

Survey on Ixodid Ticks on Cattle at Chagni Cattle and Forage Multiplication and Distribution Center, North Western Ethiopia

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Abstract

A survey was conducted on ixodid ticks infesting cattle at Chagni cattle and Forage multiplication and distribution center formerly known as Metekele Ranch with the objective of identifying important tick species and to assess some possible risk factors for tick infestation on cattle. Ticks were collected from 384 cattle of different breeds, age, and sex. During the study period, 1884 adult ixodid ticks were collected, out of which, 602 were male and 1281 were female ticks. The ticks were collected from nine different body regions of cattle, including, head, dewlap, neck/briskets, foreleg, belly, rear leg, escutcheon, tail, and shoulder/back/side. The species of ticks identified were *Amblyomma variegatum* (41.03%), *Amblyomma lepidum* (0.11%), *Rhipicephalus evertsi evertsi* (39.38%), *Boophilus decoloratus* (16.93) and *Hyalomma marginatum rufipes* (2.55%). From all the 384 cattle, haematocrit value was determined and 179 animals were found with below the normal value for all cattle. All the blood samples from the study cattle were thoroughly checked for the presence of tick born haemoparasites using thin blood film and were found negative.

Keywords: Cattle • Tick • Ixodid • Species • Haematocrit • Chagni

Introduction

Ethiopia has an extremely diverse topography, a variety climatic features and agro ecological zones that are expedient to host a very large animal population [1]. Ethiopia is one of the countries with the largest number of livestock population in Africa [2]. The country has the estimated domestic animal number of 65.35 million cattle, 39.89 million sheep, 50.5 million goats, 7.7 million camels, 2.11 million horses, 0.38 million mules, 8.98 million donkeys and 48.96 million poultry. The livestock subsector has an enormous contribution to Ethiopia's national economy and livelihoods of many Ethiopians. The subsector contributes about 16.5% of the national Gross Domestic Product (GDP) and 35.6% of the agricultural Gross Domestic Product (GDP). Livestock mainly cattle in Ethiopia represent the pillar of the economy and plays vital roles in the socioeconomic aspects of the life of the people [3].

Despite the largest live livestock population in Ethiopia, the economic benefits remain marginal due to prevailing diseases, poor management and low genetic performance [4,5]. In Ethiopia, ticks occupy the first place among the external parasites through mortality

of animals, decreased production, downgrading and general rejection of skins and hides [6]. The impacts of ticks on animals were either by inflicting direct damage or by transmission of tick-borne pathogens. They are responsible for severe economic losses both through the direct effects associated with their blood sucking behavior and also indirectly act as reservoirs and vectors for a wide range of human and animal pathogens [7].

Ticks and tick-borne diseases affect 90% of the world's cattle population and are widely distributed throughout the world. The country's environmental condition and vegetation are highly conducive for ticks and tick-borne disease perpetuation. The presence of diseases caused by haemoparasites 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 [8]. Previous study conducted in different part of Ethiopia revealed that there are five genera and forty-seven species of Ixodid ticks found on livestock [9-11].

Tick borne haemopathogen have a serious economic impact on livestock sector due to decreased productivity, lowered working efficiency, increased cost for control measures and limiting introduction

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Received: 16 August, 2024, Manuscript No. JVST-24-145560; **Editor assigned:** 21 August, 2024, PreQC No. JVST-24-145560 (PQ); **Reviewed:** 04 September, 2024, QC No. JVST-24-145560; **Revised:** 12 April, 2025, Manuscript No. JVST-24-145560 (R); **Published:** 19 April, 2025, DOI: 10.37421/2157-7579.2025.16.290

of genetically improved cattle in the area and death of livestock [12,13]. In Ethiopia, anaplasmosis, babesiosis, cowdriosis and theileriosis have been reported as major tick borne diseases affecting domestic animals [14]. Among tick-borne pathogens of zoonotic importance spotted fever, *Borrelia* spp., *Coxiella burnetii* and *Bartonella* spp. have been documented from Ethiopia [15].

The most commonly used classification systems are the traditional and the agro ecological zones. According to the traditional classification system, which mainly relies on altitude and temperature, Ethiopia has five climatic zones such as 'Wurch' (upper highland), 'Dega' (highland), 'Weynadega' (midland), 'kola' (lowland) and 'Berha' (Desert) [16]. The seasonal variations within a bioclimatic zone may favor or hinder the development or activity of a tick species during certain periods [17]. Dry environmental conditions are a serious danger to ticks, particularly to the questing larvae, which are very susceptible to drying out fatally [18]. Also, the start and end of the rainy season may influence the different phases of the life cycle [19]. Other species are more restricted to a specific habitat where their specific hosts are present and where climatic conditions allow survival and reproduction [20].

Although quite a lot of similar studies on Ixodid tick infestation and tick borne haemopathogen in cattle have been conducted in different areas of Ethiopia, it is worth noting that Ethiopia is a large country with a huge number of livestock populations, mostly cattle, and therefore most of the studies are targeting only specific areas, and not the whole country. Furthermore, there was no known research conducted in the past and no any published information regarding Ixodid tick infestation and tick borne haemopathogen in cattle in the study area. Tick and tick borne diseases are among the major constraints in the center. Apart from the direct damage, tick borne diseases such as cowdriosis and babesiosis are frequently encountered in the area. There is lack of information on tick and tick borne disease in the center. Thus, the currently study was designed to achieve the following objectives:

- Determine prevalence of tick infestation on cattle in the center.
- Identify the species of ixodid ticks on cattle in the center.
- Assess some risk factors that may be associated to tick infestation on cattle of the study area.

Materials and Methods

Study area

The study was conducted in Chagni cattle and Forage multiplication and distribution center in Guangua Woreda and is found some 3 kilometers away from Chagni town on the main road to Benishangule Gumuz region. Guangua is one of the 105 woredas in the Amhara region of Ethiopia. Part of the Awi zone, Guangua is bordered on the south by the Abbay river, which separates it from the Oromia region, on the West by Benishangul-Gumuz region, on the North by Dangela, on the North West by FagetaLekoma and on the East Ankesha. The administrative center of this Woreda is Chageni; other towns in Guangua include Kilaj and Menta Wuha. Geographically, the center is located at 11.55° N latitude and 36.26° E longitude. The center has area of 3,367 hectare where 90% of its area is bordering with Dura and Ardi rivers. The altitude ranges from 1500-1680 meter above sea level and the annual rainfall and annual temperature are 1,691 mm and 22.13°C-23.2°C, respectively. The soil type is red, brown and black. The vegetations found in the center in their local names agam, bazi, bisana, bizre, chibhas, dezn, doqma, girar, korxh, senquata, limbich, senedel, atata, zana, zigeba and others. Wild animals found in the area are ape, monkey, warthog, hyena, mantelope, pheasant and leopard. Currently, the center has 2333 cattle, out of which, 87% are Fogera breeds and 13% are Cross breeds.

Study animals

The study was conducted on pure fogera breeds and fogera x holistine record breed. Detailed on breed, number and sex of animal is presented in the Table 1.

Breed	Sex		Total
	Male	Female	
Fogera	83	186	269
Fogera x Holistine	33	82	115
Total	116	268	384

Table 1. Number and breed of sampled cattle in Chagni cattle and Forage multiplication and distribution center.

Study design and sampling procedure

A cross sectional study was conducted from December 2017 to May 2018 to determine epidemiology of Ixodid tick infestation and tick borne haemoparasites at Chagni cattle and Forage multiplication and distribution center. The survey was carried out at two randomly selected stations of the center.

Sample size determination

The sample size required for this study was determined according to Thrusfield. Since there is no documented information about on Ixodid tick infestation and tick borne haemoparasites on cattle in study area, assuming a 50% of expected prevalence, at 95% of confidence interval and 5% of required absolute precision was used. Thus, a total of 384 cattle were used for this study.

Tick sample collection

Following the recommendations of Okello-Onen et al. nine predilection sites were carefully examined by restraining animals in a crash. The examined sites are: Ear, head, dewlap/neck/brisket, foreleg, belly, rear leg, escutcheon, tail and shoulder/back/side. A total of 1884 adult ixodid ticks were collected manually and with the help of thumb forceps without causing damage to the mouth part. The ticks were placed in 70% alcohol in a universal bottle. Identification number of the individual animals was written with a pencil on an abrotape wrapped around the universal bottle.

Blood sample collection

To determine the haematocrit value of each animal, blood samples were taken from the dorsal aspect of the ear vein by pricking the vein with a lancet and by taking blood with a heparinized haematocrit tube. Crystal seal was used for sealing the tube after three-fourth of its volume was filled with blood and the tubes kept in a capillary tube rack.

Thin blood film was prepared simultaneously to screen the animals for some possible tick-borne haemoparasites. This was done by using polished slides and making a thin smear by spreading the blood at an angle of 45°. The sample was then dried and an identification mark was written at the thick part of the film by using a pencil, and it was placed on a slide rack.

Parasitological examination

The tick sample which was preserved in 70% alcohol was in a wooden box and during processing the tick samples in each universal bottle was put in a petri dish. Unwanted foreign materials such as hair, dry skin and other dirt were removed. Ticks were then spread on filter paper to absorb excess preservative fluid. Ticks with dirty scutum were rubbed on filter paper to make them clean and easy for identification.

Identification of the collected tick samples was made using a stereomicroscope. Forceps were used to manipulate ticks and tilt them towards the light source or put them on one side to clearly see the key diagnostic features. Identification to determine the genus and species levels was made using the information and drawing of the different genera of ticks presented.

The first step in identifying at genus level. This was done by thoroughly examining the body parts which are key diagnostic features, like palp, hypostome, basis capituli, scutum, eye, legs, conscutum, alloscutum, festoons, genital aperture, spiracle, anal groove, coxa I, ventral plates, pulvillus and claws as described. Examination of these structures under a stereomicroscope was used to group ticks into one of the following genera: *Amblyomma*, *Rhipicephalus*, *Hyalomma* or *Boophilus*. The key diagnostic features observed for genus level identification are described below.

Blood sample analysis

The blood samples collected from the ear vein with heparinized capillary tubes were analyzed immediately at the site. Then the haematocrit value of each tube was determined by using a haematocrit reader. This was done by placing the tube on the groove of the reader, adjusting the lower tip of the blood on the lower line, the upper tip of plasma on the upper line and then by measuring the packed red blood cells).

All stained blood smears were examined under a compound microscope at oil immersion objective for the presence of tick-borne diseases like babesia, anaplasma and theileria as described.

Data management and analysis

All data collected from laboratory examination were organized and fed into Microsoft Excel spreadsheets and coded appropriately and analyzed using STATA version 14.0 statistical software. The data were summarized by descriptive statistics and displayed by tables. Chi-square test was used to quantify the association among the factors with the presence of tick infestation. Effects were reported as statistically significant in all cases if the value is less than 5% at 95% confidence interval.

Results

Tick species

During the study period a total of 1,884 adult ixodid ticks were collected from 384 cattle. Examination of the ticks showed that 773 (41.03%) were identified as *Amblyomma variegatum*, *Amblyomma lepidum* 2 (0.11%), *Rhipicephalus eversti eversti* 742 (39.38%), *Boophilus decoloratus* 319 (16.93%) and 48 (2.55%) ticks were *Hyalomma marginatum rufipes* (Table 2).

Tick species	Number of ticks	Infestation (%)
<i>Amblyomma variegatum</i>	773	41.03
<i>Amblyomma lepidum</i>	2	0.11
<i>Rhipicephalus eversti eversti</i>	742	39.38
<i>Boophilus decoloratus</i>	319	16.93
<i>Hyalomma marginatum rufipes</i>	48	2.55
Total	1884	100

Table 2. Proportion and species of ticks on cattle at Chagni cattle and Fogera multiplication and distribution center.

Cattle with age of 6 months to 4 years of age were significantly ($P < 0.05$) more infested than both cattle of young age up to 6 months and those above 4 years of age (Table 3).

Breed	Percentage of animals infested		
	Up to 6 months	6months to 4 years	>4 years
Fogera	1.50%	23.18%	13.28%
Fogera x Holistine	2.60%	38.02%*	21.35%*

Note: * $P < 0.005$

Table 3. Prevalence of tick infestation across breeds of cattle at Chagni cattle and Forage multiplication and distribution center.

Dewlap/neck/brisket and escutcheon were having high tick infestation during the study period with relative percentage of 35.28% and 39.13% respectively (Table 4).

Predications sites	Proportion of ticks (%)
Ear	1.70%
Head	2.42%
Dewlap/neck/brisket	35.28%
Foreleg	1.94%
Belly	10.80%
Rear leg	1.82%
Escutcheon	39.13%
Tail	6.61%
Shoulder/back/side	6.30%

Note: * $P < 0.05$

Table 4. Proportion of predilection sites of ticks on cattle at Chagni cattle and Forage multiplication and distribution center.

Haematocrite determination

Out of the blood samples taken for haematocrite determination from cattle, 179 were record as those with below normal value, in contrasts to normal value of haematocrite for cattle 26–42%.

Thin blood smear sample

Even though about half of the sampled cattle haematocrite value is below normal, all the thin smears examined were found to be negative for haemoparasites.

Discussion

The tick survey done on cattle at Chagni cattle and forage multiplication and distribution center identified five species of four genera of ticks, namely: *Amblyomma varigatum*, *Amblyomma lepidum*, *Rhipicephalus evertsi evertsi*, *Boophilus decoloratus*, and *Hyalomma marginatum rufipes*. The finding on the genera spectrum and species of ticks corresponds with the findings. The diversity of the tick species found on cattle is not very high and it is in line with previous studies.

The number of ticks recorded per animal during the study period is low. This is due to the fact that the study was conducted during the dry season of the year, during which time tick infestation is generally low. This is in agreement with the findings.

In the study, determination of tick infestation on cattle of different age groups and breeds showed that adult cattle and calves up to 6 months of age were with less burden of tick infestation. Cross breeds (Fogera x Holistine) were found to more susceptible to tick infestation than pure Fogera breeds.

Results of the present survey showed the presence of tick species such as *Amblyomma avarigatum*, *Amblyomma lepidum*, *Rhipicephalus evertsi evertsi*, *Boophilus decoloratus* and *Hyalomma marginatum rufipes*. The findings of the current survey are in agreement with previous works. The diversity of the tick species found on cattle is not very high and it is in line with previous studies. The presence of these ticks is suggestive of great treat to cattle in the center. *Amblyomma varigatum* and *Rhipicephalus evertsi evertsi* were recorded as the most abundant ticks in the center. These ticks are known for transmitting deadly disease to animals. *Amblyomma varigatum* transmits the bacterium *Ehrlichia ruminantium*, which cause

heart water in cattle, sheep and goats. It also transmits the bacterium *Ehrlichia bovis*, causing bovine ehrlichiosis and the protozoan *Theileria mutans* and *Theileria velifera* causing bovine theileriosis. *Rhipicephalus evertsi evertsi* transmits the bacterium *Anaplasma marginale* in cattle, causing bovine anaplasmosis. The saliva of the female tick contains a toxin that to some extent causes paralysis to calves.

The third abundant tick is *Boophilus decoloratus*, which is known by its role as a vector of the protozoan *Babesia bigemina*, causing bovine babesiosis in cattle. This tick also transmits the *Anaplasma marginale*, the cause of bovine anaplasmosis and *Borrelia thileri*, the cause of spirochaetosis in cattle. Heavy infestation of this tick is likely to cause damage to hides and to reduce the rate of growth in cattle.

Hyalomma marginatum rufipes is also important in transmitting *Anaplasma marginale* to cattle, causing bovine anaplasmosis. The feeding of adults on cattle causing large lesions at the attachment sites, leading to the formation of severe abscess. This observation is in line with the work. The least abundant of all ticks found was *Ambylomma lepidium*. This tick can transmit the bacterium *Ehrlichia ruminantium*, which causes heart water in cattle, sheep and goat and the protozoan. *Theileria mutans* and *Theileria velifera*, which causes benign bovine theileriosis.

Conclusion and Recommendation

The current study revealed that there was high prevalence of Ixodid tick infestation on cattle of the center. In this study, a total of four genera and five tick species were identified. The study revealed that cattle of the site were infested by three common and dominant species, whereas the rest two species are minor in the area. Of them *Ambylomma variegatum*, *Rhipicephalus evertsi evertsi* and *Boophilus decoloratus* were the predominant species encountered. This implies that tick infestation is responsible for enormous economic losses in cattle, and is the major constraint to the health and productivity of cattle in the center. Hence, control options should be considering and focus on major tick species in the area.

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

- Appropriate tick control by effective acaricides is required.
- Rotation of groups of acaricides every year to delay or prevent emergence of resistance against acaricides.
- Regular screening of cattle for possible tick borne diseases.
- Studies on seasonal dynamics of the ticks for strategic tick control.

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How to cite this article: Admasu, Million and Shemsia Mohammed. "Survey on Ixodid Ticks on Cattle at Chagni Cattle and Forage Multiplication and Distribution Center, North Western Ethiopia." *J Vet Sci Techno* 16 (2025): 290.