		
	Good	138	84	60.9%		
Total		384	276	71.9%		

Table 3 Prevalence of tick infestation on bovine in relation to place of tick collection

Pace of collection		No of animal examined	No of animal positive	Prevalence (%)	x^2	p-value
	Qocci	78	57	73.1%	*0.106*	0.999
	Ifabula	77	55	71.4%		
	marawa	76	54	71.1%		
	Qofe	77	55	71.4%		
	Bosa	76	55	72.4%		
	Addis					
Total		384	276	71.9%		

In this study different possible risk factors like age, sex breed and body condition scoring were also assessed and the result was as indicated in table 2.

Age: one of a possible risk factor for the occurrence ticks infestation, here of among the three age categories the highest tick's infestation prevalence was recorded in old age (80.77%) followed by adult age (70.59%) and lower on young age (63.56%) (Table 2). However, there is statistical ($p<0.05$) significant between infestation of tick and age group P=0.010).

Sex: comparison was made on the prevalence of female and male. Out of the animals sampled, majority or 69.67% were female while about 72.9% of them were male. However, there was statistical ($p>0.5$) insignificance between the two sexes P=0.31).

Breed: As indicated in the (table 2) above, the study revealed that the prevalence of tick infestation in local breeds was recorded 73.9% and the prevalence of ticks infestation in cross breed were found to be 31.6% there was no significant different ($p>0.05$) in the prevalence of tick infestation among the two breeds of animals during out survey p=0.12).

Body condition score: were also considered during examination, animals were divided in to three body condition scores as shown in table above. These are, good, medium and poor. Out of 384 animals examined 157 animals were poor body condition state and out of these 129 (82.2%) animals were positive for tick infestation, there for, high prevalence of tick infestation was recorded in poor body condition followed by 89 animal were in medium body condition and out of these 63(70.8%) animal were positive for tick infestation, and the rest 138 animal were in good body condition, out of these 89(60.90%) animal were positive for tick infestation. These result shows that body condition scoring have significance ($p<0.05$) relation with tick infestation, P=0.03).

Place of collection: the inconsistence among these studies could be attributed to wide range of factors including agro ecological, animal health practice, or management difference with in their respect study area. In this particular study, there is no significant difference ($p>0.05$) of tick infestation within five kebeles, in table 3. This is probably due to similarities in agro-ecological setting and animal health practice in these study sites.

Table 4 Distribution of hard tick genera in my study area

Genus	Prevalence of total tick genera
Ambyloma	72.95%(1071/1468)
Boophilus	24.08%(360/1468)
Rihipicephalus	2.53%(37/1468)

Prevalence and distribution of ixodid Ticks in study area

A total of 1468 adult ixodidae ticks were collection from half body region of 384 cattle that were sampled and found to be positive for tick infestation. In general, three Ixodidae tick genera and six species were identified from the study area. From identified generas; *Ambyloma* (72.95%) was the most abundant and widely distributed genus followed by genus *Boophilus*(24.08%) and *Rihipicepulus*(2.53 %) was found to be the least abundant.

Table 5 Distribution of hard tick species on cattle

Tick species	No of animals infested	Prevalence (%)
A.coherence	195	70.65%
A.varigatium	144	52.17%
A.gemma	112	40.58%
A.lepidium	99	35.87%
B.decolaratus	113	40.94%
R.eversieversi	61	22.10%

Table 6 Genera of ticks and their distribution on body region of cattle in Jimma Town.

Body region	Amblyomma +ve (counted)	Rhipicephalus (Boophilus) +ve (counted)	Rhipicephalus us +ve (counted)	Total +ve (counted)
Dewlap	64(350)	15(113)	-	79(463)
Udder	58(294)	10(77)	3(4)	71(375)
Scrotum	50(316)	-	2(3)	52(319)
Anal region, under, tail	-	12(87)	6(12)	18(99)
Sternum	37(111)	12(83)	2(3)	51(197)
Ear	-	-	5(15)	5(15)
Total	**209(1071)**	**49(360)**	**18(37)**	**276(1468)**

Total positive animal

Total positive animal is 276. From three genera and six species identified in the study area and rate A.coherence 70.65%, A.varigatum (52.17%), B.decolaratus 40.94%, A.gemma 40.58%. A.lepidium 35.87 and R.evertsi were preventing on the animals of current study.

Table 7 Prevalence and total number of identified ixodid tick species on cattle

Tick species	No of identified	Prevalence (%)
A.coherence	617	42.27% (617/1468)
A.varigatium	319	21.73% (319/1468)
A.gemma	72	4.90% (72/1468)
A.lepidium	63	4.25% (63/1468)
B.decolaratus	360	24.52% (369/1468)
R.eversieversi	37	2.52% (37/1468)

Discussion

In the present study, overall prevalence of tick infestation observed in the cattle was 71.9%. The current result was in agreement with [21] Jelalu and Tesfaye, 2017, 72.13% prevalence and infestation load of ixodid ticks of cattle in Dassenech District, Southern Ethiopia. High tick infestation in the area could be attributed to the environment factors such as humidity that are conducive for the survival and growth of development stages and reproduction of ticks.

The current finding is in agreement with study by [22] Tamiru (2008) in Asela. Several other reports revealed higher tick infestation prevalence of cattle in different geographic area of the country such as [23] Meaza et al. (2014) (74%) in Bahir Dar; [24]Pawlos and Derese (2013) (61.98%) and [25]Ammanuel and Abdu (2014) (65.5%) in WolaitaSoddo, Sothern Ethiopia. Lower prevalence was reported by [26] (morel, P,. 1980), 27.3% at Bench Maji zone and 25.6% at Holeta central Ethiopia [18] by (Nicholson and Butterworth, 1986) However, higher prevalence was reported by [27] (Okello-Onen et al,. 1991,), 89.4 in western Amhara. This variation could be due to the difference in the agro climatic condition of the study areas. Tick activity influenced by rainfall, temperature, altitude and atmospheric relative humidity and management system include the use of accaricide and other preventive measures.

Amblyomma cohereance is the first abundant tick species in this study, has also been reported as prevalent in many other parts of the country such as rift valley by [28, 29] and in Dire Dawa [30]. The result of this study disagrees with finding of [31] Alekaw 1998 at Metekel Ranch, Ethiopia showing prevalence of 5.7%. This may be due to the different in geographical location and altitude factor.

Amblomma variegatum was the second abundant tick species. Its distributions is similar to that of Boophilus decoloratus [28] and more wide spread throughout the Western Zone but less abundant than Amblyomma cohaerens [32]. It was also the most widely distributed cattle tick in ethiopia, as reported by the survey in north Omo [33] (tesfanesh, 1993) and Bahir Dar [34](mesele, 1989) with prevalence of 59% and 75.91, respectively. A. variegatum has a great economic importance, because it is an efficient vector of Cowdria ruminatantum. *Amblyomma* infestation often leads to ulcer formation because the tick has long mouth part which can inflict a deep painful bite [35]. A. gemma, A. lepidium and R. eversti evetsi was other fourth, fivth and sixth one respectively.

The study also showed that the infestation level of ticks were higher in poor body condition than good body condition animals ($p<0.05$). This may be due to the high infestation of tick result in weight loss due to consumption of high amount of blood and fluid by those ticks. This present study also agrees with previous reports at Mizan Teferi [36] (seid, 2004). The effect of age on the burden of tick was statistically significance ($p<0.05$) that will agreed with [37, 38] (Hussen 2009) and Seyuom (2001). This may be due to location and claving stress among other possible predisposing factor such as adult animals serve as draft animal's burden was significantly associated with age of the animals. ($P=0.01$) in that old animals were the highest tick loads than adult animals had significantly higher tick loads than young animals. This is probably associated with decreases in immunity as the animals get older. In this study the prevalence of tick infestation between different Kebeles were 73.1 %, 72.455, 71.4% and 71.1% in Qocci, Ifabula, Marawa, Qofe and Bosa Adis Kebeles respectively and the difference was not significant ($P>0.05$). This is could be due to the same Agro-ecological conditions

Conclusion and Recommendations

The important and abundant tick species investigated in the study area were R.(B) decolaratus R.evertsi, A.varigatum A.coherence and A.lepidium. The study indicated that there was high burded of ticks in the study area. However, the attention given to controlling the infestation had not been sufficient. Generally, the distribution of ticks are not fixed but are determined by a complex interaction of factors such as climate, host density, host susceptibility, grazing habits and pasture- here in management. Therefore, effective tick control program should be formulated and implemented based on the distribution pattern of ticks factors and responsible for their distribution.

Based on above conclusion the following recommendation are forwarded

- Application of acaroid to prevent and control ticks infestation should be implemented in regular manner.
- Appropriate pasture management in communal gazing area in important
- Further studies on factor affecting tick burden and tick control strategies as well as on tick born diseases are recommended.
- The current attempt by the distribution of improved cattle breeds to farmers should take in to consideration the widespread existence of tick in the area, and the susceptibility of exotic or crossbred animal to tick and tick born diseases.

Acknowledgments

First, let me praise and honor the GOD for the opportunity and capacity given to me to realize my aspiration. My special and sincere gratitude goes to my Advisor, Professor Tadele Tolosa, for his encouragement, support and continual guidance and understanding throughout my works. I also acknowledge heart fully my parents and friends for their encouragement, advice and moral appreciation.

At the end, I would like to acknowledge Jimma University College of Agriculture and Veterinary Medicine, for facility support and internet access.

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Subject: Veterinary Sciences

Quick Response Code

DOI:10.22192/ijarbs.2021.08.08.006

How to cite this article:
Begidu Tesfaye and Abriham Abera. (2021). Infestation, Identification and Associated Risk Factors of Bovine Hard Ticks in and around Jimma Town, Ethiopia. Int. J. Adv. Res. Biol. Sci. 8(8): 48-56.
DOI: http://dx.doi.org/10.22192/ijarbs.2021.08.08.006