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Assessment of tick prevalence and associated potential risk factors on small ruminant populations in and around Gondar town, Amhara regional state, Ethiopia

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Abstract
A cross-sectional study was conducted from November 2018 to April 2019 to estimate prevalence of tick infestation and the associated risk factoris on small ruminant's population in and around Gondar town. The study was carried out through physical examination and laboratory identification of ticks. Out of 245 small ruminants (165 sheep and 80 goats) examined, 51.02% were found infested with ticks. The prevalence of tick infestation in goats and sheep was found to be 43.75% and 52.72%, respectively. Among the potential risk factors considered in this study, season and body conditions were showed a significant difference ($P<0.05$) in ticks infestation of small ruminants. The predominant tick species identified in the study were *Amblyomma variegatum* (57.1%), *Hyalomma* (26.6%), *Boophilus* (9%) and *Rhipicephalu* (7.3%). Therefore, to reduce high prevalence of ticks and their impacts on the productivity in small ruminants, appropriate and strategic control measure should be taken in addition to the community awareness creation about the importance and control stratagies of ticks and tick borne diseases of small ruminants for the animals` owners.

Keywords: Gondar town, ticks, prevalence, risk factors, small ruminants.

Introduction

Ethiopia has the largest number of livestock in Africa, approximately 44.3 million cattle, 46.9 million sheep and goats, more than 1.0 million camels, 4.5 million equine, and 40.0 million chickens (CSA, 2004) [4]. Livestock serve as an important source of income for the agrarian community and are one of the Ethiopia's major sources of foreign currency through exportation of skins and hides (Ayele *et al.*, 2003) [3]. Ticks are obligate, blood feeding ectoparasites of vertebrates, particularly mammals and birds and the most important group of ectoparasites, primarily because they feed on blood and tissue fluids in order to develop and because of the wide range of pathogenic agents that they transmit. Among livestock, small ruminants play a significant role in socio- economic life of the people of Ethiopia. Owing to their high fertility, short generation interval and adaptation even in harsh environments, sheep, and goats are considered as investments and insurance to provide income to purchase food during seasons of crop failure and to meet seasonal purchases such as improved seed, fertilizer, and medicine for rural households. Hides and skins accounts for 12-16% of the total value of exports in Ethiopia **(**Zelalem and Fletcher, 1993) [20].

Ticks are divided into two families: Argasidae (soft bodied ticks), a relatively small group comprising 170 species, and Ixodidae (hard ticks); a larger group comprising over 650 species. Hard ticks are more common ectoparasites of mammals, in part because of their widespread distribution and prolonged association with the host while blood-feeding. Ticks are primarily parasites of wild animals and only about 10% of species feed on domestic animals, primarily sheep and cattle (Wall and Shearer, 2001) [19]. Ticks and the pathogens they transmit have co-evolved in equilibrium with wild animals that serve as hosts, and reservoirs at the same time. Normally situations of instability only occur when these reservoirs come into contact with domestic animals, either by the introduction of uninfested animals to infested regions, or by the movement of infested animals to non-infested regions (Jongejan and Uilenberg, 2004) [9]. However skin parasites of small ruminants especially ticks is the major agents causing serious economic loss to small holder farmers, the tanning industry and the country as whole (ESGPIP, 2009) [5]. Ticks display a wide range of forms of association with their hosts: obligate to facultative, permanent to intermittent, in superficial. The activity of ticks infesting livestock and companion animal hosts is of particular interest because it results in a wide range of pathogenic effects.

Feeding may cause direct damage to skin and inflammation during scratching in object and significant blood loss. This activity is usually associated with purities, erythematic, excoriation, papules, scale and crusting and self-trauma. Wounds may be subject to secondary infestation or bacterial infection. The salivary and fecal antigens produced by ticks they feed can stimulate immune responses, in some individuals leading to hypersensitivity (Taylor M. *et al*., 2003) [15].

The effect of ticks usually depends on the size of invading population, on the manner on which the parasite long out its existence and the state of nutrition of the host animal when infected. Ticks inflict may be mechanical, but the situation is complicated also by host reaction to the presence of the particular parasite, their secretion and excretion. Young animals are generally more susceptible to ticks because of higher ratio of accessible surface to the body volume and poor grooming behavior (Lehmann, 1993) [10].

Transmission occurs by a direct contamination and contaminated fomites can be source of infestation. Poor nutrition and concurrent infections increase the susceptibility of animals ticks. The control program against ectoparasites and skin diseases have been designed by the Ministry of Agriculture and Rural Development of Ethiopia (MoARD) in 2005 and launched in Tigray, Amhara and Afar regions. In Oromia regional state, this activity started in 2010 and still ongoing. Even though national and regional efforts and emphasis given to the control programs against ectoparasites; as some reports from north-west Amhara region indicate, the problem seems to be still alarming (Sisay *et al*., 2013). The objective of this research is,

- To know the prevalence of the ticks.
- To assess the risk factors of the ticks infestation in the small ruminants in species, breed, sex, age, body condition and production system.

Materials and Methods

Descriptions of the Study Area

The study was conducted from November, 2018 to April 2019 in and around Gondar town of the Amhara National Regional State, located in the Northwestern part of Ethiopia. It is located at a distance about 728 km away from the capital city of the country Addis Ababa. The study zone was located between geographically coordinates 12.3º to 13.38º north latitudes and 35.5º to 38.3º east longitudes and the altitude ranges from 1177 meters above sea level (m.a.s.l) in western lowland and in north Semen Mountain, respectively. The average annual rain fall vary from 880mm to 1772 mm, which is characterized by a monomodal type of distribution. The mean annual minimum and maximum temperature is 10 ºC in the highland and 44.5 ºC in the lowland respectively (NMA, 2011) [13]. The indigenous small ruminant's population in the study zone is estimated at sheep 26950 and goats 22590 respectively. Most of these small ruminants are in the extensive farming system in the private farmer.

Study Design

A cross- sectional types study was carried extensively in and around Gondar area. In this study a simple random sampling of individuals from a population is taken at a point in time. Individuals included in the sample are examined for the prevalence of ticks in that area with regard to the presence or absence of specified risk factors (species of animal, sex, age and body condition). The study was conducted from November 2018 to May 2019. During the study period the sample was collected from clinically suspected and visual examination from small ruminants. The history may gatherd as qoustionary form to know overall view of ticks hazard toward their animal. The examination of each animal was conducted by detailed clinical examination for the presence of ticks and subsequently samples was taken from animal and then to laboratory of parasitology for further examination.

Study Population

The study population comprises of extensively, semi-intensively and intensively managed in the study area. All live local breed of both sexes in and around town Gondar was available during study period. But it was conducted more to assess the local breed of small ruminants because there was no more exotic breed of the small ruminants even also cross breed which in the study priod. A total of 245 (165 sheep and 80 goats) were examined to study the distribution of ticks. Species, age, breed and sex of selected animals were recorded. Body condition was categorized as poor, medium and good by according to the (Gatenby *et al*., 1991) [7]. Examination of animals was done by close inspection after proper restraining and by taking samples to the laboratory for further processing.

Sample Size and Sampling Methods

Simple random sampling method is used for sampling and using 95% confidence interval and 0.05 desired level of precision, the sample size will be determined by the formula given by (Thrusfield, 2005) [18] as follows:

$$N = \frac{za2\ p\ exp\ (1\text{-}p\ exp)}{d^2}$$

Where, n = sample size
Pexp = expected prevalence
Z_a = related to confidence level (value of a level of significance)
D = desired level of precision (5%).

To calculate the total sample size, the following parameters was used 95% Level of Confidence (CL), 5% desired level of precision, 20% expected prevalence of ticks in the previous study in and around Gondar town (Tewodros *et al.*, 2012) [17]. The sample sizes were determined as n = 245 of the small ruminants was conducted to study.

Sample Collection

Samples was collected in the sample bottle and examined at room temperature within 24 haurs. If delay occurs in the examination, samples was preserved in 10% alcohol. The collected samples was examined by microscope and further identification in Genera levels was conducted in the parasitology laboratory.

Laboratory Methods

Clinical Examination

Prior to clinical examination, the origin, age, sex, attachment site, breed, agro-ecology and body conditions were recorded in the data record book. The clinical

examination will be performed by visual inspection and palpation on all parts of animals' body.

Data Management and Analysis.

Generated data was classified, filtered, coded and entered in to Microsoft Excel® 2007. The data was then be exported to SPSS version 20. Results was summarized as descriptive results in percentages and presented in tables. Chi-square (χ^2) was used to assess the prevalence and the risk factors of the ticks on the small ruminants. The risk factors was to observe the variation in ticks on the small ruminant prevalence and risk factors between sex, speceis, age, body conditions, production system and season by using x^2-test and p-value.

Results

A total of 245 small ruminants (165 sheep and 80 goat) were examined for tick infestation. The prevalence of tick infestation in goats and sheep was found to be 43.75% and 52.72%, respectively. The difference in prevalence of tick infestation was found statistically significant variation with (P< 0.05) between the sex, age, body conditions, season, production system and physiology of animals groups but not between species.

Table 1: Prevalence of tick infestation based on sex, age, and species

Risk factors		No. of positive animals	No. of negative animals	Prevalence in%	x^2	P-value
Sex	Male	61	67	50.8%	0.513	0.474
	Female	61	54	49.2%		
	Total	124	121	100%		
Age	Young	55	45	44.4%	1.301	0.254
	Adult	69	76	55.6%		
	Total	124	121	100%		
Species	Caprine	35	42	28.27%	1.195	0.848
	Ovine	89	79	71.8%		
	Total	124	121	100%		
Body conditions	Poor	64	22	50%	6.2	0.00
	Moderate	57	39	44.3%		
	Good	7	60	5.7%		
	Total	128	121	100%		
Season	September-November	10	22	8.1%	11.056	0.001
	December-February	19	30	15.3%		
	March-May	95	69	76.6%		
	Total	124	121	100%		

Table 2: Production system of animals

Production system					
Risk Factors of production system	Extensive	Intensive	Semi intensive	df	*P-value*
Negative Animal	82(67.8%)	4(3.3%)	35(28.9%)	1	0.825
Positive Animal	81(65.3%)	11(5.6%)	36(29%)		
Total	163(66.5%)	11(4.5%)	71(29%)		

The season of the year is related comparison was considered to see the influence of season on the occurrence of tick infestation on sheep and goats as tabulated in table above. This study has revealed that there was statistically significant difference (P<0.05) in prevalence of tick's infestation between the three seasons which include the (tesday, winter and belg up to beginning of summer).

Table 3: Ticks in genus level

Genus					
	Boophilus	Ambyloma	Hyloma	Ripicephalus	Total
Tick Negative	0	0	0	0	121
	0.0%	0.0%	0.0%	0.0%	100%
Tick Positive	11	71	33	9	124
	8.9%	57.3%	26.6%	7.3%	100%
Total	11	71	33	9	245

Discussion

The current study revealed that tick infestation is still wide spread and most significant external Parasites of small ruminants in the study area. In this study, 245 small ruminants were examined and a total of 145 sheep and 80 goats. In the present study in and around Gondar town from overall prevalence (51.02%) of small ruminants were found to be infested by one or more species of ticks. The higher prevalence of ectoparasites in study area could be due to the fact that sheep and goats could have frequent exposure to the same communal grazing land that favored the frequent contact and management system of animals, this result is higher than the report of Tefera (2004) [16].

However, the prevalence of tick infestation in the current study was higher when compared to the previous works conducted by Mersha *et al.* (2012) [12] who reported 20% prevalence in the same study site The difference in the Prevalence might be due to the farmer deworming awareness, and season of the study period, frequent exposure to the same communal grazing land that favored the frequent contact, production systems and management of animals. The infestation of ticks was statistically significant (P< 0.05) among body condition of animals. This is in agreement with the study conducted by Sileshi *et al.*, (2007) [14] in Mizzen Teferi. This is due to high infestation of tick result poor body condition due to consumption of high amount of blood and fluid by those ticks. The poor body condition may occurred by problems of the feeding and healthy management.

The highest prevalence in the current study might be due to the presence of wide range of cracking soil that helps larva of ticks to stay long and survive, short and sticky grasses used for adherence of adult ticks and their transmission to grazing animals, large livestock population and herd size may also contribute as ticks can easily get access to host and complete their life cycle to perpetuate rapidly. Furthermore, arid agro-ecology, poor veterinary extension service,

sedentary management practice employed by herders might also pave the way for the highest tick infestation.

Statically the infestation of the tick is highly inter related with the season and significant of the *p-vale* become less than 0.05. Ecto-parasites are common in tropical countries because of the favorable climatic conditions for their development especially in wet climates, ticks easily hatch their egg and also in humid condition Mungube *et al.* (2008) [12].

The association of ectoparasites prevalence with sex in current study was not statistically significant (P>0.05) in this agreement with the work of Johnson (2004) [8] who reported a study but it was noted that males were more frequently affected than females (76.1% vs. 67.3%). This study was not in significant result that males were more resistance than females. This could probably be due to differences in the study time/season and climatic factors. Access for pregnant and lactating females which were not allowed to go to the pasture area which in turn results in poor climatic conditions favorable to ectoparasites development may also be related to the low prevalence of ectoparasites in females in this study. Goats are considered to be relatively resistant to ectoparasites probably because of their self-grooming, licking, scratching, rubbing and grazing behavior which could contribute for rapid ectoparasites elimination Pegram *et al*. (2004) [14].

The association of ticks prevalence with sex in current study was not statistically significant (P>0.05) which means the young and adult have no difference the current study but on the other hand, Lehman (1993) [10] observed a greater susceptibility of young animal to ectoparasites. The higher prevalence in young animals could be attributed to their poor grooming behavior. Moreover, acquired immunity added to the relative thicker skin of older animals may also contribute to greater resistance against ectoparasites in older age category.

The prevalence found in the present study in risk factors of species was not statistically signfinat because p-value greater than 0.05. The occurrences of tick infestation in species level of current study in goats (43.75%) and in sheep (52.72%) was lower than the reports done by Abunna *et al.* (2007) [1] in Miesso district, Western Hararghe, who recorded a prevalence of 87.5% (goats) and 89.9% (sheep), Eyob and Matios (2014) [6] recorded a higher prevalence of 97.58% (goats) and 69.86%(sheep) in Dhas district of Borana pastoral area, Southern Rangelands of Ethiopia. However, lower prevalence 66.12% (goats) and 80.30% (sheep) was recorded in Bedelle district, Oromia Region, Ethiopia Abunna *et al*. (2009) [2]. The difference of prevalence between goat and sheep is reveled because of the sheep having less grooming behavior and the wooly sheep whose skin does not accessibly to actinide spraying. But the tick can infests both species without precondition.

Conclusion and Recommendations

The infestations of Ticks are important affecting the health and productivity of small ruminants in and around Gondar town. Lack of awareness about the significance of the problems among owners for control schemes have contributed to the wide spread nature of ticks in the area. In view of the significance of skin and hide production as main source of foreign currency to the country and the ever increasing demands of livestock market. The high prevalence of ticks prevailing in sheep and goat in the area require serious attention to minimize the effect of the problem. Species of animals, sex and body condition were not found as a risk factors for ticks prevalence in small ruminants in the present study. However, season and body condition of the animals was an important factor for ticks infestation.

Based on the above conclusion the following recommendations are forwarded:-

- Strategic and appropriate applications' of acaricides for effective ectoparasites control is required for small ruminants.
- Awareness creation for the local farmers about the control of ticks is essential.
- Newly introduced animals should be treated before they are introduced in the herd or in to the farm.
- Further detailed study must be done to assess the seasonal dynamicity and epidemiology of ectoparasites in the study area.

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