Prevalence of Ixodidae Ticks and its Associated Risk Factors in Local Breed (Zebu) Cattle at Mao Komo Special District Benishangul Gumuz Regional States, Western Ethiopia

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Abstract: Ixodidae ticks are an ectoparasites of cattle that can cause huge economic loss in cattle. A cross-sectional study was conducted from December 2019 to November 2020 in Mao Komo special district of Benishangul Gumuz Regional State, Western Ethiopia The objectives of the study were to estimate the prevalence of hard tick infestation and to identify the tick species prevalent in the study areas. A total of 384 Local breed cattle were randomly selected from the district and examined for the presence of tick's infestation. Out of the total examined animals, 286(74.74%) were found to be infested by one or more tick species. Four genera of ticks: *Amblyomma, Boophilus (*recently *Rhipicephalus), Rhipicephalus and Hyalomma* were identified. *Amblyomma* was the most dominant tick genera 38.05% followed by Rhipicephalus 33.58%, Boophilus 24.93% and *Hyalomma* 3.48 % was the least recorded genera in the study of areas. According to present study, the tick had strong preference for dewlap (19.09%), udder, (18.35%) perineum (16.61%) scrotum, (13.02%) flank (12.71%) Genital 10.15%) and Ear part (10.05%) respectively. The prevalence of tick infestation was studied along with the risk factors like age, sex, body conditions of the animals. However, there was no significant association between these risk factors and tick infestation. Also, the association between tick infestation and body parts of animals were studied and significant association was found. Generally, the study indicated that high tick infestation of different genera on Local breed cattle was found in each Kebeles of the district and it necessitates control measures against those economically important genera of ticks.

Keywords: Benishangul Gumuz, Cattle, Ixodidae ticks, Prevalence, Western Ethiopia.

1. TNTRODUCTION

Ticks are ectoparasites of livestock, which are classified (together with mites) in the order Acari. All ticks are obligate ectoparasites of vertebrates. They have three pair's legs in larvae and four pairs of legs as nymphs and adults and the body is divided into the capitulum and theopisthosoma. There are at least 840 tick species in two major families, namely the *Ixodidae and Argasidae* [1].

Ticks are very significant and harmful blood sucking external parasites of mammals, birds and reptiles throughout of the world [2]. Ethiopia is believed to have the largest livestock population in Africa. This livestock sector has been contributing a considerable portion to the economy of the country and still promising to rally round the economic development of the country. In Ethiopia livestock production remains crucial and represents a major asset among resource-poor smallholder farmers by providing milk, meat, skin, manure and traction force [3]. Ticks have considerable impact on animals either by inflecting direct damage or by transmission of tick-borne pathogens. Tick and tick born disease affect 90% of the world's cattle population and are widely distributed throughout the world [4].

The country's environmental condition and vegetation are highly conducive for ticks and tick-borne disease perpetuation [3]. The presence of diseases caused by hemoparasitic is broadly related to the presence and distribution of their vectors. Ticks are more prevalent in the warmer climates, especially in tropical and sub-tropical areas [5]. Ticks are considered to be most important to the health of domestic animal in Ethiopia. Ticks comprise various type of genera, including *Amblyomma*, *Rhipicephalus*, *Haemaphysalis*, *Hyalomma* and *Rhipicephalus* (*Boophilus*). The genus *Amblyomma* and *Rhipicephalus* (*Boophilus*) are predominating in many parts of country [6].

Tick borne hemoparasitic diseases of ruminants' suchas *Anaplasmosis*, *Babesiosis* and *Theileriosis* remain more important in tropical countries. The effects of ticks estimated annual loss of US$ 500,000 from hide and skin downgrading and approximately 65.5% of

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major defects of hides in Eastern Ethiopia [7]. The country's environmental condition and vegetation are highly conducive (favorable) for ticks and tick-borne disease perpetuation. The life of ticks depends on the host animal which results in retardation to animal growth, loss of milk and meat production. Generally, ticks could be affecting the market price and decreasing the annual income of humans [8]. Tick distribution and their population in the country vary according to their adaptability to ecology, eco-climate, microhabitats, ambient temperature, rainfall and relative humidity which is critical factors affecting life cycle of ticks. The relative humidity on the other hand remains an important factor for survival of ticks by regulating the water balance and prevents dehydrations [9].

In Ethiopia, ticks and tick-borne diseases in cattle population cause serious economic loss to smallholder farmers, the tanning industry and the country as a whole through the mortality of infected animals, decreased production, down grading and rejection of hide [10]. Various studies have been conducted in different localities of Ethiopia. The prevalence of the previous studies has shown a range of 23-85%. However, limited information has been made in the present study areas. Therefore, the objectives of the present study were:

- To estimate the prevalence of hard tick infestation on cattle in the study areas,
- To determine the burden of tick infestation in local breeds of cattle
- To identify the genera of dominate ticks found in the study areas

2. MATERIALS AND METHODS

2.1. Study Area

The study was conducted in 5 kebeles (Fafa, Gure, Shoshor, Tongo and Mimi) of Mao-Komo special districts found in Benishangul Gumuz regional state Western Ethiopia. The district has 32 kebeles /locality covering an area of 2,100 km with human population of 63,227 [11]. The district is characterized by low land plane 81%, amid altitude 119% with altitude range of 567-1983 meter above sea level. Its annual average temperature is 33.5 /27-40 / and its rain fall 900-1400mm. The livelihood of the people in the district largely depends on mixed livestock and crop production having livestock population of 9,982 cattle 8,692 sheep, 1,677 goats, 2,352 equines 50,169 poultry and 55,812 beehives [12]. The district is bounded on the north by Assosa zone on the south by Gambella region on the west by Oromia region and on the east by Sudan country.

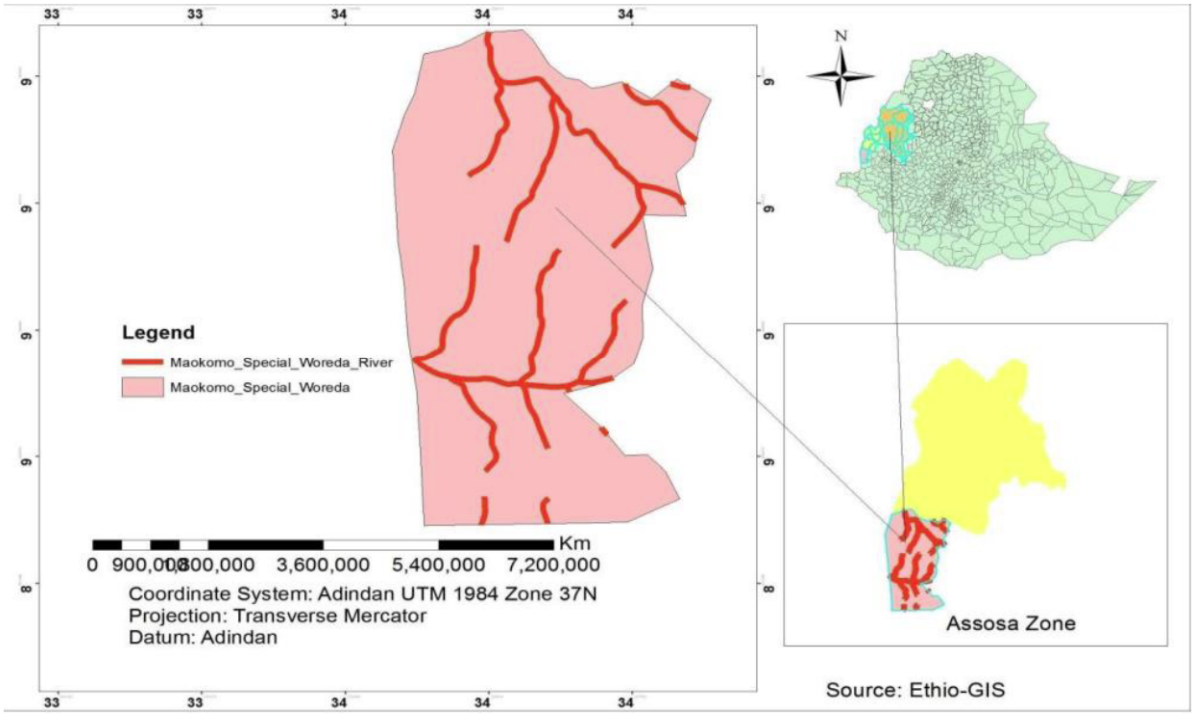

Figure 1: Map of study area (Zelalem *et al.,* 2019) [13].

2.2. Study Design

Cross- sectional study design was used to determine the Distribution or prevalence of tick species in the study area, predilection site variations and the tick burden within (between) age and body condition group (poor, medium and good) [14]. Cattle were categorized based on their age (<1yr, 1-3 yr. and >3yr) [15].

2.3. Study Population

The study population was cattle with different age, sex and body condition scores found in the districts of five selected Kebeles. The animals are managed with extensive management system and depend on grazing throughout the year for their feed sources with little supplementation of crop residues.

2.4. Sample Size Determination

The sample size was determined by assuming the expected prevalence of 50% tick infestation. The desired sample for the study was calculated by setting 95% confidence interval at 5% absolute precision [16].

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

n= is required sample size Pexp is expected prevalence

D= is desired absolute precision.

N=pexp--(in this case 50%), d= (in this case 5%) therefore $n=1.96^2*0.5\ (1\text{-}0.5) / (0.05)^2=384$ cattle.

The number of animals expected to estimate the prevalence of ticks were 384 cattle and samples were taken from 384 cattle.

2.5. Study Methodology

2.5.1. Tick Collection

Half body tick collections on alternative sides were made. The animals were properly casted and adult ticks were collected from 7 different sites of the body (*dewlap, head, udder/scrota, back, leg/hoof and tail*). Adult ticks were collected and coded then it was preserved with prefilled 68% ethanol in universal bottle separately according to their site. Required information were like date of collections, place of collection, body site of collection, species and breed of host were recorded, and then transported to Assosa regional Diagnostic and Research center laboratory and the half body tick counts were doubled to obtain whole body tick burden according to [17].

2.5.2. Tick Identification

Investigation procedure requires both field works and laboratory investigation of collected sample which seems the following. Adult ticks were collected from seven half body regions of cattle in to sample bottle containing 68% ethanol [18]. The half regions used for collections were dewlap, brisket and back, udder or scrotum, Ano genital, leg and tail [17]. Ticks were removed from the host skin whilst retaining their good condition for identification using good steel forceps. The collected ticks from each body regions were kept separately for identification in separate sample bottles. Then taken to laboratory to identify tick genera using stereo microscope based on tick identification keys of [19].

Ticks were usually identified by the size and length of the capitulum, the color of the body, site preference and location on the host. Male and unengored female ticks were easier to identity than engorged female ticks [20].

2.5.3. Questionnaire Survey

Questionnaire was prepared to collect data from respondents concerning to tick infestation problem on the cattle from their local area, 48 model farmers were selected randomly in both sex to give their responses on major actors that lead cattle to tick infestation problem.

2.6. Data Analysis

All raw data that was recorded from study area and was entered in to Microsoft excel database system and analyzed by using SPSS 20 version. Descriptive statistics were used both for questionnaire survey to show favorable predilection site of tick species computer program was used to determine the significant variation of tick burden among different age and body condition groups.

3. RESULTS

3.1. Knowledge Attitude and Practice (KAP) Questionnaire Result

A total of 48 households that had at least one cattle were involved in this study. The majority of the respondents were male (68.75 %) and the rest female

Table 1: General Overview of Farmer's Knowledge Regarding Hard Ticks

Parameters	Frequency	Proportion (%)
Gender of respondents	**48**	
Male	33	68.75
Female	15	31.25
Marital status	**57**	
Single	5	9.7
Married	39	68.5
Divorced	16	19.8
Educational back ground	**53**	
Secondary	3	5.69 %
College or university	7	13.28 %
No formal education	43	81.37 %
Total	**158**	

(31.25 %). The majority of respondents (68.5%) were married. The ages of respondents were ranges 20 to 55 years old. Regarding education status of the participants (81.37 %) of them had no formal education, secondary (5.69 %) while (13.28 %) of them college (university) level educated and the. Total number Out of a total 384 animals that 48 households had more than half of them were male cattle (75.9 %) and (72.6 %) were female. Similarly, (76.5%cattle population were young (1-3 years), (72.2%) adults (>3 years) (Table **1**).

Majority of peoples involved in the questionnaire survey were know about the diseases, its epidemiology, ways of transmission and acts treatments (Table **2**).

3.2. Results of Ticks Genera and Species

Overall prevalence is 74. 47%, out of total 384 cattle examined, 286 were found to be interested with different genus of ticks. As indicated in Table **3** below, as to genus level Amblyomma was found the highest prevalence (38.5%) whereas Rhipicephalus, Boophilus and Hyalomma were found 33.58%, 24.93 %, 3.48% respectively in this study area (Table **3**).

The present study revealed that the total prevalence of ticks according Kebeles the highest prevalence were recorded in Mimi kebeles (87.5%) followed by Tongo (83.1%), Gure, (75.3%) Shoshor (67.5%) and Fafa (61%) in all study sites. However, there was no significant association between Kebeles and prevalence of ticks (Table **4**).

Table 2: General Overview of Farmer's Knowledge Regarding Hard Ticks

N/S	Overview of cattle's Hard Ticks	Response category	
		Yes	No
1	Do you know what Hard Ticks means?	27 (56.25%)	21 (43.25%)
2	Which age group of Hard Ticks affect?	25 (52.3%)	23 (47.6%)
3	Do you know seasonal occurrence of the Hard Ticks?	33 (68.75%)	15 (31.25%)
4	What are the economic effects Hard Ticks?	39 (81.25%)	9 (18.75%)
5	Do you know what types of disease cause?	23 (47.96)	25 (52.03%)
6	Are there other diseases in your area other than Hard Ticks?	35(72.92%)	13 (27.03%)
7	Simply assume that there is cure for this tick?	32 (66.6%)	16 (33.3%)
8	What are the possible transmission of Hard Ticks	22 (45.83%)	26 (54.16%)
9	In which site of body area more stick with it?	35 (72.96%)	13 (27.083%)

Table 3: Distribution of Tick Genera of Cattle in Mao-Komo Special District

S/N	Tick Genus	Total prevalence Ticks
1	*Amblyomma*	38.05 %
2	*Rhipicephalus*	33.58 %
3	*Boophilus*	24.93 %
4	*Hyalomma*	3.48 %

Out of 384 cattle examined, 212 of them were males and 172 were females in which 161 (75.9%) and 125 (72%) of them were infested by ticks, respectively. Different age groups of animals were observed for tick's infestation. Highest numbers of young (200) were examined as compared with adult animals (184). Relatively highest prevalence was recorded in young animals (70.7%). Also tick infestation was observed in relation to body condition. The highest prevalence of tick infestation was recorded in animals with medium body condition (79.4%) and followed by poor body condition (78.7%). Good body condition animals were less affected by tick infestation (63.3%) according to the study (Table **5**).

In relation to the attachment sites of ticks on the host body, different tick genera were found to be having different predilection sites in this study. According to present study, the tick had strong preference for dewlap (19.09%), udder, (18.35%) perineum (16.61%) scrotum, (13.02%) flank (12.71%) Genital 10.15%) and Ear part (10.05%) respectively. There was significant association between prevalence of tick and attachment site (Table **6**).

4. DISCUSSIONS

This study shows that out of 384 cattle examined, 286 were harboring at list by one species of ticks. The overall prevalence of ticks in the area was 74.74%. This finding is in agreement with the reports of 74 % [14]. Prevalence of ixodidae ticks on cattle in Northwest Ethiopia. However, the prevalence of ticks in the current study is higher than the reports of Tadesse and Sultan (2014) and Abdissa (2012) [21, 22] who reported prevalence of tick with overall prevalence of 59.4 and 53.2%, respectively. In addition, various researchers work has proven to find less prevalence of tick infestation than the present study including the

Table 4: Total Prevalence of Bovine Ticks within 5 Kebeles in Mao and Komo Special District

N/S	Name of kebeles	No of examined	No. of infected	P value
1	Fafa	77	47(61%)	0.13
2	Gure	77	58(75.3%)	
3	Tongo	77	64(83.1%)	
4	Shoshor	77	52(67.5%)	
5	Mimi	76	65(87.5%)	
	Total	**384**	**286(74.47%)**	

Table 5: Tick Prevalence Based on Sex, Age and Body Conditions of Animals

Risk factors	Group of risk factors	Number of Examined	Number of positive	Prevalence	P value
Age	Young	200	153	76.5%	0.09
	Adult	184	133	72.2%	
	Total	**384**	**286**	**(74.47%)**	
Sex	Male	212	161	75.9 %	0.36
	Female	172	125	72.6 %	
	Total	**384**	**286**	**286(74.47%)**	
Body condition	Poor	155	122	78.7	0.17
	Medium	117	93	79.4	
	Good	112	71	63.3	
	Total	**384**	**286**	**286(74.47%)**	

Table 6: Tick Attachment Sites from Animal Body Part

Body Parts	Ticks Collected	Prevalence %	P value
Ear	98	10.05	0.041
Dewlap	186	19.09	
Flank	124	12.71	
Udder	179	18.35	
Perineum	162	16.61	
Scrotum	127	13.02	
Genitalia	99	10.15	
Total	**975**		

reports of Tikit and Addis (2011) and Onu and Shiferaw (2013) [23, 24] who indicated tick prevalence of 25.64 and 14.5%, respectively. This difference could be due to the difference in the agro-climatic condition of the study areas, since tick activity was influenced by rainfall, altitude and atmospheric relative humidity [25].

The tick genera identified in this study area were *Amblyomma and Boophipause Amblyomma* was the most abundant tick genus in the area accounts (38.05%) from 975 ticks collected during study period, and followed by Boophilus which account for 24.93% of total collected. This finding is in agreement with the reports of survey conducted at Bedele Ethiopia region Oromia [26]. This was found to be prevalence of 31.25% infestation. At genera level *Boophipause* is the most abundant tick species in this study area account 32% which is lower than the finding of 47.8% [27] who reported 47.93%. The distribution of *Boophipause* is generally annual rain fall about 800mm according to [25]. The second abundant tick genus in study area was *Amblyomma* with the prevalence of 22.3%. The prevalence of the study was disagreeing with other report conducted 4.7 % [24]. That reports low prevalence of this ticks which may be due to geographical location and weather condition [28].

5. CONCLUSION AND RECOMMENDATIONS

The present study indicated a high prevalence rate of cattle ixodidae ticks with four tick genera identified. Among the four genera *Amblyomma, Boophilus, Hyalomma and Rhipicephalus* was the most prevalent, followed by *Amblyomma*, *Rhipicephalus* and *Hyalomma*. Currently the ixodid tick infestation seems to be associated with different risk factors and result in severe constraint for agricultural activities in the study areas. Almost all, the parasite affects each cattle owner in the area having socioeconomic impacts in the area. Therefore, bearing in mind the above conclusion the following recommendations were forwarded:

- Integrated control and prevention method should be implemented in order to combat the high prevalence of bovine ixodid ticks from and around the study area.
- Awareness creation should be given for the stakeholders regarding socioeconomic effects due to ixodide ticks.
- The district veterinary serves or government and nongovernmental institute should give attention for other control options besides application of acaricides.
- In general, the distribution limits of tick are not fixed but are determined by a complex of factors such as climate, host susceptibility and grazing habits. So further studies on the distribution pattern of tick species and their epidemiology are necessary for the continuous understanding of improved control strategies application there by bringing the tick number on livestock to numbers that age more manageable.

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AVAILABILITY OF DATA AND MATERIALS

All reviewed data and Questionnaire used during the study were summarized and included in this article.

CONFLICT OF INTEREST

The authors read and agreed on there is no conflict of idea on publishing this manuscript.

ACRONYMS AND ABBREVIATIONS

A = Amblyomma

B = Decoloratus

BERO = Bedele Ethiopia region Oromia

CSA = Central Statistical Authority

IRB = Institutional Review Board

MOA = Ministry of Agricultures

SNNN = South Nation Nationalities of North

Spps = Species

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