Journal of Biology, Agriculture and Healthcare
ISSN 2224-3208 (Paper) ISSN 2225-093X (Online)
Vol.5, No.15, 2015
www.iiste.org

Epidemiology of Major Small Ruminant Ectoparasites and Effectiveness of the Control Approaches Employed in Selected Pastoral Districts of Afar, Northeastern Ethiopia

Fikre Zeru[1] Hailegebrael Bedada[1], Mu'uz Gebru[1] Ahmed Seid[2] Ashenafi Gebregergious[2]
1, College of Veterinary Medicine, Samara University, P.O.Box 132, Semera, Afar, Ethiopia
2, Semera Veterinary Regional Laboratory, P.O.Box 33, semera, Afar, Ethiopia.

Abstract
A cross-sectional study was conducted from January 2014 to April 2015 aimed at determining the epidemiology of major ectoparasites of small ruminant and assessment of effectiveness of the control approaches employed in Zone four of Afar region state. Out of 614 goats and 446 sheep examined for ectoparasites, 564 (91.86%) goats and 422 (94.62%) sheep were found infested with one or more ectoparasites. The overall prevalence was 93.02% (986/1060). The overall prevalence of ectoparasite was significantly higher in adult (96.91% in sheep, 93.83% in goat) than young (88.52% in sheep, 86.25% in goat) (P< 0.05). No significant association between the ectoparasite prevalence among the woredas, sex and body condition was evidenced in both species. Higher tick infestation prevalence, 90.75%, were observed both in sheep (90.58%) and goat (90.88%) followed by lice prevalence rate of 6.41% (11.66% in sheep and 2.93% in goat) and mange (*Demodex*) (0% in sheep and 0.65% in goats). Overall eight genera of ectoparasites belonging to ticks (*Boophilus, Amblyomma, Rhepicephalus, Hyalomma* and *haemaphisalis*), lice (sucking and biting lice) and mange (*Demodex)* were identified. Even though there was irregular or unplanned application of diazionon application campaigns in the study area the burden/trend of ectoparasite infestation in the area were remain high (91.75%). Because of this and prevailing poor veterinary services in the area pastoralist forced to treat their animals traditionally which is unsafe and not effective. Most of pastoralists in the study area were awarded of the effect of ectoparasite on the animal health and productivity and skin quality. The present study revealed that extremely high prevalence and widespread occurrence of ectoparasites in small ruminant and the employed control approaches were not effective in the study area. Therefore, control of ectoparasites requires integrated ectoparasite management systems that combine sanitation, application of ectoparasiticides appropriately, reduction of breeding sites, environmental sprays, weed and vegetation controls and other biological control.
Keywords: Goat, Sheep, Ectoparasites, diazionon, prevalence, Afar, pastoral area

1. BACKGROUND AND JUSTIFICATION

Ethiopia's livestock population is believed to be the largest in Africa, and in 2007/2008 livestock accounted for 10.6% of Ethiopia's export income, with leather and leather products making up 7.5% and live animals 3.1%.Ethiopia exported 17 million tons of leather and leather products worth $81 million in 2007, and in the first half of 2008, export value increased 17 percent from the first half of 2007. Livestock is the second major source of foreign currency through export of live animals, skin and hide (USAID 2008; FAO 2010). Skin from goats and sheep are important economic products contributing for the largest share to the total and agricultural export commodities (Jemere *et al.,* 2011).

However, the contribution of sheep and goat to the national income is under the expected potential. The most probable reasons are persistent drought and attack by disease. Diseases of various causes are considered to be the main factors that impair the overall contribution of livestock particularly the small ruminants to the country's economy. Small ruminant population and survival are threatened by a number of health hazard; the most notable are skin disease caused by ectoparasite and infectious diseases. Parasitic and infectious skin diseases have been reported to cause substantial economic looses by reducing the productivity and reproduction performance of small ruminants and resulting in downgrading and rejection of skins (Berhanu *et al*. 2011).

Small ruminants represent the most important part of the Ethiopian livestock system. The sheep and goats population of the country is estimated to be 25.5 and 23.4 million respectively. From these small ruminants population, afar region possesses about 2.4 million sheep and 3.9 million goats in the country (Rahmeto *et al.* 2011). Small ruminants are exploited in the country for diverse purposes including meat, milk and skin production, breeding and as means of cash income. Within Dry Areas the majority of the rural population is involved in the agricultural sector and the development of agriculture is recognized as the engine for national economic growth and development. Livestock in the pastoral areas are the major source of food (milk and meat) and income, as well as a source of employment; sheep and goat are among the major species perform the above role. They also serve similar purposes and functions for people living in urban and rural towns adjacent to the pastoral areas. In general, Livestock are the principal source of subsistence providing milk and cash income to cover family expenses for food grains and other essential household requirements (mostly consumer goods). In

many countries, the final product of the goat production system, besides the kid and the fiber or skin, is the milk, directly used for family consumption or put on the market as a dietetic product (FAO 2011).

Skins and hides of livestock have the largest share of exports in Ethiopia. Annually 16.2 million pieces of skins are produced in the country, based on the off take rates of 33% and 32.5% for sheep and goats respectively (MoARD 2008; FAO 2010). According to the FAO statistical yearbook (2010) report about$1.56x10^5$ tones meat were produced by small ruminants in Ethiopia. It is estimated that 70% of hide and sheep skins are derived from the highland areas of the country; while 75% of goat skins and about 30% hide output comes from the lowland areas, of these, afar region account 17.55% of goat skin and 10% of sheep skin. Goats mainly occupy lowland areas and are mainly consumed by their pastoralist owners. Some are sold along the fringes of the highlands or treks to nearby commercial (export) abattoirs, etc. Thus, the supply of goat skins primarily comes from these areas (MoARD 2008).

Nevertheless, large number of sheep and goats are slaughtered per annum; quality skins production remains very low due the effect of ectoparasites. Studies conducted in Ethiopia have indicated the extent of skin disease and identified ectoparasites as being the major obstacles of the small ruminant's production. Lice, keds, mange and tick are the major cause of skin disease in Ethiopia (Berhanu *et al.* 2011).

In Ethiopian tanneries, 35% of sheep and 56% of goat skins have been downgraded and rejected due to defects caused by external parasites (Mulugeta *et al*. 2010; Rahmeto *et al.* 2011). The Ethiopian tanning industry has long complained about the poor quality of processed skin. This has created a serious problem for competition in international markets through the export of semi-processed and processed skin (MoARD, 2008; Berhanu *et al.* 2011). The study done for assessment of major factors that cause skin rejection at Modjo export tannery, Ethiopia, revealed that ectoparasites play key role in the rejection of skin (Berhanu *et al.* 2011). All ectoparasites cause intense irritation to the skin, the extent depending on the parasite involved. Infested animals scratch, rub and bite the affected areas and this end up with skin damage (USAID, 2008). Ectoparasites of small ruminants cause blood loss and very heavy infestations result with severe anemia. Moreover, they are the most important vectors of protozoan, bacterial, viral and rickettsial diseases (Radostits *et al.* 2007 and Rhabari *et al*. 2009). All these contributed towards the extreme reduction of small ruminant productivity. In Ethiopia there is limited information regarding the prevalence and distribution of small ruminant ectoparasites.

Skin diseases are known to affect the quality of skin. As many as 1/4 to 1/3 of all skin processed at tanneries have various defects and are unsuitable for export purpose (MoARD, 2008 and Berhanu *et al.,* 2011). Up to 65% of defects occur in the pre slaughter stage of production while the animal is alive. Considerably large portion of this pre slaughter defects are directly related to parasitic and to secondary self-inflicted damage (FAO 2008; Jemere *et al*. 2011).

Grazing land of the dry pastoral area is widely occupied by bushes and invasive weeds (mainly, *prosopise maliphera*). Hence, these plants serve as a shelter for both the ectoparasite as well as for the animals; this condition play significant role of animal exposure for ectoparasite infestation. Moreover, waste disposal of the community in the study area favors for the survival and multiplication of ectoparasite because the parasite use the garbage as a food source. Beyond the above points farming system of the study area also have important part for potential infestation of small ruminants; apparently pastoralists move from place to place with their animals in order to search feed and water. Such movements of animals increase the infestation of ectoparasite among the animals and introduce the parasite from vicinity to the other. Furthermore, extensive mixed farming system in the only practiced farming system of the pastoral area which increases the magnitude of ectoparasite transmission among the animals and among herds. Along with the animals in this region inhabit grass area, edge of water source (especially river) and bushes; such conditions are important shade for the survival and replication of ectoparasite and the animal may acquire infestation while searching feed, shelter and water.

The region contains huge potential of animal population and more or less majority of hide and skin and live animals exported from this region. However, veterinary extension service of the region is too low and the awareness of the community about the ectoparasite and its effect on the quality of export hide and skin is negligible. Therefore, even such important risk factors are found in the region, studies which address the epidemiological pattern, impact and types of ectoparasites are not yet well conducted. Therefore the objectives of the study were to identify the major ectoparasites of small ruminants in selected Afar districts, to determine the epidemiology of major ectoparasites of sheep and goats in the study area, To assess pastoralist awareness about effect of ectoparasites on animals and skin and To assess the possible treatment and control approach of ectoparasites used in the area.

2. MATERIALS AND METHOD

2.1. Description of study area

The study was carried out in four districts selected from zone four of Afar region state, namely; Yalo, Aura, Gulina and Ewa. Afar region is one of the four major pastoral regions in Ethiopia located in north eastern part of the country. The annual temperature and rainfall in the region is $30\text{-}50^0$c and 200-600mm, respectively. The

altitude in the region is from 100-1000 meters above sea level. People in the region mainly depend on livestock production for their livelihood. Afar Region has a total population of 1,411,092, consisting of 786,338 men and 624,754 women; urban inhabitants number 188,723 or 13.4% of the population. With an estimated area of 96,707 square kilometers, this region has an estimated density of 14.59 people per square kilometer. For the entire region 247,284 households were counted, which results in an average for the Region of 5.7 persons to a household, with urban households having on average 3.9 and rural households 6.1 people (FAO 2010). The study population was indigenous breed of sheep and goats kept under pastoral type of production which allows free grazing, usually mixed with other animals. In the study area camel, sheep, goat and cattle are the animals commonly reared together. Children and females are the most responsible for rearing of sheep and goat, however camel and cattle are rearing by adult male.

2.2. Study animals

The CSA estimated in 2010 that pastoralist in Afar had a total of 327,370 cattle (representing 0.84% of Ethiopia's total cattle), 2.4 million sheep (1.13%), 3.9 million goats (3.73%), 200 mule (0.14%), 12,270 asses (0.49%), 99,830 camels (21.85%), 38,320 poultry of all species (0.12%), and 810 beehives (less than 0.1%), (FAO 2010). Therefore, the study populations was indigenous breed of 1060 small ruminant kept under pastoral production system which allows free grazing and usually mixed with other animals. In majority of the study districts sheep and goat are flocking together.

2.3. Sampling method and Sample size determination

The Afar region has 5 administrative zones, 32 wereda and 331 kebelles or Peasant associations. The sampling method was supposed to be a muti-stage cluster sampling approach. However, due to the absence of between cluster variance and sampling frame in pastoral community and, during sample collection due to migration of animals, reluctance of pastoralists to include their animals in this study, conflict among pastoralists and inaccessibility to vehicle, the wereda, kebelle and herd were sampled purposely. However, proportional allocation was used to distribute the individual sampled sheep and goats evenly among the flock. Accordingly, 30% individual sheep and goat from each small ruminants flock were sampled. Zone four was purposively selected based on history of the application diazinon. The primary stage was sampling of weredas within the selected zone. Selection of kebelles, herds and individual animals within the herds were the 2nd, 3rd and 4th stages, respectively. Accordingly, four weredas and two kebeles from each Woreda, proportional flocks from each Kebeles and 30% of the small ruminant population from each flock was sampled. Therefore, total of 1060 small ruminant was included in this study. In all stages the sample units were selected using the systematic random sampling.

2.4. Collection and identification of ectoparasites

After the animal restrained physically, clinical examination for ectoparasites was performed by visual inspection and palpation of skin for parasites and/or lesions on all parts of animal. Ectoparasites like tick and lice was collected from the body surface manually and preserved in proper universal bottle labeled with serial numbers while other data was written on special field register format prepared for this particular purpose (date, address, age, sex, body condition score of animals and production system etc). The collected ectoparasites were transported to parasitology laboratory of Samara Veterinary Laboratory. All collected samples was examined for further identification and confirmed in the laboratory as being ticks, lice and mange mite as per the procedure recommended by Urquhart *et al*. (1996).

For mange mite: The sampled animals were clinically inspected for presence of mange mite. From animal showing signs of scales, crusts, alopecia itching, a skin scraping was taken using scalpel by scrape the edge of the affected area until blood oozed. The collected scrapped samples was preserved in 70% ethanol contain universal bottle and dispatched to laboratory for further confirmatory examination (Urquhart *et al*., 1996).

For tick and lice: The neck, shoulder, breast, ribs, back, flank and rump areas of both sides of the body was examined for presence of ticks and lice by parting the hair/wool. From each site five partings of about 10 cm long was examined. From clinically positive animals, specimens was collected and preserved in 70% ethanol and transported to laboratory for further identified or confirmed (Urquhart *et al*., 1996).

2.5. Questionnaire survey

A semi-structured questionnaire format was administered to sixty flock keeper (24, 18,12 and 6 respondents were involved in interviewed from Yalo, Gulina, Aura and Ewa respectively.) to obtain general information on the production system, small ruminant production and management, awareness on ectoparasites that affect small ruminants and skin. Seasonal varation, treatment approach to alleviate ectoparasite infestation and ectoparasite control practices exercised in the area. Furthermore, key informant and focus group discussion was also employed in each woreda.

3. DATA MANAGEMENT AND ANALYSIS

The collected data were entered into Microsoft Excel data sheets and analyzed using STATA 11 statistical software (STATA Corporation, College Station, TX). Both qualitative and quantitative analysis was employed to manage the questioner survey. The prevalence was calculated by dividing the proportion of animals found infested by the total number of animals examined for external parasite multiplied by 100. The association of different risk factors with the prevalence of ectoparasites was analyzed using the Pearson chi-square ($\chi 2$) test. A statistically significant association between variables was said to exist if the calculated P-value was <0.05 (Thrusfield 2005).

4. RESULTS

4.1. Prevalence of Ectoparasites

A total of 1060 (614 (57.92%) caprine) and (446 (42.08%) ovine) were examined for ectoparasite infestation. Out of the 1060 small ruminants examined for ectoparasites, 986 were found infested with one or more ectoparasites. Accordingly, the overall prevalence was 93.02%. The prevalence of ectiparasites seems slightly higher in sheep (94.62%) than in goats (91.86%), however, it was found insignificantly associated (table-1).
Table 2 indicates that, there was no statistically association the prevalence of ectoparasites among the four woredas of the selected zone of Afar Regional state.

The overall prevalence of ectoparasite was significantly higher in adult (96.91% in sheep, 93.83% in goat) than young (88.52% in sheep, 86.25% in goat) both in sheep and goats ($p < 0.05$) (Table3). No significant association between the ectoparasite prevalence among the sex and body condition was evidenced in both species.

Table 5 shows that, the prevalence of small ruminants ectoparasites on diazinon applied and non-applied was not significantly varied.

Higher tick prevalence (90.75%) were observed both in sheep (90.58%) and goat (90.88%) followed by lice prevalence rate of 6.41% (11.66% in sheep and 2.93% in goat) and mange (*Demodex*) (0% in sheep and 0.65% in goats) (Table 6).

Most of the infestations were monoinfestation caused by tick 92.49% (87.74% in sheep and 96.09% in goats), followed by lice 2.43% (4.72% in sheep and 2.49% in goats). However, 4.66% (7.55% in sheep and 2.49% in goat) of the cases were polyinfestation by tick and lice, similarly polyinfestation of tick and demodex (0.46%) were observed in 2 goats. Moreover flies (stomoxy) were observed in most visited areas. On the other hand, soft ticks (named as “kudkud” in local language) were observed in the ground especially at watering point.

4.2. Major Ectoparasite Identified

The different ectoparasites identified were 970 ticks (412 in sheep and 554 in goats), 56 lice (42 in sheep and 18 in goats) and 2 demodex in goats. Overall eight genera of ectoparasites (Figure 2) belonging to ticks, lice and mange mites were found infesting goats and sheep in the study area. The major identified genera of ticks were *Boophilus, Amblyomma, Rhepicephalus, Hyalomma* and *haemaphisalis* (Table 1). Sucking and biting lice were responsible for pediculosis. *Demodex* is the causing agent of mange mite infestations in the districts.

4.3 Pastoralist Awareness on the Effect of Ectoparasite and Its Control approach

The most prevalent production system in area is pastoral production system with constant mixing of the flock with other flock from similar area and neighbor regions during communal browsing/grazing, at watering point, market place, vaccination posts, dipping and others. The major constraints of small ruminant production in the area are drought, feed shortage and diseases. Fifty four (90%) respondents recognized that ectoparasite infestation is a disease that affects health of their livestock by sucking blood, disturbing the animal during grazing, lameness, hair removing and pickling. According pastoralist their animal got ectoparasite infestation at watering point, during mobility and communal grazing. However six (10%) respondents were believe that ectoparasite is not disease of livestock.

i. Awareness of pastoralist on the effect of ectoparasite on skin quality

Fortify eight (80%) respondents awarded that ectoparsite infestation can downgrade skin quality. However, twelve (20%) respondents were not awarded on the effect of ectoparasite on skin. None of the respondent and key informant sold skin, rather the skin used for local use purpose.

ii. Treatment and Prevention approach of ectoparasite infestation in Selected district of Afar region.

The pastoralist indicated that the ectoparasite prevention and control strategy employed in the area is minimal. Some of the pastoralist flock get treatment by campaign, purchasing diazionon from veterinary clinic and apply themselves. The most commonly used acaroids is 1% diazinon. Even though there is irregular application of diazionon application campaigns in the area the burden/trend of ectoparasite infestation in the area were not change. Fortify eight (80%) respondents were treated their flock were using modern way ectoparasite treatment. However, twelve (20%) respondents were never used acaroids for treatment of ectoparasite infestation rather

they were used the traditional method. The commonly used ectoparasite traditional treatment, prevention and control approach in study area were stated as follow:

1. **Cleaning /Burning of the barn:** Those small flock rearing with fenced compound clan the barn regularly every morning. However, those having large flock are managed in free space; the barn was not clean rather move the flock to other place and fire the area. After the ash is removed by rain the flock returns back to the area.
2. **Washing with tree leaf**: pastoralist treat ectoparasite infested animals by application of leaf tree. The animal become washed their body thoroughly with the leaf tree. According to the pastoralist the curability rate is high but some animals become dead because of the application of this leaf tree. This treatment method is most commonly used in Gulina woreda of zone four of Afar regional state.
3. **Mobility**:- most pastoralist move their animals from infested area to get escape from ectoparasite infestation. Another believes that decreasing of mobility may decrease the probability of getting infested from other sources.
4. Some pastoralist treat ectoparasite by washing of the infested shoat with soap, apply carbon materials to infested area, some community also apply animal feces for tick infestation.

iii. Seasonal occurrence of ectoparasite

Key informants, focus group discussion and all respondents (100%) indicated that ectoparasite infestation become prevalent after short rainy season ("Gilal") followed by long rainy season (Hagay). 90% of the respondents believe that malnutrition (feed shortage) play great role on increment of the disease prevalence.

5. DISCUSSION

In the present study higher prevalence rate of 93.02% (94.62% in sheep and 91.86% in goats) was recorded in small ruminants from selected districts of Afar regional state. Similarly higher prevalence rate was reported from different area of Ethiopia. A prevalence rate of 99.38% was reported by Jemere *et al.* (2011) from Wolmera district of Oromia region. Chanie *et al*. (2010) also reported that an overall 81.50% infestation of sheep with one or more types of ectoparasites in Ethiopia. 73.3% of ectoparasite infestation also recorded from in and around Kombolcha by Tadesse *et al.* (2011). However, the present finding was higher than the findings reported by other authors from different regions of Ethiopia: 40.2% (Yacob *et al*. 2008b) in Mekelle, northern Ethiopia, 47.0% from bishoftu, central Ethiopia (Gebreselama *et al*, 2014). This higher prevalence of ectoparasites in the study area may be associated with pastoral production system in which different herd and flocks of animals coming in close contact at communal watering and grazing sites (contact points), because of the feed scarcity, mobility, mixed farming and contact with neighbor districts. In this study pastoralist explained that their animal got infested by ectoparasite at watering point, during mobility and communal grazing. Thus, this condition favoring the establishment and spread of ectoparasites. Furthermore, the prevailing poor veterinary services, improper application of acaricides by non-professionals could also amplify this endemic situation (Yacob *et al*. 2008a).

In the study area ectoparasite infestation become prevalent after short rainy season ("Gilal") followed by long rainy season (Hagay). There was no statistically association on the prevalence of ectoparasites among the four woredas of the selected zone of Afar Regional state. This may be due to similarity in production system, constant mixing of flock among the four districts.

Because of quick knockdown effect and relatively low price diazinon is widely used in Ethiopia for ectoparasite control. Even though control campaign was implemented once a year, the present study indicated that the prevalence of small ruminant ectoparasites on diazinon applied (91.75%) and non-applied (93.83%) was not significantly associated. Moreover, the pastoralist indicated that the ectoparasite prevention and control strategy employed in the area is minimal. They said that even though there is irregular application of diazionon application campaigns in the area the burden/trend of ectoparasite infestation in the area were not change. Among the factors which might be responsible for high prevalence of ectoparasite in the diazinon applied area were; the effectiveness of the diazinon in use, method of acaricides application, animal husbandry, nature of the ectoparasite, absence of environmental control. Development of acaricide resistance in ectoparasites is reported worldwide. In order for a chemical to be effective as an ectoparasiticides it needs to be delivered to the site of infestation or potential infestation in sufficient quantities to be effective for the maximum period of time. The spraying method of ectoparasite control is not as efficient as dipping (Drummond 1983). In the study area diazinon solution applied to animals by means of manual spray. The spraying equipment is portable and needs only small amounts of acaricides to be mixed for the application. In addition this method of application involves the manual spraying by means of applying power to spray acaricides solution and the individuals undertake the spraying responsibility may exhaust due to the method requires high level of energy. Therefore, acaricides may not be thoroughly applied to all parts of the animal body hence it is less efficient than the dipping method of application. Spraying method may not exposed ectoparasites those found in the inner parts of the ear, under part of the tail, the tail brush and the areas between the teats and the inter-digital space to the acaricides and also

liquid acaricide might not reach at the base of the skin in wooly sheep hence ectoparasite

Some species of ectoparasite such as tick spend more time off the host and can exist for a very long period of time without feedin. In the study area especially soft tick were live in watering point as free living. For ectoparasites that are free living in one or more life cycle stage or are present on the host for only short period such as ticks, fleas and flies, acaricides may be directed at the free living stages in the environment (Wall and Shearer 2001). However, in the study areas the control campaign only focus on the application of the acaricides (diazinon) on the animal only but no more application of environmental control of the ectoparasites. Hence, the free living stages and those found in the environment may responsible for the occurrence of high prevalence of ectoparasite of the study areas.

As a fact that ectoparasite are most often introduced to herds by bringing in infested animals (Kufman *et al.* 2012). In pastoral production system there is free movement of animals from one place to the other. Hence infested animal form non-diazinon applied area serve as a source for re-introduction of ectoparasites to the following acaricide spraying. Among the ectoparasites known to infesting wide range of domestic animals ticks and lice are the principal one; so in the study area only control campaign is implemented only on sheep and goat but the rest species of animal remains untreated. Hence untreated animals can also serve as a source for the re-infestation of small ruminant following spraying acaricides.

In agreement, Yakob *et al* (2008) reported prevalence of 53% and 15% for adult and young small ruminant in wolaita sodo. The overall prevalence the present study of ectoparasite was significantly higher in adult > 1 year (96.91% in sheep, 93.83% in goat) than young (88.52% in sheep, 86.25% in goat) both in sheep and goats ($p < 0.05$). Maternal grooming and separate housing could reduce exposures to younger animals.

In this study higher tick prevalence (90.75%) were observed both in sheep (90.58%) and goat (90.88%) followed by lice prevalence rate of 6.41% (11.66% in sheep and 2.93% in goat) and mange (*Demodex*) (0% in sheep and 0.65% in goats). Similarly reports were recorded by Yishak *et al.* (2015) Sodo Zuria district, Yacob *et al*. (2008a) in wolaita sodo. In the present study most of the infestations were monoinfestation caused by tick 92.49% (87.74% in sheep and 96.09% in goats), followed by lice 2.43% (4.72% in sheep and 2.49% in goats). Ticks are the main ectoparasite affecting small rumnants in Ethiopia (Yacob *et al.* 2008a; Gebreselama *et al*. 2014, Yishak *et al.* 2015). Similarly, the present study reviled that tick infestation was the major ectoparasite of livestock in the pastoral production of Afar regional state.

In this work, eight genera of ectoparasites belonging to ticks, lice and mange mites were found infesting goats and sheep in the study area. Moreover flies (stomoxy) were observed in most visited areas. On the other hand, soft ticks (named as "*kudkud*" in local language) were observed in the ground especially at watering point. The major identified genera of ticks were *Boophilus, Amblyomma, Rhepicephalus, Hyalomma* and *haemaphisalis.* Sucking and biting lice were responsible for pediculosis. *Demodex* is the causing agent of mange mite infestations in the districts. Similar genera of ticks, lice and mites were identified in different location of the country by different authors (Yacob *et al*. 2008a; Kumsa *et al.* 2012; Tesfaye *et al*. 2012; Gebreselama *et al.* 2014; yishak *et al.* 2015).

Most of pastoralists in the study area were awarded of the effect of ectoparasite on the animal health and productivity and skin quality. Skin in the study area were only used for local use purpose but not sold. Because of limited veterinary service infrastructure in the study area, pastoralist were forced to use the traditional way of ectoparasite treatment and prevention approach such as cleaning or burning of the barn, mobility (move their animals from infested area to no infested area), washing of infested animals with tree leaf or soap, apply carbon materials to infested area, some community also apply animal feces for tick infestation.

6. CONCLUSION AND RECOMMENDATIONS

The present study revealed that extremely high prevalence and widespread occurrence of ectoparasites in small ruminant in the study area, and the major ectoparasites identified were tick, lice and mange mite. Pastoral production system, conducive environment, malnutrition and weak animal health extension services are believed to have contributed for widespread distribution and occurrences of ectoparasites. Even though there was irregular or unplanned application of diazionon application campaigns in the study area the burden/trend of ectoparasite infestation in the area were remain high. This might be due to the problem with effectiveness, formulation and application of diazinon, mixing of animals with infested flock after diazinon application, absence of environmental spray and absence of locally applicable strategic control approach. Because of this and prevailing poor veterinary services in the area pastoralist forced to treat their animals traditionally which is unsafe and not effective. Most of pastoralists in the study area were awarded of the effect of ectoparasite on the animal health and productivity and skin quality. Skin in the study area were only used for local purpose but not sold. As ectoparasites are the major causes of skin downgrading and rejection in tanneries, reduce livestock productivity and vector of various diseases incurring economic losses. Control of ectoparasites requires integrated ectoparasite management systems that combine sanitation, application of ectoparasiticides, reduction of breeding sites, environmental sprays, weed and vegetation controls and other biological control. In view of the findings of

the present study it is possible to conclude that even though irregular control campaign were implemented skin diseases caused by ectoparasites were common in Afar region state in small ruminant.

Based on the above conclusive remarks the following recommendations are forwarded:

- Strategic, regular, and appropriate application of acaricides (dipping than spraying) during control campaign for effective ectoparasite control is required.
- Animal health workers in the study area need to train and aware on epidemiology of ectoparasite, designing of holistic control approach and, formulation and application of acaricides.
- Further investigation should be conducted either resistance develop against the acaricides currently in use (diazinon) or not.
- Effective extension system and programs that could raise public awareness on selling of skin and hide to tannery need to develop
- Market chain should be developed for marketing of hide and skin the pastoral area
- Locally applicable integrated ectoparasites control programs should be designed and implemented with the participation of all stakeholders (pastoralist, tanners, and government and policy makers) and there should be strong coordination between neighboring regions and/or districts with strict follow up and control.

ACKNOWLEDGMENTS

The authors would like to acknowledge to Samara university research and community service vice president office for funding this research project. We are most deeply grateful to the officials and experts of Samara Regional veterinary laboratory especially Yimer , Mekonen Ali and Hussen Mohammed for their unforgettable hospitability and supports they gave us during our stay in the laboratory session. Our special thanks shall also go to official administrators, local leaders and pastoralist in the study areas for allowing us to do this research and assisting us to collect the samples and related information.

7. REFERENCES

Berhanu W, Negussie H, Alemu S, and Mazengia H. (2011), Assessment on major factors that cause skin rejection at Modjo export tannery, Ethiopia. *Tropical Animal Health and Production*, 43(5):989-93.

FAO, (2010), Food and Agriculture Organization Statistical yearbook, Statistics division. www.fao.org/economic/ess-publications/essyearbook/en/.

Gebreselama, M., Zeru, F. and Romha, G. (2014). Identification and Prevalence of Ectoparasites in Cattle and Sheep in and Around Bishoftu Town, Central Ethiopia. *Animal and Veterinary Sciences* 2 (4):124-129.

IGAD, (2009), IGAD Livestock Policy Initiative. The Contribution of Livestock to the Economies of IGAD Member States Study Findings, Application of the Methodology in Ethiopia and Recommendations for Further Work, Odessa center.

Isreal, Y., Abera, T. and Urga, W, B. (2015), Epidemiological study on ectoparasite infestation of small ruminant in Sodo Zuria districts, Southern Ethiopia. *Journal of veterinary medicine and animal health* 7(4):140-144.

Jemere, B., Martha,T., and Rahmeto, A. (2011). External Parasite Infestations in Small Ruminants in Wolmera District of Oromiya Region, Central Ethiopia. *Journal of Animal and Veterinary Advances 10: 518-523*

Kumsa, B., Beyecha, K. & Geloye, M. (2012), Ectoparasites of sheep in three agro-ecological zones in central Oromia, Ethiopia, *Onderstepoort Journal of Veterinary Research* 79(1), Art. #442, 7 pages.

MoARD, (2008), Ministry of Agriculture and Rural Development (MoARD). The effect of Hide and skin quality on Domestic and export markets and evaluation of the campaign against Ectoparasites of sheep and goats in Amhara, Tigray and Afar Regions, official report to Regions and other sectors, Addis Ababa, Ethiopia.

Mulugeta, Y., Yacob H,T. & Ashenafi, H. (2010). Ectoparasites of small ruminants in three selected agro-ecological sites of Tigray Region, Ethiopia. Tropical Animal Health and Production **42**: 1219- 1224.

Radostits, O.M., Gay, C., Hinchcliff, K.W. & Constable, P.D. (2007), A textbook of the diseases of cattle, sheep, goats, pigs and horses, 10th edition, Saunders, Edinburgh, London, pp: 1585-1612.

Rahmeto, A., Makelesh, T., Bekele, M. & Desie, S. (2011), Prevalence of Small Ruminant Ectoparasites and Associated Risk Factors in Selected Districts of Tigray Region, Ethiopia, *Global Veterinaria* 7 (5): 433-437

Rhabari, S., Nabian, S. & Bahonar, A.R. (2009), Some observations on sheep sarcoptic mange in Tehran province, Iraq, *Tropical animal health production*, **41**:397-401.

Tesfaye, D., Assefa, M. Demissie, T. and Taye, M. (2012), Ectoparasites of small ruminants presented at Bahir-Dar Veterinary Clinic, Northwest Ethiopia, *African Journal of Agricultural Research* 7: 4669-4674.

Thrusfield, M. (2005), Veterinary Epidemiology, 3edn, Blackwell Publishing Company,Blackwell Rd Ltd, UK. pp: 229-246

Urquhart, G.M., J. Armour, J.L. Duncan, A.M. Dunnanad F.W. Jennings, 1996. Veterinary Parasitology, 2edn. Blackwell Science Ltd., UK, pp: 141-205.
USAID, (2008). USAID (FAO), SUCCESS STORY, Ethiopians learning to fight ectoparasites
USAID, (2011). USAID (FAO) EAST AFRICA Food Security Outlook Update.
Yacob, H., Ataklty, H. & Kumsa, B. (2008b), Major ectoparasites of cattle in and around Mekelle, northern Ethiopia. *Entemological Research* 38:126-130.
Yacob, H., Yalew, T. & Dinka, A. (2008a). Part I: Ectoparasite prevalences in sheep, and goats in and around Wolaita Soddo, Southern Ethiopia. *Revue de Médecine Vétérinaire*, 159: 450-454.

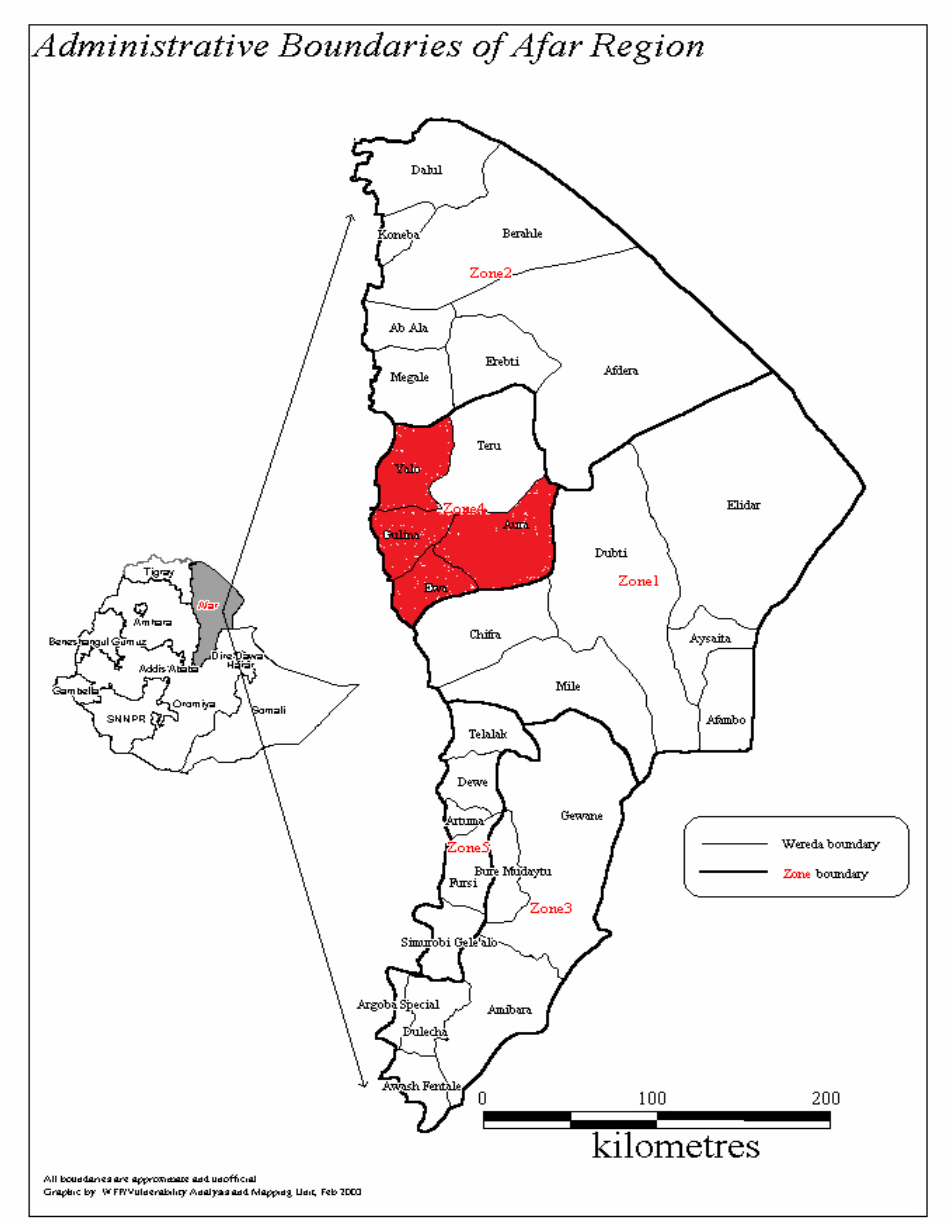

Figure 1. Administrative location of Afar region showing the study zones and woredas

Table 1: Prevalence of ectoparasites in small ruminants selected from districts of Afar Regional state

Species	Total number of animal examined (%)	Positive (%)	Negative (%)	Pearson chi square (X^2)	P-value
Sheep	446(42.08%)	422 (94.62%)	24(5.38%)	1.5176	0.218
Goats	614(57.92%)	564 (91.86%)	50(8.14%)		
Total	1060(100%)	986(93.02%)	74(6.98 %)		

Table 2: Prevalence of ectoparasites on small ruminants by woredas in selected districts of Afar regional state.

Woreda	Number of examined shoat	Positive	Negative	Pearson chi square (X^2)	P-value
Yalo	206(19.43%)	198 (96.12%)	8(3.88%)	5.0931	0.165
Gulina	258(24.34%)	241(93.80%)	16(6.15%)		
Aura	224(21.13%)	212(94.64%)	12(5.36%)		
Ewa	372 (35.09%)	334 (89.78%)	38(10.22%)		
Total	**1060(100%)**	**986 (93.02%)**	**74(6.98%)**		

Table 3: Prevalence of ectoparasites on small ruminants by sex, age and body condition in selected districts of Afar regional state.

Risk factors		Sheep (n=446)			Goats(n=614)		
		Total examined	Positive (%)	chi square (P-value)	Total examined	Positive (%)	chi square (P-value)
Sex	Female	384	36(94.79%)	0.0810 (0.776)	564	516 (91.49%)	0.6246 (0.429)
	Male	62	58 (93.55%)		50	48(96 %)	
Age	Adult	324	314 (96.91%)	6.1250 (0.013)	454	426 (93.83%)	4.5468 (0.033)
	Young	122	108(88.52%)		160	138 (86.25%)	
BCS*	Good	102	90(88.24%)	5.2970 (0.071)	178	170 (95.51%)	2.2772 (0.320)
	Medium	166	160(96.39%)		258	234 (90.70%)	
	Poor	178	172(96.63%)		178	160(89.89%)	

- BCS= Body condition score

Table 5: Prevalence of small ruminant ectoparasites on diazinon applied and non-applied in selected districts of Afar regional state

Diazinon applied	Total animal examined	Positive (%)	Negative (%)	Pearson chi square (X^2)	P-value
Yes	412 (38.87%)	378 (91.75%)	34(8.25%)	0.8387	0.360
No	648 (61.13)	608(93.83%)	40(6.17%)		
Total	1060 (100%)	986 (93.02%)	74 (6.98%)		

Table 6: Ectoparasites prevalence in small ruminants in selected districts of Afar regional state.

Ectoparasites	Sheep (n= 446)		Goat (n=614)		Total (n= 530)	
	Number of infested	Prevalence	Number of infested	Prevalence	Number of infested	Prevalence
Tick	404	90.58%	558	90.88%	962	90.75%
Lice	52	11.66%	18	2.93%	64	6.41%
Demodex	-	-	4	0.65%	4	0.65%
Total	424		580		1030	

Table 7: Ectoparasites prevalence in small ruminants by etiology in selected districts of Afar regional state

Etiology	Sheep (n=446)		Goat (n=614)		Total (n= 1060)	
	Number of infested	Prevalence	Number of infested	Prevalence	Number of infested	Prevalence
Tick	372	87.74%	540	96.09%	912	92.49%
Lice	20	4.72%	4	0.71%	24	2.43%
Tick and lice	32	7.55%	14	2.49%	46	4.67%
Tick and Demodex	0	-	4	0.71%	4	0.41%
total	424		843		986	
				Pearson chi2(3) = 17.0047 Pr = 0.001		

Table 8: Identified genera of ectoparasites and their corresponding prevalence in goats and sheep examined in selected districts of Afar regional state

Ectoparasite	**Total**	**Sheep**	**Goats**	**Ground***
Tick	970	412	554	4
- *Rhipicephalus*	562	224	336	2
- Amblyomma	94	46	46	2
- *Hyalomma*	132	76	56	
- *Boophilus*	178	62	116	
- *Haemaphsalis*	2	2	-	
Lice	56	42	14	
- Sucking lice	44	32	12	
- Biting lice	12	10	1	
Demodex	2		2	

***Ground** means watering point, grazing area and barn.

The IISTE is a pioneer in the Open-Access hosting service and academic event management. The aim of the firm is Accelerating Global Knowledge Sharing.

More information about the firm can be found on the homepage:
http://www.iiste.org

CALL FOR JOURNAL PAPERS

There are more than 30 peer-reviewed academic journals hosted under the hosting platform.

Prospective authors of journals can find the submission instruction on the following page: http://www.iiste.org/journals/ All the journals articles are available online to the readers all over the world without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. Paper version of the journals is also available upon request of readers and authors.

MORE RESOURCES

Book publication information: http://www.iiste.org/book/

Academic conference: http://www.iiste.org/conference/upcoming-conferences-call-for-paper/

IISTE Knowledge Sharing Partners

EBSCO, Index Copernicus, Ulrich's Periodicals Directory, JournalTOCS, PKP Open Archives Harvester, Bielefeld Academic Search Engine, Elektronische Zeitschriftenbibliothek EZB, Open J-Gate, OCLC WorldCat, Universe Digtial Library , NewJour, Google Scholar