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Prevalence of Bovine Hard Ticks in Chiro District, West Hararghe Zone, East Oromiya

[1]Zelalem Abera, [1]Asfaw Ejigu, [1]Alemayehu Fikadu, [1]Belay Daka, [1]Ala Dawe, [1]Admasu Mosisa, [2]Geremew Batu and [3]Moti Wakgari

[1]School of Veterinary Medicine, College of Medical and Health Sciences, Wollega University, P.O. Box 395, Nekemte, Ethiopia
[2]West Wollega Livestock and Fisheries Development and Resource office; Gimbi, West Wollega Zone, Oromiya, Ethiopia
[3]Bedelle Veterinary Regional Laboratory,Bedelle, Illubabor Zone, Oromiya, Ethiopia

Abstract: The aims of the study were to determine the prevalence of tick infestation and to identify the common genera of ticks infest bovine in the study area.The study was conducted from June 2015 to September 2015 in Chiro district of West Hararghe Zone by applying field and laboratory studies.Peasant Associations (PAs), sex, age, body conditions of animals and ticks genera were major factors involved in the study. A systematic random sampling study design was followed to collect samples. From the total of 384 cattle heads, 146 (38%) cattle were found to be infested by one or more tick genera. Different prevalence of tick infestations were recorded in five peasant associations with 32.3%, 42%, 32.8%, 35% and 40.4% in Galma Caffe, Baka Kubi, Baka Bilu, Kara Gudina and Baredina Sabaka, respectively. Prevalence of tick infestation was statistically significant in both Galma Caffe($P<0.05$, OR=1.42 and CI=1.74-2.81) and BakaBilu ($P<0.0.05$, OR=1.39 and CI=1.73-2.72) peasant associations. Relatively higher prevalence rate was observed in adult animals (39.4%) as compared to the young age groups (35.4%) and prevalence of tick infestation was statistically insignificant in adult age group ($P<0.05$, OR=1.19 and CI=1.77-1.84). The result of the study was indicated that tick infestation rate was slightly higher in female (41.9%) sex groups. However, there was no significant variation on the prevalence of tick infestations ($P>0.05$) among sex groups. Twotick genera were identified with different prevalence of tick's infestation in *Amblyomma*and *Rhipicephalus* with 75.5%, 71%and51.2%, respectively. *Amblyomma* was highly prevalent and statistically significant among tick genera identified in the study area ($P<0.05$, OR=6.56 and CI=3.16-13.62). However higher infestation of animals with poor body condition (39.4%) was observed, tick infestations among body conditions of the animals was not statistically significant ($P>0.05$). The most popular attachment site of ticks on animal body with different tick genera were dewlap (19.8%), ear (5.2%), tail (2.1%), scrotum (9.6%) and leg (1.3%). The study showed that ticks are important ectoparasites in the study area and induce huge economic losses which need attention in livestock productivity. Improving animal's husbandry and management to reduce the rate of infestation of these ticks is warranted.

Key words: Age · Amblyomma · Body Conditions · *Peasant associations* · *Rhipicephalus* · Sex

INTRODUCTION

Ethiopia has a huge number of livestock populations with an estimated 35 million Tropical Livestock Unit (TLU). This includes 44.3 million cattle, 49.9 million small ruminants (sheep and goats), 1 million camels, 45 million equines and more than 40 million chickens [1]. Livestock contributes 18.8 % of the total GDP and over 30% of the agricultural GDP of the country economy [2]. In Ethiopia, the majority of cattle are raised under extensive traditional system with communal grazing land based on natural selection. Cattle provides meat and milk, for food power and traction for agricultural purpose, a source of manure for fertilizer and fuel as well a major source of foreign trades [3].

Corresponding Author: Zelalem Abera, P.O. Box 395, Department of Clinical Studies, School of Veterinary Medicine, Wollega University, Nekemte, Ethiopia.

Cattle husbandry (industry) potential in Ethiopia is very high, however, is characterized by low productivity which is limited due to a numbers of production constraints, animal health constraints is one of the major problem that is specially overwhelming during outbreak of diseases and the prevalence and infestation of pest and vectors including ticks [3]. The presence of diversified environment and different agro-ecological zones, the country makes suitable for different livestock diseases including TBDs [4]. Ticks have considerable impact on animals either by inflicting direct damage or by transmitting a variety of TBDs [5]. Ticks and tick born diseases are widely distributed thought out the world and they are affecting more than 90% of cattle population particularly in tropical and sub-tropical countries, they present and important proportion of all animal disease affecting the livelihood of poor farmers [4].

Ticks are reported to surpass all other arthropods in the number and variety of disease they transmit to animal and human. Tick of economy importance to livestock belongs to family Ixodidae. Ticks are obligate, blood feeding, ecto-parasites of vertebrates, particularly mammals and bird. They belong to arachnids, in the sub-class acari and are closely related to the mites. They are usually large and long-lived compared to mites, are surviving for up to several years [6]. Economy losses caused by tick and TBDs, in cattle alone are estimated as US $13.9-18.7 billion annually worldwide [4]. The problem is severing in developing countries where the resource for control and eradication is very limited [7].

Information of tick genera available on the area, relative seasonal abundance of the general and the predilection site of these tick on the host are prerequisite in controlling tick and tick borne disease. Approximately 80% of the world`s cattle populations of 1281 million are at risk from ticks and TBD. In Africa, with 186 million of herd of cattle, tick and TBDs are the most constraints to increased production [8]. Ticks are effective disease vectors to transmitting infectious disease [9]. Major cattle ticks born disease in Ethiopia are an aplasmosis, babesiosis, theileriosis and Streptothricosis [10].

Besides to disease transmission tick inflict a huge economic loss. Production loss due to tick and tick born disease (TTBD) around a globe have been estimated at US$ 13.9 to US$ 18.7bilion a annual leaving worlds 80% cattle at risk [11, 12, 13] estimated an annual loss of US$ 500000 from hide and skin down gradi.ng from ticks and approximately 65.5% of major defects of hides in eastern Ethiopia are from ticks. Over 79 different species of tick are found in eastern Africa and of many of these appear to be of little or no economic importance [14].

In Ethiopia; ticks are common all agro ecological Zones [8]. There are 47 species of tick found on livestock [15]. The Genus *Amblyomma* and *Rhipicephalus* ticks are predominating in many parts of country. *Hyalomma* ticks also have a significant role [16]. *Amblyommacohaerence*is prevalent and abundant in western humid high land areas of Ethiopia. *Rhipicephalus*(*Boophilus*)*decolaratus* and *Rhipicephalus e. everts* are widely distributed in most altitudinal ranges [17]. Due to economic and veterinary importance of ticks; their control and transmission of ticks born disease remain a challenge for the cattle industry in the tropical and subtropical areas of the world and it is priority for many countries in tropical subtropical regions [18].

Tick and tick borne disease are the main constraints of animal's health, products and their market value in developing countries as well as in Chiro district of West Hararge Zone due to poor farm managements or extensive system. This prevalence of hard ticks leads to reduce animal production and productivity and their market in the study area from time to time. This problem also affects the overall economic endeavor of the country.

In order to improve animal products for the growing marketing in the country and abroad, indentifying and tackling the major constraints that hinder animal production and productivities are necessary.

In different assessments, beside others, bovine ticks affect milk production due to mastitis infection. However, the prevalence of hard ticks is not yet well studied which needs attention regarding the economic importance of these parasites in the study area. Therefore, the objectives of this study were to determine the prevalence of tick infestation and to identify the common genera of ticks infest bovine in the study area.

MATERIALS AND METHODS

Description of Study Area: The study was conducted from June 2015 to September 2015in Chiro district of West Hararghe zone,Oromia Region. It is located 326km far away from capital city of Ethiopia, Finfinne. The district has 40 rural peasant associations(PAs) and one urban administration. The weather climate of the woreda is characterized by four main seasons in a year. The dry season (Winter) which extends from January to the end of April and long rainy season (Summer) that extend from July to the end of November. The district has daily mean temperature ranging from 27.5-38.5°C andrain fall ranging from 900-1800mm. The agro ecological zone of the district can be categorized into, high land (Dega) which portion 8%, midland (Weynadega) 38% and lowland (kola) 54%.

Its altitude ranges between 2500m-3748m above sea level. The soil type of the district is consists of loam 42.5%, Black soil 32% and red soil 25.5% [19].

According to CDLFO [19] annual data, the livestock populations of the district are cattle 92656, goat 67962, sheep 37594, horse 403, mule 234, donkey 15404, camel 626 and poultry 105,253. The total land size of the district is 70,962.8, cultivated land 31,659.1, forest land 10,110.7, grazing land 482.0, bush and miscellaneous land 13,725.0, village 14,980.0 hectare. Out of the total land coverage non suitable for agriculture area is 19%. The district has the total population of 174,840 in which 89526 male and 85314 are female population.

Study Population: Study animals involved in this study were all indigenous zebu or local breed of cattle population of all age groups and kept in extensive management system inChiro district.

Study Design and Sample Collection: A systematic random sampling study design was followed in which sampling cattle was selected at 10 individual animalsintervals during vaccination campaign was conducted from June 2015 to September 2015. The district was purposively selected based on the accessibility, lack of information on tick's infestation, extensive management system. Animals included in the study were distributed over the purposively selected district. These animals to be sampled and five PAs from which the animals should be examined were randomly selected from a total PAs of the district in consultation with the respective district of Animal and Fish Development Office expert's based on location and accessibility.

Sampling Technique and Sample Size Determination

Tick Collection Techniques and Identification: Out of a total cattle population randomly selected five PAs which were 7,800, 384 individual animals were randomly selected to be considered as a sample cattle size of the study. The entire body surface of these systematically selected cattle's was examined thoroughly and adult ticks were collected manually with the help of thumb forceps perpendicularly without causing damage to the mouth part and other body regions.The collected adult ticks from different study sites were kept separately in to a universal sample bottle containing 70% alcohol for identification [20, 21]. The universal bottles were labeled according to cattle age, sex with the different attachment sites from where the tick/ticks were collected. Ticks sample in the universal bottle were gathered and then transported to Chiro District Clinic Laboratory to carry out the identification of genera by using stereo microscope. The identified tick types were registered and tabulated according to their genera.

Sample Size Determination: The sample size was decided based on formula described by [22] with 95% confidence interval at 5% desired absolute precision and by assuming the expected prevalence of 50%.

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

Where: n=required sample size, P_{exp} = expected prevalence and d = desired absolute precision. Accordingly, the estimated sample size was 384 animals.

Data Management and Analysis: Data collected from primary sources were entered in MS Excel work sheet and analyzed using SPSS version 20.0 software. A descriptive statistical analysis, such as tabulation, averages, percentage etc were applied in order to indicate the degree of prevalence of hard ticks in the study area. Odd ratio (OR) was also used to analyze and compare an associations of tick infestation in relation to sex, age, place of origins and body condition of the animals and a 95% confidence interval and 5% absolute precision was used to determine whether there was significance difference between measured parameters.

RESULTS

The study was conducted on bovine and from a total of 384 examined cattle, overall of 146 (38%) were found to be infested by different genera of ticks. The study comprised Peasant Associations (PAs), sex, age, body conditions of animals and ticks genera as a major factors those play a role for the occurrence of infestation by ticks in cattle.

Prevalence of Ticks Infestation Based on Pas, Sex, Age and Body Conditions of Animals: We have made an effort to observe prevalence of tick infestation in cattle of different peasant associations of the Berbere district. Different prevalence of tick infestations were recorded in five peasant associations with 32.3%, 42%, 32.8%, 35% and 40.4% in GalmaCaffe,BakaKubi,BakaBilu,Kara Gudina and BaredinaSabaka, respectively. A relatively high tick infestation was recorded in BakaKubi peasant association. The study revealed that, prevalence of tick

Table 1: Prevalence of Ticks Infestation Based on Peasant Associations

						95%CI	
Pas	No. of examined	No. of infested	Prevalence (%)	P-value	OR	Lower	Upper
Galmacaffe	65	21	32.3	0.032	1.423	1.74	2.81
Bakakubi	71	30	42	0.818	0.928	0.50	1.80
Bakabilu	73	24	32.8	0.032	1.387	1.73	2.72
Kara gudina	86	35	35	0.973	0.990	0.54	1.83
Baredinasabaka	89	36	40.4	-	-	-	-
Total	384	146					

Note: OR= Odd Ratio, CI= Confidence interval

Table 2: Prevalence of Ticks Infestation Based on Age, Sex, Ticks Genera and Body Condition

						95%CI	
Factors	No. of examined	No. of infested	Prevalence (%)	P-value	OR	Lower	Upper
Age							
Adult	254	100	39.4%	0.04	1.19	1.77	1.84
Young	130	46	35.4%				
Sex							
Male	217	76	35%	0.168	1.339	0.884	2.028
Female	167	70	41.9%	-	-	-	-
Ticks Genera							
None	225	0	75.5	-	-	-	-
Amblyomma	68	51	71.0	0.00	0.13	0.08	0.23
Rhipicephalus	91	56	51.2	0.015	1.88	1.94	3.748
Body condition							
Poor	213	84	39.4%	0.64	0.91	0.60	1.37
Good	171	62	36.3%	-	-	-	-
Total	384	146	38%				

Note: OR= Odd Ratio, CI= Confidence interval

infestation was statistically significant in both GalmaCaffe(P<0.05, OR=1.42 and CI=1.74-2.81) and BakaBilu (P<0.0.05, OR=1.39 and CI=1.73-2.72) peasant associations (Table 1).

In this study, age wise prevalence of tick infestation was seen in which relatively higher prevalence rate was observed in adult animals (39.4%) as compared to the young age groups (35.4%). As indicated in the following Table 2, prevalence of tick infestation was statistically insignificant in adult age group (P<0.05, OR=1.19 and CI=1.77-1.84).This is may be because of their higher movement than that of young animals.

Comparison was also made between sex and female animals (41.9%) were slightly more infested than male animals (35%). The result of the study was indicated that tick infestation rate was slightly higher in female sex groups. This susceptibility of female animals for tick infestation may be due to milk production and reproductive physiology this sex groups. However, there was no significant variation on the prevalence of tick infestations (P>0.05) among sex groups.

In this study, different tick species were collected from 384 cattle and only three tick genera were identified. These tick genera were collected with different prevalence of tick's infestation in *Amblyomma*and *Rhipicephalus* with 75.5%and51.2%, respectively. The study showed that *Amblyomma* was highly prevalent and statistically significant among tick genera identified in the study area (P<0.05, OR=6.56 and CI=3.16-13.62). That means *Amblyomma* has potential to infest cattle in the study area by more than six times as compared to the rest tick genera (Table 2).

Based on body condition of the animal, cattle were grouped into three poor and good, with prevalence of 39.4% and 36.3%, respectively. However higher infestation of animals with poor body condition was observed, tick infestations among body conditions of the animals was not statistically significant (P>0.05) (Table 2).

Also we have tried to observe the most popular attachment site of ticks on animal body. In this study the most infested regions of the animal body with different tick genera were Dewlap (19.8%), Ear (5.2%), Tail (2.1%),

Table 3: Tick genera identified from cattle in the study area and their predilection site

	Predilection site of Ticks						
Tick Genera	None (%)	Dewlap (%)	Ear (%)	Tail (%)	Scrotum (%)	Rear leg (%)	Total
None	238	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	238 (62)
Amblyomma	0 (0)	30 (39.5)	8 (40)	2 (25)	25 (67.6)	5 (100)	70 (18.2)
Rhipicephalus	0 (0)	46(60.5)	12 (60)	6 (75)	12 (32.4)	0 (0)	76(19.8)
Total	238 (62)	76 (19.8)	20 (5.2)	8 (62)	37(9.6)	5 (1.3)	384 (100)

Scrotum (9.6%) and Rear leg (1.3%). Reason to occupy these is due to short moth and behavior which makes them to feed on these specific soft areas (Table 3).

DISCUSSION

There are different parasitic diseases those affects the productivity of livestock and tick is one of the parasite that resulted in anemia and loss of productivity. The study was conducted atChiro district of West Hararghe Zone by applying field and laboratory studies.About 38% cattle were found to be infested by one or more tick genera. In this study, a major factors those play a role for the occurrence of infestation by ticks in cattle like Peasant Associations (PAs), sex, age, body conditions of animals and ticks genera were involved.

The prevalence of tick infestation in cattle of different peasant associations of the Berbere district was observed. Different prevalence of tick infestations were recorded in five peasant associations with 32.3%, 42%, 32.8%, 35% and 40.4% in Galma Caffe, Baka Kubi, Baka Bilu, Kara Gudina and Baredina Sabaka, respectively. A relatively high tick infestation was recorded in Baka Kubi peasant association.Prevalence of tick infestation during this study was statistically significant in both Galma Caffe ($P<0.05$, OR=1.42 and CI=1.74-2.81) and Baka Bilu ($P<0.0.05$, OR=1.39 and CI=1.73-2.72) peasant associations (Table 1). The high prevalence of BakaKubi might be due to having large common grazing area where they stay the whole day time.

Age wise analysis was made to observe prevalence of tick infestation in which relatively higher prevalence rate was observed in adult animals (39.4%) as compared to the young age groups (35.4%). As indicated in the following table 2, prevalence of tick infestation was statistically insignificant in adult age group ($P<0.05$, OR=1.19 and CI=1.77-1.84). This is may be because of their higher movement than that of young animals. This present study agrees with previous work reported by [23-25] in which predisposing factors such using adult animal as draft animals opens the door for the occurrence of burden of tick infestation.

The prevalence of tick infestation between sex and female animals were slightly more infested than male animals. Out of total female animals examined, 41.9% of them were infested while 35% of male animals were infested by ticks. This susceptibility of female animals for tick infestation may be due to milk production and reproductive physiology. However, there was no significant variation on the prevalence of tick infestations ($P>0.05$) among sex groups. The study agrees with previous research reported by [24, 25] in which female animals were highly infested by ticks due to lactation and calving stress.

However different tick species were collected from 384 cattle, only three tick genera were identified during this study. These tick genera were collected with different prevalence of tick's infestation in *Amblyomma* and *Rhipicephalus* with 75.5% and 51.2%, respectively. *Amblyomma* was the most abundant genus followed by *Rhipicephalus*. The study showed that *Amblyomma* was statistically significant among tick genera identified in the study area. That means *Amblyomma* has potential to infest cattle in the study area by more than six times as compared to *Rhipicephalus*. The genus was encountered during the study period, this may be due to environment condition which is favorable to their survival, humid and highland nature of the area it is confined to semi study which support the pervious finding [26, 27].

The result of this study is similar to previous studies reported by [8] and [28] in which *Amblyomma*genus was the most widely distributed cattle tick in Ethiopia and has a great economic importance being a vector of *Ehrlichiaruminatum* which causes ehrlichiosis. As reported by [29], this may be due to geographic location and humid climatic condition of south Western part of Ethiopia and its being relatively active throughout the year.

It has a potential to transmit *babesiaabegmina* and *anaplasmamarginale* to cattle and sever infestation can lead tick worry, anorexia and anemia. Abundance of *Amblyomma* and *Rhipicephalus* (formerly *Boophilus*) in that area is related to the presence of suitable vegetation cover. That is agreement with finding of [31].

These authors also noted that bush areas in pasture had high tick population. There are different genera of ticks (*Amblyomma* and *Rhipicephalus* (formerly *Boophilus*) were identified in Jimma district. This result also agreed with previous studies conducted [8, 26, 27,29].

This genus was more widely spread through the Western zone but less abundant than *Amblyomma* genus [27]. It was also widely distributed cattle tick genus in Ethiopia, as reported by the survey in North Omo[32] and has great economic importance, because it is an efficient vector of *Ehrlichiaruminatum*. This parasite also causes the greatest damage to hide and skin because of its long mouth parts which render the ulcers, if the ticks are in number. Furthermore, ulcers caused by this tick genus become favorable sites for secondary bacterial infection like *Dermatophiluscongolensis* [33] It has also been reported as prevalent in many other parts of the country such as rift valley in Dire Dawa [8, 31, 34].

The result of this study disagrees with finding of [35] at Metekel Ranch, Ethiopia showing lower prevalence of tick infestation (5.7%). This may be due to the different in geographical location and altitude factor. Its peak population occurs in May, June, July, September and October is moderate in south western part of Ethiopia [29].

In this study, *Rhipicephalus* was the third abundant tick genus which has lower prevalence rate of infestation as compared to other genera discussed above. This was due to seasonal occurrence of infestation and host diversity. The result agrees with the work reported in Bahir Dar [36, 37], Jimma [38] and Asela [39]. [8,2 8] were also mentioned high infestation of this tick genus in middle high land, dry savannas and steppes in association with seasons. Most *Rhipicephalus* species have usually three host tick, although some have two hosts. The brown ear tick is the most important *Rhipicephalus* tick in eastern and southern Africa where it occurs on variety of domestic and wild ruminant [40]. *Rhipicephalus* is the possible vector of *Babesia*, *Rickettsia* and *Thieleria* [41].

The most popular attachment site of ticks on animal body was observed. In this study the most infested regions of the animal body with different tick genera were Dewlap (19.8%), Ear (5.2%), Tail (2.1%), Scrotum (9.6%) and Rear leg (1.3%). Reason to occupy these is due to short moth and behavior which makes them to feed on these specific soft areas. Different researchers were reported variety of attachment sites like udder or scrotum (28.35%), Perineum (21.31%) ano-vulva (12.01%) and neck (9.19%) the predilection sites mentioned in the results contributed with those reported by other author [16, 36]. Information on predilection sites of the ticks is help full in spraying individual animals since it gives clue as to which part of the body requires more attention [42]. However, there was no significant variation on the prevalence of tick infestations ($P>0.05$) among attachment site of ticks on animal body.

The study also showed that the infestation level of ticks where higher in poor bogy condition than good body condition animals ($p<0.05$). This may be due to high infestation of ticks result in weight loss due to consumption of high amount of blood and fluid by those ticks. Although, this study was conducted for short periods of time (September to March), it is possible to indicate the trend of seasonality of tick population by comparing the number of tick collected every month. The trend was tendency of tick population to show seasonal variation that is decreasing slightly from wetter months to the drier month, similarly it has been reported by [16,30] and [35] that infestation by tick during the months reaches. It is difficult to control in general to make cattle less attractive or to develop breeds that are able to defend tick has less important. The best solution would be the proper pasture management and accaricide use strategy [38].

CONCLUSION

The present study was conducted to determine the prevalence of bovine hard ticks and the major genera in selected five Peasant Associations of Chiro District. The result of the study indicated that ticks were the most wide spreaded and prevalent parasite affecting the health and productivity of animals with an overall prevalence of 38%. In general, this causes economic losses in terms of damage to the skin by tick are very great and it may lead to weight loss of cattle, decrease in milk and meat production which needs great attention to control the Ectoparasites as it affects their health condition which in turn affects the productivity of cattle and reduce the grades and quality of skin. So, the present study demonstrated that bovine hard ticks being one of the most prevalent problems of most cattle breeders or farmers which need more attention. Based on above conclusion the following points are forwarded:

- Further investigation of the frequency, distribution and seasonality of tick and the disease they transmits should be conducted in order to undertake or design effective and cost effective measures.

- There should be awareness creation for the livestock owners regarding the impact of tick and other ectoparasite on the health and productivity of their animals through agricultural extension program.
- Improving animal's husbandry and management to reduce the rate of infestation of these ticks is essential.
- Frequently dipping or spraying infected animals in order to reduce their wide area spread.
- Rotational grazing should be advised or implemented and pasture decontamination on communal grazing area.
- Minimizing the frequent contact among different herds of unknown parasitic infestation level.

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REFERENCES

1. CSA, 2003. Central statistical authority, Ethiopian agricultural sample enumeration results for SNNPR·Statistic Al Report on Livestock and Farm Implements. IVPP29-34.
2. FAO, 2004. Resistance Management and Integrated Parasite Control in ruminants. FAO of the United Nations, pp: 11-81.
3. Minjaw, B. and A. McLeod, 2003. Tick born disease and poverty, Center for tropical Veterinary medicine, university of Edinburgh, UK., pp: 1-116.
4. De Castro, J., 1997. Sustainable tick and tick born disease control in livestock improvement in developing countries·Prentice Hall, New York.
5. Okello, J., S. Hassan and S. Usman, 1999. Taxonomy of African ticks and Ecology and host relationship of tick species infesting livestock, Bull Ent Rea., 71: 339-354.
6. Wall, R. and D. Sheerer, 1997. Veterinary Entomology: Arthropod Ectoparasite of Veterinary Importance. Chapman and Hall, London.
7. FAO, 1984. Tick and tick borne diseases control a practical field manual. Rome Italy, Vol 1.
8. Pegram, R.G., H.H.M. Hoogstral and H.V. Wassef, 1981. Ticks of Ethiopia distribution, ecology and host relation hips of tick species infesting livestock, Bull. Entomology Res., 71: 339-359.
9. Le Bars, 2009. Tick-borne disease management. Veterinary Times, 18th May.
10. Mekonnen, S., J.J. Decestro, S. Gebre, Hussein and A. Regessa, 1992. Tick and tick borne disease and their control in Western Ethiopia. Insect science applications, 13: 661-664.
11. De Castro, J., 1999. Sustainable tick and tick born disease control in livestock improvement in developing countries· Prentice Hall, New York.
12. De Wall, D., 2000. Anaplasmosis control and diagnosis in South. Ann. N.Y. Acad. Sci., 916: 474-483.
13. Ghosh, S., P. Azhahianambia and M.P. yadav, 2007. Upcoming and future strategies of tick contro.
14. Cumming, G., 1999. Host distribution does not limit the species ranges of most African Tick. Acari: lxodida Bull. Entomo. Res., 89: 303-327.
15. Bayu, K., 2005. Standard veterinary laboratory diagnostic manual, Vol 3, MoA Addis Ababa.
16. Solomon, G. and B. Kassa, 2001. Seasonal Variation of Ticks on Calves at Sebata in WESTERN Shoazone. Ethiopia. Vet., 7(1): 17-30.
17. Bekele, H., 1987. Study of the topographical distribution of ticks on economically important domestic animal in Illubabor. DVM thesis *Boophilus* ticks on cattle. Vet. Parasitological, pp: 315-326.
18. Lodos, J., O. boue and J. Fuente, 2000. Model to simulate the effect of vaccination against ticks.
19. CDLFO, 2015. Chiro District Livestock and Fishery Office.
20. OkelloOnen, J., S. Hassan and S. Usman, 1999. Taxonomy of African ticks and Ecology and host relationship of tick species infesting livestock·Bull Ent Rea, 71: 339-354.
21. Wallkere, J., J. Kelrans and I. Horak, 2000. The Genus *Rhipicephalus*, Cambridge. Cambridge University press.
22. Thrusfied, M., 2007. Veterinary Epidemiology 3rd edition, Back Wall Science ltd.
23. Seid, B., 2004. A survey of cattle tick species in and around MizanTeferi, bench maji zone and SNNPRS. DVM thesis, Addis Ababa Universty, Faculty of veterinary Medicine, Debrezeti, pp: 121.

24. Hussen, Y., 2009. Survey on prevalence of Bovine Tick spcies in and around Bako Town. DVM Thesis, School of Veterinary Medicine, Jimma University College of Agriculture and Veterinary Medicine, Jimma, Ethiopia.
25. Seyoum, Z., 2001. Distribution and host parasite relationship of Ixodids ticks in eastern Amhara, Ethiopia. Ethiopian Veterinary Jounal, 9(1): 57.
26. Yitbarek, G., 2004. Tick species infesting livestock in Jimma area, South West Ethiopia. DVM Thesis, Faculty of Veterinary Medicine, Addis Ababa Universty, Debrezeit, Ethiopia.
27. De Castro, J., 1994. Sustainable tick and tick born disease control in livestock improvement in developing countries· Prentice Hall, New York.
28. Morel, P.C., 1980. Study of Ethiopian ticks: (Acarina; Ixodidae), Ministry of foreign Affairs, France: IEMVT.
29. Abebaw, G., 1994. Seasonal dynamics of ticks (*Amblyomma* coherence and *Boophilusdecoloratus*) and development of a management plan for tick and tick borne diseases control on cattle in Jimma zone, Southwestern Ethiopia. Institute of Agronomy and Animal production in the Tropics. Georg-August-University, Gottingenl.
30. Feseha, G., 1983. Notes on tick species and tick borne disease on domestic animals Ethiopia, DVM Thesis, Faculty of veterinary medicine Debrezeit, Ethiopia.
31. Solomon, G. and G. Keeya, 1996. Studies on the development and survival of Rhipicephalus Pulchellus and Amblyommagemma under field condition. Ethiopian Veterinary Association, 5(1).
32. Tesfanesh, G., 1993. Tick and tick had borne disease of cattle in North Omo Administrative Zone, DVM thesis, faculty of veterinary medicine, Addis Ababa.
33. Mohammed, A. and J.J. de Castro, 1993. Host resistance to tick (Acari: Ixodidae) in different breeds of cattle at Bako, Ethiopia. Tropical Health production, 25: 215-222.
34. Manuerik and J. Tilahun, 1991. A survey of ectoparasites of cattle in Harer and Dire DawaDistricts, hareghe administrative region of Ethiopia. Bull. Anim.
35. Alekaw, S., 1998. Distribution of ticks and tick borne at Metekel Ranch. Ethiopian Veterinary Association.
36. Mesele, A., 1989. Bovine tick survey in Bahir Dar awarja. DVM thesis, Faculty of Veterinary Medicine, Addis Ababa University, Debrezeit Ethiopia.
37. Behailu, A., 2004. A survey of tick and tick bore blood protistia in cattle at AsselaArsi Zone DVM thesis, FVM, AAU, Debrezeti, Ethiopia.
38. Abebaw, G., 1996. Study on the epizootology of tick and tick borne disease of naturally infested Cattle in Jimma zone. M.Sc. Thesis, Unversity of Goitingen, Germany.
39. Tamiru, T., 2008. A survey of bovine tick species in and aoundAssela Town. DVM thesis, school of Veterinary Medicine, Jimma Universyt, Jimma, Ethiopia.
40. Walker, Kieranis and Horak, 2003. Ticks of Domestic Animals in Africa, A Guide to Identification Tick species, Bio Science Report, London.
41. Morel, P.C., 1989. Manual of tropical veterinary parasitology: Tick born diseases of livestock in Africa. CAB International, UK., pp: 229-460.
42. Zeleke, D., 1980. Major cattle tick and their distribution in Ethiopia. Veterinary. Bulletin, 5(2).