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Full Length Research Paper

A cross-sectional study on the prevalence of ectoparasite of sheep and the effectiveness of control in Tiyo and Diksis districts

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A cross-sectional study was conducted from November 2013 to July 2014 with the objectives to determine the prevalence of ectoparasite of sheep in the Tiyo and Diksis districts, determine the effectiveness of control program against sheep ectoparasites in the study area and major risk factors associated with effectiveness of control program. A total of 646 sheep (323 from each districts) were examined for the presence of ectoparasites. From the total sheep examined, 371 (57.43%) were infested with one or more ectoparasites. The ectoparasites identified were lice 49.23%, sheep keds 7.4%, tick 9.75% and mixed infestation 8.98%. Favorable climatic conditions, poor husbandry and animal management, lack of awareness by the farmers, and weak animal health extension services are believed to have contributed for widespread distribution and occurrences of ectoparasites. Even if control campaign is practiced in the study areas, higher prevalence of sheep ectoparasite was recorded. The growing threat of ectoparasites to small ruminant production and the tanning industry needs well-coordinated, appropriate and urgent control intervention.

Key words: Control program, ectoparasites, prevalence, sheep, Tiyo/Diksis.

INTRODUCTION

Ethiopia is currently considered among the largest livestock producer and biggest exporter of livestock in Africa (CSA, 2012). Small ruminants represent the most important part of the Ethiopian livestock system; about 24.2 million sheep are estimated to be found in the country (CSA 2012). In Ethiopia, sheep is reared in all agro climatic zones. The highland area comprises 70% of the sheep, while the lowland pastoral and agro pastoral area have 30% of the sheep population (Degume, 2002). Agriculture is the mainstay of the Ethiopian economy. It employs over 80% of the adult population and account for 45% of the GDP and 85% of the export earnings

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Livestock production performs several functions primarily as source of household incomes, food and animal drought power for livestock producers (UNECA, 2012). However, the current levels of contributions of sheep in Ethiopia, either the macro or micro level is below the expected potential. Among major constraints hindering the productivity of sheep in the country are diseases, among which sheep skin diseases caused by ectoparasites accounts a wide range of health problems that confront the productivity. Ectoparasites are very common and widely distributed in all agro-ecological zones in Ethiopia (Berhanu et al., 2007; Kumsa et al*.,* 2012; Yacob 2014).

Parasitic diseases caused by helminths and arthropods are among the major diseases of sheep causing serious economic loss to small holder farmer, the tanning industry throughout the globe (Singla, 1995; Mulugeta et al., 2010; Kumsa et al., 2012). Skin diseases cause mortality, decreased production and reproduction; in addition to these, currently skin diseases affecting the tanning industry very seriously causing enormous down grading and rejection of skins and hides (Bayou, 1998; ESGPIP, 2010; Yacob, 2013). It is reported that 35% of sheep skin rejections in Ethiopia are attributed to ectoparasites (Bayou, 1998; Kassa, 2005). All these established facts imply that ectoparasites pose serious economic losses to the farmer, the tanning industry and the country as a whole (Berhanu et al. 2007; Chanie, et al. 2010). In many part of the Ethiopia, skin diseases due to ectoparasite have prevented many farmers from keeping sheep and becoming serious threat to sheep production (Demissie et al., 2000; Asnake et al., 2013; Yacob, 2014).

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; Yacob, 2014).

Despite the large population of sheep in the region and national and regional efforts and emphasis given to the control programs against ectoparasites, ectoparasites are also among serious problems in Arsi zone of Oromiya region (Hailu, 2010). Even control program against ectoparasites in the study areas started, the effectiveness of control campaign on the status of ectoparasite infestation on sheep was not yet studied. Therefore, the present study was conducted with the objective to determine the prevalence of ectoparasites and to define the effectiveness of control program by studying major risk factors associated with the effectiveness of control program against sheep ectoparasites.

MATERIALS AND METHODS

Study area and population

A cross-sectional study was employed from November 2013 to July 2014 to address the objectives of the study. The study area is found in the central part of the Oromiya Regional State, astronomically lies between 60 45’ N to 80 58‘N and 380 32’ E to 400 50’ E. The mean annual temperature of the study area is found between 20 and 25°C in the low land and 10 and 15°C in the central high land with the mean annual rainfall varying from 633.7 to 1059.3 mm. The production system implemented in the study area is mixed crop livestock. According to CSA (2012), the study areas contain a total population of cattle 2,295,138, sheep 1,207,182, goats 653,327, Equines 593,272, poultry 1,449,583 and 94,456 beehives.

Sampling method and sample size determination

The study involves districts, peasant associations (PAs) and sheep as a sampling unit. The study districts were selected purposively based on their history of representation of ectoparasite controlled area; five PAs from each district were also selected randomly with corresponding control status. Sheep found in selected PAs were included in the study randomly from animals grazing in communal pastures.

The required sample size was determined as described by Thrusfield (2007). The expected prevalence of ectoparasite was taken from previous work of Hailu in the area before initiation of control program was 70% and by setting 95% confidence level and 5% desired level of precision. Hence, 646 sheep were sampled from the study districts, 323 sheep were included in the study from each district.

Clinical examinations

A total of 646 sheep randomly selected from the study districts were clinically examined for presences of ectoparasites and/or lesions. Before clinical examination, the sex, age, body condition and management of the selected sheep was recorded. Body condition score (poor and good) and age categorization of the animal was made by modifying the system described by Gatenby (1991). Sheep up to 1 year of age were categorized as young and older than 1 year of age as adult.

The clinical examination was performed by multiple fleeces parting in the direction opposite that in which hair or wool normally rests and visual inspection and palpation of the skin for parasites and/or lesion on all parts of the animals including the ears and the digits. Those sheep found infested by ectoparasites were considered as positive.

Sample collection

Sheep keds, ticks and lice were collected manually from their sites of attachment. The ticks were removed from the host skins whilst retaining their mouth parts for identification using forceps. Coat brushing techniques were used for collection of lice (Soulsby, 1982; Walker et al., 2003). They were placed in labeled bottles containing 70% ethanol. Samples were processed as per the standard

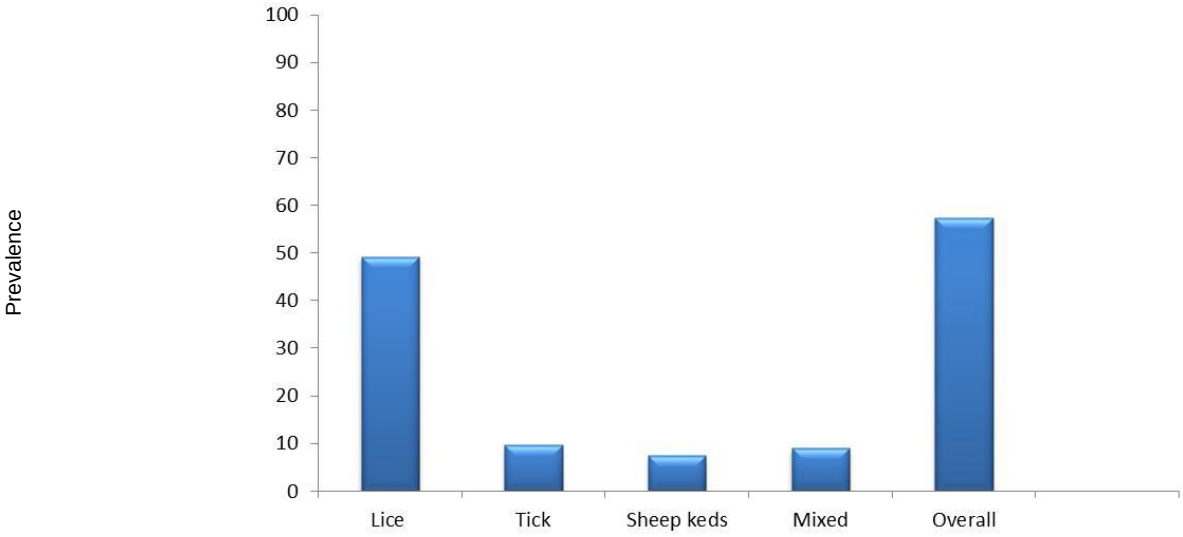

Figure 1. Prevalence of lice, tick, sheep keds in the study area.

Table 1. Frequencies and percentages of ectoparasites identified.

Ectoparasite group	Frequency	Prevalence (%)
Lice	318	49.23
ticks	63	9.75
Sheep ked	48	7.4
Mixed infection	58	8.98
Overall	371	57.43

procedure (Gupta and Singla, 2012) and identified under a stereoscopic microscope (Urquhart et al., 1996; Wall and Sheare, 2001).

Data analysis

Raw data was carefully recorded and stored in Microsoft Excel database system used for data management. Statistical software package SPSS version 20.0 was used for data analysis. Descriptive statistics and percentages were used to summarize the proportion of infested and non-infested animals. The effects of different environmental, managemental and host risk factors were analyzed by regression and $\chi 2$ test. Statistical significance was set at $p \leq 0.05$.

RESULTS

Overall prevalence

Out of 646 sheep examined from the study districts 371 (57.43%) were infested with one or more ectoparasites.

The major ectoparasites identified on sheep were lice (49.23%), ticks (9.75%), sheep keds (7.4%) and (8.98%) mixed infestation (Table 1 and Figure 1).

Sex wise prevalence

The overall prevalence of ectoparasite in female and male was 63.11 and 44.4%, respectively (Table 2). Statistically significant variation in the overall prevalence of ectoparasites was recorded between male and female sheep of the study districts (OR= 0.455, p=0.000). Likewise significant difference on the prevalence of lice was also recorded between ram and ewe of the study area (OR= 0.567, p=0.000)

Age wise prevalence

The overall prevalence of ectoparasite in young and adult sheep was 56.9 and 57.8% (Table 3). Difference was

Table 2. Prevalence of ectoparasites in sheep by sex.

Ectoparasite type	Sex		P value
	Ram (n=196)	Ewe (n=450)	
Lice	38.78 (76)	53.8(242)	0.000
Sheep ked	9.7 (19)	6.4(29)	0.421
Ticks infestation	8.2 (16)	10.4 (47)	0.127
Overall	44.4 (87)	63.11 (284)	0.000

Table 3. Prevalence of ectoparasite in sheep by age.

Ectoparasite	Age	
	Young (n=267)	Adult (n=379)
Lice	49.1 (131)	49.3 (187)
Ticks	10.1 (27)	9.5 (36)
Sheep keds	7.5 (20)	7.4 (28)
Overall	56.9 (152)	57.8 (219)

Table 4. Prevalence of ectoparasite in sheep by body condition.

Ectoparasite	Body condition	
	Poor (n=363)	Good (n=283)
Lice	48.5 (176)	50.2 (142)
Sheep ked	7.7 (28)	7.1 (20)
Ticks	9.1 (33)	10.6 (30)
Overall	56.7 (206)	58.3 (165)

seen to be statistically insignificant (p>0.05) in the overall prevalence of ectoparasite infestations between young and adult sheep of the study area.

Body condition based prevalence

The overall prevalence of ectoparasites in good and poor body condition sheep were 58.3 and 56.7%, respectively (Table 4). Prevalence of ectoparasite infestations (p>0.05) between sheep with poor and good body condition did not show statistically significant difference.

Management based prevalence

The overall prevalence of ectoparasites in sheep reared separately and sheep reared with other animals were 43.5 and 79.3%, respectively (Table 5). Statistically significant variation in the overall prevalence of ectoparasites was recorded between sheep reared separately and sheep reared together with other species of animals in the study districts (OR= 0.015, p=0.000); higher in the sheep reared together with other species of animals than reared separately. Similarly significant difference on the prevalence of lice and tick were also recorded between sheep reared separately and those reared with other animal species, respectively (OR= 0.493, p=0.002) (OR=0.732, p=0.000). The prevalence of lice and tick infestation was significantly higher in sheep reared together with other animal species than sheep reared separately.

DISCUSSION

The results of the present study revealed an overall prevalence of 57.43% of sheep ectoparasites in the study area, which are in agreement with the previous reports from different parts of the country (Tefera, 2004; Yacobet

Table 5. Prevalence of ectoparasites in sheep reared separately and reared with other species of animals.

Ectoparasite	Management		P value
	Sheep reared separately (n=395)	Sheep reared with other animals (n=251)	
Lice	37.2 (147)	68.12 (171)	0.000
Sheep ked	45.8 (n=22)	54.2 (n=26)	0.346
Tick	33.33 (n=21)	66.67 (n=42)	0.002
Overall	172 (n=43.5)	199 (n=79.3)	0.000

al., 2008; Hailu, 2010; Mulugeta et al., 2010; Rahmeto et al., 2011; Asmare et al., 2012; Dawit et al., 2012; Shibeshi et al., 2013; Tewodros et al., 2012: Taddese et al., 2013). The higher prevalence rate is attributable to several important factors including management problems, conducive environment, malnutrition and poor husbandry systems, poor awareness of farmers and inadequate veterinary services in the study districts (Pegram et al., 1981; Mekonnen et al., 2001; Mekonnen et al., 2007).

Even though control campaign was implemented in the study area, the prevalence of ectoparasite was as high as the areas where control campaign was not under implementation. Among the factors which might be responsible for high prevalence of ectoparasite in the study area were the type of acaricides in use and method of acaricides application (spray).

Development of acaricide resistance in ectoparasites is reported worldwide, wherever acaricides are in use. 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). Spraying method may not expose ectoparasites found in the inner parts of the ear, under part of the tail, the tail brush and the areas between the teat and the interdigital space to the acaricides and also liquid acaricide might not reach the base of the skin in wooly sheep, hence, ectoparasite may escape treatment and stay alive to induce re-infestation.

Some species of ectoparasite such as tick spend more time off the host and can exist for a very long period of time without feeding. 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) . Also contaminated bedding and farm equipment's with lice and fleas can perpetuate the re-infestation of the flocks (ESGPIP, 2010). However, in the study areas, the control campaign only focus on the application of the acaricides (diazinon) on the sheep only, but no more application of environmental control of the ectoparasites on house and bedding or farm equipment; hence the free living stages and those found in the bedding may be responsible for the occurrence of high prevalence of sheep ectoparasite of the study areas.

Government control measures, such as depopulation of affected animals, quarantines and movement restrictions, may reduce disease transmission and losses due to disease (Daniel et al., 2006). In Ethiopia, there is no policy which restricts free movement of animals from one place to the other. Hence, infested sheep may introduce into the study areas from other areas (neighboring districts or zones) during marketing of sheep, searching of food and water.

Quarantine is the best method of ectoparasites control. It is used to isolate animals when they are introduced from other area to new area; treatment and follow up should be carried out if the animal is infested (Thrusfeild, 2007). However, knowledge of the farmers on quarantine and treating of newly introduced animal is negligible.

As a fact that ectoparasite are most often introduced to herds by bringing in infested animals (Kufman et al., 2012). Therefore, ectoparasite might be introduced to the controlled area. Actions the USDA takes to minimize the risk of disease introduction are driven by the awareness that animal health is a public good (Daniel et al., 2006). The awareness of farmers of the study areas regarding to transmission of ectoparasite, host range and management of animal is minor.

Therefore, the farmer's rear and house different age group and different species of animals together, hence, such condition may favor the transmission of ectoparasites which are characterized by infesting different species of animals.

Among the ectoparasites known to infesting wide range of domestic animals ticks and lice are the principal one; so in the study area, control campaign is implemented only on sheep but the rest species of animal remains untreated. Hence, untreated animals can also serve as a source for the re-infestation of sheep following spraying acaricides by transmitting ectoparasite through direct contact with sheep or by contaminating the environments (pasture, house and bedding or farm equipment).

CONCLUSION AND RECOMMENDATIONS

This study was conducted to identify the major ecto-parasites prevalence, effectiveness of control campaign and associated risk factors of effectiveness of control strategy on sheep of the study districts. Even though control campaign is implemented, ectoparasites infestation is still among the major causes of sheep production constraints and quality deteriorations of exported skin in the study areas. Among the major possible reason of finding high prevalence of ectoparasite infestation, following acaricide spraying are proper formulation and application of acaricides, awareness of the farmer on the transmission of ectoparasite and quarantine of newly introduced animal, unavailability of policy which restricts free animals movement from one place to the other. 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. Based on findings, one can clearly conclude that even though control campaignwere implemented, several species of ticks, lice, and sheep keds represent common health and productivity problems of sheep. Therefore, control programs should be designed and implemented with the participation of all stakeholders (farmers, tanners, and government and policy makers) and there should be strong coordination between neighboring regions and/or districts with strict follow up and control, strategic and appropriate application of acaricides (dipping than spraying) during control campaign for effective ectoparasite control is required, effective extension system and programs that could raise public awareness on management of animals, effect of ecto-parasites and control methods should be implemented.

Conflict of Interests

The authors have not declared any conflict of interests.

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