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Prevalence and associated risk factors of tick infestation on cattle in selected Woreda of Wolaita zone

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Keywords

Amblyomma,
Boophilus,
Rhipicephalus,
Humbo,
Soddo zuriya,
Ethiopia.

Abstract

A cross sectional study was conducted from October 2016 to April 2017 in Soddo zuriya and Humbo woreda of wolaita zone with the objectives of determining the prevalence of Ixodid ticks, identify the Ixodid ticks at genera level and their respective proportion. A total of 1133 adult Ixodid ticks were collected from the randomly selected 384 cattle. Results showed that the overall prevalence of tick infestation was found to be 56.3% (216/384). The most abundant species found in this study were Amblyomma (41.9%) followed by Boophilus (31.8%) and Rhipicephalus (26.3%). The prevalence significantly differed among the breed (65%) and body condition score (64.8%). Thus, cross cattle (P=0.014, OR=1.9) and animal with poor body condition score ((p =0.001, OR=2.7) had a higher chance of being infested by ticks than the local breed cattle (52.4%) and animal with good(43.3%)&medium(58.1%) body condition score, respectively. There is no statistically significant difference recorded between the occurrence of tick infestation and other risk factors including age, woreda, kebele and sex. In conclusion, this study avail important information on the occurrence of tick in the study area. It is strongly recommended that the need to implement community awareness together with the setting up of tick prevention and control strategies.

Introduction

Livestock plays an important role in providing export commodities, such as meat, live animals, hides and skins to earn foreign exchange to the country. In mixing crop livestock farming system at the highlands parts of the country, livestock mainly used for drought power, milk production and as source of manure (Kidane 2001, Solomon 2005). Even though the livestock sub sector contributes much to the national economy, its development is hampered by different constraints. The most important constraints to cattle productions are widespread endemic diseases including parasitic infestation, poor veterinary service and lack of attention from government (Solomon, 2005).

Ethiopia has the largest livestock population in Africa, but the contribution for the economic aspect of the country is still lowest amount and disease can be considered as a major constrain. Ticks are the most important ectoparasites of livestock in tropical and sub-tropical areas. Ticks are cosmopolitan in distribution, but occur principally in tropical and subtropical regions (Soulsby, 1982). Ethiopia being a tropical country provides optimal climatic conditions for growth and multiplication of ticks. Several tick species of the genera Ambylomma, Haemaphysalis, Boophilus, Hyalomma and Rhipicephalus have been identified in Ethiopian (Morel, 1980). In Ethiopia, ticks are responsible for severe economic losses both through the direct effects of blood sucking and

indirectly as vectors of pathogens and toxins. Ticks are blood sucking ectoparasites of mammals, birds and reptiles worldwide, with approximately 850 species been described (Bishop *et al*., 2008). The lifecycle of ticks (both Ixodids and Argasids) undergo four stages in their development; eggs, 6-legged larva, 8-legged nymph and adult (Minjauw and McLeod, 2003).

According to the numbers of hosts, Ixodids ticks are classified as one-host ticks, two-host ticks, three-host ticks and Argasids classified as multi-host ticks. In one-host ticks, all the parasitic stages (larva, nymph and adult) are on the same hosts; in two- host ticks, larva attach to one host, feed and moult to nymphal stage and engorged, after which they detach and moult on the ground to adult; and in three-host ticks, the larva, nymph and adult attach to different hosts and all detach from the host after engorging, and moult on the ground (Taylor *et a*l., 2007). Feeding by large numbers of ticks causes reduction in live weight gain and anaemia among domestic animals, while tick bites also reduce the quality of hides (Nejash, 2016).

However, the major losses caused by ticks are due to the ability to transmit protozoan, rickettsial and viral diseases of livestock, which are of great economic importance world-wide (Nejash, 2016). From health constraints livestock are highly affected by ectoparasites mainly ticks and tick borne disease which is a directly affect the socio-economic development of poor farmers in the area. Additionally the absence of well-established research regarding socio-economic and public health implication of tick and tick borne disease in the farm have a negative impact on food security, animal product and byproducts (William, 2001). The impact of ticks and tick borne diseases on the individual and national economics warrants application of appropriate tick control strategies on priority basis (Bansal, 2005).Ticks are mainly control by conventional acaricides. But these acaricides have undesirable effects on host organisms and the environment. Problems like environmental contamination, residues in food and feed, high costs, residual in milk and meat, development of acaricides resistance in tick stimulated research on new safe methods for tick control (Habeeb, 2010).And there are associated risk factors which facilitate the occurrences of tick infestation in cattle such as age, sex, nutritional factors and rearing system (S.A. Roney *et al.*, 2010). Therefore, the objectives of this study are:

- ❖ To determine the prevalence of tick infestation in selected districts soddozuriya and humboworeda in wolaita zone
- ❖ In order to identify type of ticks at genera level and their respective prevalence and
- ❖ To assess the strength association of potential risk factors with the occurrence of ticks.

Materials and Methods

Study area

Study was conducted from October, 2016 to April, 2017 in selected district of Soddo zuriya and Humbo woreda in Wolaita Zone Southern Ethiopia. Wolaita Zone has a total of 4471.3 Km2 Areas, and is located between 6.40– 7.20N and 37.40– 38.20E and 383kms far from Addis Ababa and 165kms far from Hawassa town. The Wolaita Soddo zuriya woreda located around Wolaita Soddo town lies between the altitude range of 2000-2500 meters above sea level and annual Average rainfall 1446 mm. The mean annual maximum and minimum Temperature are 26.6C0and 11.4C0, respectively. The predominant farming system is mixed Livestock and crop production system with livestock population of cattle (12,323), sheep (19,394), goat (17,261), mule (91), donkey (7,586) and poultry (64,489) (Wolaita Zone Finance and Economic Development Department, 2003).And the Humbo Woreda is located some 20 km south of the Wolayta Sodo town following the tarmac road that passes through the town to Arbaminch. The Woreda has a total area of about 866 Km^2 and is composed 42 rural Kebeles. 70% Kola (lowland <1500m) and 30% Woina-Dega (mid-altitude 1500-2300m). Rainfall is bimodal, with an average amount of about 1000mm (lower in the kola and higher in the Woina-Dega). Mean monthly temperature vary from 29^0C in January to 11^0C in August. As far as the livestock population is concerned, cattle (140,266), sheep (20,683), goat (34,684), mule (52), donkey (11,324), and poultry (80,589) are commonly reared (Asale, *et al,*. 2016).

Study animal

The study populations were cattle of different breed, age and sex brought to sodo zuriya woreda veterinary clinic, vaccination site and in rearing field visit in respective kebeles from humboworeda were sample collected. A total of 384 animals from which local (267) and cross (117) were randomly selected and examined, which are managed under extensive system.

The age, sex, breeds and body condition scores (good, medium and poor) were classified based on the criteria set by (Nicholson and Butterworth, 1996).

Study design

A cross sectional study was conducted from October 2016 to April 2017 on cattle which were found in the study area.

Sample size and sample size determination

Simple random sampling was subjected on the study population. The total number of cattle required for the study was calculated based on the formula given by (Thrusfield, 2007). By rule of thumb where there is no documented information about for the prevalence of tick infestation disease in the study area, it is possible to take 50% prevalence. In this study the sample size were calculated using 50% prevalence with 5% desired level of precision and 95% of confidence interval.

$$N=\frac{1.962(p)\ (1-p)}{d2}$$

Where N= sample size
P= Expected prevalence
D= Desired level of precision (5%)
By using this formula the sample size were 384.

Study methodology

Tick collection and identification: Tick samples were also collected from each animal half body part in different region of the body (neck, around tail, groin, brisket, scrotum, udder and etc.) and put into a sample bottle containing 70 % ethyl alcohol (ethanol). The sampling bottles were properly labeled indicating the kebele's of collection, number of tick, animal (breed, sex, age, body condition) and the date of collection. The ticks were then taken to wolaita Soddo regional laboratory to identify their genera by stereomicroscopic examination and observing it with poster and soft copy available there to tick in their genera (Morel, 1980).

Statistical analysis

The collected raw data from field was be entered into Microsoft excel spread sheet. The data was analyzed by using Statistical Package for Social Students (SPSS) version 11. For different variables, frequency, 95% confidence interval and p-value ($p<0.005$) were used to compute the assessment of degree of association between dependent and independent variable.

Results

Prevalence

In this study, a total of 384 animals where, local (n = 267), cross (n = 117), breeds of cattle were examined from Humbo and Soddo zuriya woreda. Then the overall prevalence was calculated by dividing the number of positive samples by the total sample size and multiplied by 100. Out of the 384 animals examined, ticks were found on 216 animals yielding an overall prevalence of 56.3%. The distribution of tick genera were identified and located in (Table 5). The statistical analysis was done for the prevalence of tick infestation with hypothesized risk factors (woreda, kebele, age, sex, breed and body condition). There were statistically significant association with breeds ($p = 0.014$) and body conditions ($p= 0.001$) (Table 1). Higher tick infestation rate was seen on both poor body condition and cross breeds. There were no statistical significances ($p > 0.05$) associated with woreda, kebele, sex and age of animals (Table 1).

Table 1: Logistic regression analysis of tick infestation with different risk factors (variables): both binary and multiple logistic regressions

Risk factors	No exa-mined	No (%) positive	Cu OR (95%) P-value	Ad OR(95%) p-value
Woreda				
Soddozuriya	193	55.9%(108	1	1
Humbo	191	56.5%(108	1.02(0.68, 1.54) 0.908	1.02(0.44, 2.38) 0.962
Kebele				
Bugewanche	45	25(55.5%)	1	1
Digiso	48	30(62.5%)	1.33(0.58, 3.05) 0.496	1.34(0.57, 3.12)0.501
Hobichabadda	49	27(55.1%)	1.02(0.45, 2.32) 0.965	1.01(0.44, 2.32) 0.982
Hobichabongota	47	25(53.2%)	1.1(0.48, 2.5) 0.82	1.14(0.49, 2.65) 0.761
Hobichaborkosh	47	26(55.3%)	1.01(0.44, 2.2) 0.98	----------
Kokate	48	27(56.2%)	1.03(0.45, 2.33) 0.946	1.04(0.45, 2.42) 0.929
Ofagandaba	47	28(59.6%)	1.18(0.51, 2.67) 0.69	1.27(0.54, 2.98) 0.583
Ofa sere	53	28(52.8%)	1.1(0.5, 2.5) 0.78	1.12(0.49, 2.56) 0.793
Breed				
Local	267	140(52.4%)	1	1
Cross	117	76(65%)	1.7(1.07, 2.63) 0.023	1.9(1.13, 3.09) 0.014
Sex				
Male	185	101(54.6%)11	1	1
Female	199	5(57.4%)	1.15(0.76, 1.72) 0.53	1.1(0.7, 1.74) 0.43
Age				
<2 year	70	34(48.6%)	1	1
[2, 4]	179	100(55.9%)	1.34(0.77, 2.33) 0.300	1.4(0.84, 2.68) 0.173
(4, 7]	96	57(59.4%)	1.54(0.83, 2.87) 0.17	1.5(0.79, 2.85) 0.215
>7	39	25(64%)	1.89(0.84, 4.22) 0.12	1.7(0.71, 3.83) 0.238
Body condition Good				
Poor	97	42(43.3%)	1	1
Moderate	108	70(64.8%)	2.4(1.36, 4.16) 0.02	2.7(1.47, 4.87) 0.001
	179	104(58.1%)	1.33(0.83, 2.17) 0.26	1.41(0.83, 2.38) 0.197

Identification of tick genera and their prevalence

Of the total 1133 adult Ixodid ticks collected from different body region of 384 cattle's, three genera were indentified. The tick genera identified were, Rhipicephalus (26.3%),Boophilus (31.8%) and Ambyloma (41.9%)in ascending order of prevalence (Table 6). By considering relative prevance of each tick genera identified in the study area, Ambylomawas the most dominant (41.9%) and Rhipicephaluswas the least (26.3%). The relative prevalence of Ambyloma show no great differences in woreda, kebele, sex, age and breed. However, there is sounded variation in body condition highest in poor (62%) and lowest (29%)(Table2).Also,the same to that of Ambylomain terms of different risk factor the relative prevalence of Boophilus indicates that means there is no expanded variation and observable variation in body condition highest in poor body condition (58.4%) and lowest in good body condition(19.6%) (Table 3).In contrast to Ambyloma and Boophilus there is effect of kebele in addition to body condition for the prevalence Rhipicephalus with highest in the Hobicha Bongota (46.8%) and lowest in kokate (25%) and poor body condition dominate with (59.2%) and lowest in good body condition (20.6%)(Table 4).From the direction of relative proportion tick genera the result indicates Ambyloma was highest (18.4%), Boophilus (16.3%), Rhipicephalus (16.1%), Ambyloma with Boophilus (14.2%), Ambyloma with Rhipicephalus (11.9%), Boophilus with Rhipicephalus (12.5%) and three genus together were lowest (10.5%) (Table(5).

Table 2: prevalence, count and average quantification of genus Ambyloma in relation to different risk factors (woredas, kebele, breed, sex, age and body conditions).

Risk factors	No Examined	No (%) positive	Count	Average
Woreda				
Humbo	191	91(47.6%)	234	2.6
Soddozuriya	193	96(49.7%)	241	2.5
Kebele				
Bugewanche	45	23(51.1%)	55	2.4
Digiso	48	24(50%)	61	2.54
Hobichabadda	49	24(49%)	63	2.6
Hobichabongota	47	21(44.7%)	59	1.3
Hobichaborkosh	47	22(46.8%)	51	2.3
Kokate	48	24(50%)	62	2.9
Ofagandaba	47	28(59.6%)	61	1.5
Ofa sere	53	21(39.6%)	55	1.1
Breed				
Local	267	121(45.3%)	319	2.56
Cross	117	66(56.4%)	165	2.5
Sex				
Female	199	99(49.7%)	245	2.47
Male	185	88(46.7%)	231	2.61
Age				
<2 year	70	30(42.8%)	79	2.6
[2, 4]	179	86(48%)	198	2.3
(4, 7]	96	49(51%)	145	2.9
>7	39	22(56.4%)	53	2.4
Body condition				
Poor	108	67(62%)	189	2.82
Moderate	179	92(51.4%)	220	2.39
Good	97	28(29%)	66	2.35

Table 3: prevalence, count and average quantification of genus Boophilus in relation to different risk factors (woredas, kebele, breed, sex, age and body conditions).

Risk factors	No Examined	No (%) positive	Count	Average
Woreda				
Humbo	191	81(42.4%)	176	2.2
Soddozuriya	193	85(44%)	184	2.3
Kebele				
Bugewanche	45	21(47%)	44	2.1
Digiso	48	24(50%)	51	2.1
Hobichabadda	49	20(41%)	44	2.2
Hobichabongota	47	20(42.6%)	40	2
Hobichaborkosh	47	17(36.2%)	41	2.4
Kokate	48	23(47.9%)	51	2.2
Ofagandaba	47	21(44.7%)	45	2.1
Ofa sere	53	20(37.7%)	44	2.2
Breed				
Local	267	109(40.8%)	239	2.2

Cross	117	57(48.7%)	121	2.1
Sex				
Female	199	96(48.2%)	209	2.1
Males	185	70(37.8%)	151	2.2
Age				
<2 year	70	34(48.6%)	80	2.3
[2, 4]	179	54(30.2%)	121	2.2
(4, 7]	96	47(49.9%)	110	2.34
>7	39	21(54%)	59	2.8
Body condition				
Poor	108	63(58.4%)	152	2.4
Moderate	179	84(47%)	177	2.1
Good	97	19(19.6%)	31	1.6

Table 4: prevalence, count and average quantification of genus Rhipicephalus in relation to different risk factors (woredas, kebele, breed, sex, age and body conditions).

Risk factors	**Number examined**	**Number positive**	**(%)**	**Count**	**Average**
Woreda					
Humbo	191	84(44%)		156	1.9
Soddozuriya	193	80(41.4%)		142	1.8
Kebele					
Bugewanche	45	21(41.7%)		36	1.71
Digiso	48	22(45.8%)		41	1.9
Hobichabadda	49	20(40.8%)		39	2.0
Hobichabongota	47	22(46.8%)		36	1.6
Hobichaborkosh	47	20(42.5%)		40	2
Kokate	48	16(25%)		28	1.8
Ofagandaba	47	19(40.4%)		35	1.8
Ofa sere	53	24(45.3%)		43	1.8
Breed					
Local	267	112(41.9%)		203	1.9
Cross	117	55(47%)		95	1.7
Sex					
Female	199	85(42.7%)		150	1.8
Male	185	89(48.1%)		148	1.9
Age					
<2 year	70	27(38.6%)		50	2
[2, 4]	179	71(39.7%)		130	1.89
(4, 7]	96	43(44.8%)		81	2.2
>7	39	23(59%)		37	1.6
Body condition					
Poor	108	64(59.2%)		134	2
Moderate	179	80(44.7%)		131	1.6
Good	97	20(20.6%)		33	1.6

Table (5): The relative proportion of the tick in cattle of tick positive

Genera of tick	Number of positive	Relative (%)
Ambyloma	187	18.4%
Boophilus	166	16.3%
Rhipicephalus	164	16.1%
Ambyloma with boophilus	144	14.2%
Ambyloma with rhipicephalus	121	11.9%
Boophilus with rhipicephalus	127	12.5%
Ambylomaboophilus and rhipicephalus	107	10.5%
Total	1016	100%

Table (6): Prevalence of tick genera of cattle

Genus	Count	Percentage
Ambyloma	475	41.9%
Boophilus	360	31.8%
Rhipicephalus	298	26.3%
Total	1133	100%

Discussion

Different tick genera's are widely distributed in Ethiopia and a number of researchers reported the distribution and abundance of ticks in different parts of the country (Nigatu and Teshome,2012). In the present study, the total tick infestation prevalence was found 56.3%. This finding is agree with report of (Bemrew *et al*.,2015) with the prevalence of 56.3% and greater than the reports of (Kassa and Yalew, 2012) with prevalence of 33.21% in Haramaya district and (Tesfahewet and Simeon, 2013) a prevalence of 16.0% in BenchiMaji Zone of the Southern Nations and nationalities of Ethiopia. And less than(Nigatu and Teshome, 2012) were reported a higher prevalence of ticks (89.4%) from Western Amhara Region. The lower result of the present study may due to the awareness of people to the modern production system of livestocks, application acaricides and different methods of prevention and control strategies. Amblyomma, Boophilus and Rhipicephalus were the three important genera of ticks encountered during the study period, with a total prevalence of 41.9%, 31.8% and 26.3% respectively. The genus Boophilus tick was greater in prevalence in this study (31.8%) than (Tiki and Addis's, 2011) reported (18.13%) in and around Holeta and (Tamiru and Abebaw, 2010) in Asella (15.4%). However, it was less than the report of(Bossena and Abdu, 2012) study in and around Assosain a greater prevalence rate (45%) than the current study (31.8%), Amblyoma tick infestation was indicated higher in studies of (Tiki and Addis, 2011), (Kassa and Yalew, 2012), (Tamiru and Abebaw, 2010) and (Bossena and Abdu, 2012) with a prevalence of 50.5, 47.16, 60.1 and 45%respectivey than this study(41.9%).

A greater result of Rhipicephallus tick was recorded in (Gedilu *et al*., 2014) with a prevalence of (39.2%). Similar findings were reported by (Kassa and Yalew, 2012) study in Bahir Dar (48.1%) than the current study (26.3%). But, studies by (Nigatu and Teshome, 2012) indicated lesser prevalence of 6.6% from western Amhara Region. Risk factors (woreda, kebele,sex, age, breed and body condition scores) were also involved in the variations of prevalence of ticks in the study area. There was no statistical significant association of woreda. This is may be due to similar agro-ecology, common livestock handling practices and the same governmental support for livestock health of both woredas. There was no statistically significant association kebelebe cause all those kebeles have the same agro-ecology. But the percentage of tick infestation is highest in Digiso (62.5%) and is lowest in Ofa sere (52.8%) this finding agree with report of (Amanuel and Abdu, 2014). The prevalence of ticks were 64.8, 58.1 and 43.3% in poor, medium and good body condition scores respectively. It appears with statistical significance association where the p value is less than 0.05 (P=0.001). Similar finding was indicated in (Bossena and Abdu, 2012) and (Bemrew *et al.*, 2015). And also it has been lined with the study made by (Gedilu *et al*.,2014). This result disagree with the statement given by (Kassa and Yalew, 2012) and (Tesfaheywet and

Simeon, 2013) because there existed no statistical difference (p>0.05) in the prevalence of ticks among the body condition score. And, also in binary and multivariatelogistic regression analysis body condition was statistically highly associated (P=0.001) with tick infestations in which the odds of engaging with tick infestation in poor body condition cattle was 2.7 times higher than those animals having good body conditions. The higher prevalence of ticks in the poor body condition scores than other counter parts could be due to the less resistance of weak animals to ticks infestation as a result of low immunity.

Local breeds (52.4%) were affected less than the cross breeds (65%) and statistical significance differences (p<0.05). This result was notin line with the findings of (Kassa and Yalew, 2012) who reported the prevalence of tick infestation was significantly higher (P<0.05) in local breed cattle (58.18%) than cross breed ones. In thiscontrast this finding in line with the findings of (Tamiru and Abebaw, 2010) and (Bemrew *et a*l., 2015) in that the prevalence of ticks was higher in the cross breeds than local breeds. This might be due to cross breed animals are genetically less resistance for any disease conditions than local breed animals.

The difference in prevalence was found statistically insignificant (P>0.05) between sex of cattle.Male animalswere found less affected than females (in male 54.6% andin female it was 57.8%) with no statistical significancein female it was 57.8%) with no statistical significance(P- value>0.05). This result is in line with theother author in BenchiMaji by (Tesfaheywet and Simeon, 2013) but it disagreed with the previous works in Assosaby (Bossena and Abdu, 2012) that the difference inprevalence was found statistically significant between sexgroups. This result is also concurred with the results of(Kassa and Yalew, 2012) where the p-values were greater than 0.05. Age also matters in the prevalence of ticks in cattle inthe study area. In those less than two year it was 48.6% whiletwo year to four year, greater than four to seven year and greater than seven yearwere 55.86%, 59.4% and 64% respectively. But there is nostatistical significance difference (P> 0.05) between theage groups. Similar findings were reported by (Kassa and Yalew,2012) and (Tesfahewet and Simeon, 2013).

However,(Bossena and Abdu, 2012) reported that exist statistical significance difference in the age group. Also, it contradicts the study made by (Gedilu *et al.*, 2010) the difference in prevalence among the age groups were statistically significant (P<0.05,x=93.040) and he stated that the higher prevalence were recorded in animals>3years (85.1%). In general, the prevalence of ticks in all the researchers indicated that very young animals are affected less than adult animals. This could be due to the less exposure to field grazing with other animals in the field and adults are exposed due to the communal grazing habit and maternal immunity of the youngest has its own effect.

Conclusions and Recommendation

The present study in the study area Soddo zuriya and Humbo woreda of Wolaita zone identified the distribution of three Ixodid tick genera Ambyloma, Boophilus and Rhipicephalus. In this study, Ambyloma was the most abundant and widely distributed tick genus in the study area and Rhipicephalus was the least prevalent. The community, in the study area, has limited interest and knowledge of giving attention for medication in case of tick infestation on cattle.

From the above conclusion the following recommendations are forwarded:-

- There should be seasonal pasture treatment and cattle before and after rainy season.
- An awareness creation on routine investigations of tick species and their control measures should be adopted by various groups of cattle producers.
- Knowledge of acaricides and its way of treatment should be awared to livestock owners.
- Different acaricides should forward from the government to the society.

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