



Questionnaire Survey on Ectoparasites Challenges and Impact of Ectoparasites Control Campaign Conducted in Welkait, Tigray Region, Ethiopia

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Authors' contributions

This work was carried out in collaboration among all authors. Author LB designed the study, data collection, data entry, performed the statistical analysis and wrote the first draft of the manuscript.

Author BA designed the study and managed the analyses of the study. Author EK participated in designing of the study and editing the manuscript. Author HKB participated in the editing of the paper. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JAERI/2019/v19i430090

Editor(s):

(1) Prof. Ozdal Gokdal, Adnan Menderes University, Çine Vocational School, Turkey.

Reviewers:

(1) Wafaa Abd El-Ghany Abd El-Ghany, Cairo University, Egypt.

(2) Mamdouh Yousif Elgendy, National Research Centre, Egypt.

Complete Peer review History: <http://www.sdiarticle4.com/review-history/51496>

Original Research Article

Received 11 July 2019
Accepted 13 September 2019
Published 27 September 2019

ABSTRACT

A cross-sectional survey study was conducted from November 2015 to May 2016 in Welkait district Western part of Tigray Region. A total of 120 small ruminant owners were interviewed using semi-structured questionnaire. The survey was focus on husbandry system, awareness status of animal owners on ectoparasites and their effect, treatment approaches and an assessment on the implementation and impact of ectoparasites control intervention practiced in the study district. The current assessment showed that the production system practiced in the study area is mixed production with (31.67%) owners managed their sheep and goats independently in their own house whereas (62.5%) had been kept their sheep and goats together with other domestic animal including dog and cat. With regard to the knowledge of ectoparasites species, (100%) of the respondents clearly indicate that they knew one or more ectoparasites that affect sheep and goats. During the survey, the veterinary service delivery and the free charge governmental ectoparasites

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control campaign conducted was assessed. According to the response of (89.61%) respondents reported that modern veterinary service delivery had in their nearby but; the rest did not have any service. Out of 120 interviewed, (98.33%) respondents knew the free charge governmental ectoparasites control program conducted from 2012 to 2015. From the total 120 intertwined individual, (94.17%) small ruminant owners sprayed/dipped their sheep and goats one or more times at different interval using acaricides (diazinone 60%). From (94.17%) respondents which had sprayed/dipped their sheep and goats, (88.49%) were used knapsack spraying option whereas (4.42%) disinfected by dipping. During the survey the interval of treatment applied was assessed. According the response (70.00%) interviewed individuals, they were treated their sheep and goats at two week interval whereas (25.00%) and (5.00%) of the respondent provided and treated their small ruminants at three and four week interval respectively. As indicated by (96.5%) respondents, there was re-infestation of ectoparasites after the control campaign. Based on these findings, designing and implementing proper annual chemical control, develop clear animal movement policy and strict quarantine, creating awareness and better management practice should be implemented.

Keywords: *External parasites; goat; prevalence; sheep; Welkait.*

1. INTRODUCTION

In Ethiopia, agriculture contributes to the livelihood of an estimated 80% of the rural population and accounts for 45% gross domestic product (GDP) and 85% of the export earnings [1]. In addition livestock subsector currently contributes about 16.5% of the national Gross Domestic Product (GDP), 35.6% of the agricultural GDP, 15% of export earnings and provides employment to over 30% of the agricultural labor force [2,3]. Ethiopia is generously endowed with livestock resources that put the country rank first in Africa with estimated 54 million cattle, 29.33 million sheep and 39.6 million goats population [4]. Majority cattle population are local breeds managed under extensive production system and the remaining few are hybrid and exotic breeds in urban and semi-urban area [4]. Sheep and goats have high fertility, short generation interval and adaptation even in harsh environments, and considered as an investment and insurance to provide income for the purchase of food during seasons of crop failure [5]. In Ethiopia, sheep and goats providing 25% of meat consumption, about half of the domestic wool requirements and 92% of the value of semi-processed skin and hide export trade. They also play an important role by providing export commodities such as live animals, meat and skins to earn foreign exchange to the country. Sheep and goats skins rank among the largest export commodities in the country and Ethiopia earning significant foreign currency by exporting skins and hides [6,7].

The productivity of small ruminants is constrained by many factors, among which,

traditional husbandry practices, availability of poor quality and quantity feed and the presence of endemic and epidemic diseases are the major ones [8]. Among the many factors skin diseases caused by lice, keds, ticks, and mange mites are the major diseases of sheep and goats causing serious economic loss to small holder farmer, the tanning industry and the country as a whole. Skin diseases cause animal mortality, decreased production and reproduction. In addition to these, currently skin diseases affecting the tanning industry seriously by down grading and rejection of skins and hides [9,10]. It was reported that 35% of sheep skin rejections in Ethiopia are attributed to ectoparasites [11]. All these established facts imply that ectoparasites pose serious economic losses to the farmer, and the tanning industry as well as the country as a whole [12].

To reduce the economic losses due to ectoparasites on small ruminants, the Ministry of Agriculture and Rural Development of Ethiopia designed treatment and control campaign program against ectoparasites in 2005 and launched in Tigray, Amhara and Afar regions in the past from 2006 to 2008 [5]. During the campaign program a number of sheep and goats were treated using spraying and dipping majorly using organophosphates (Diazinon 60%) and in fewer cases using Ivermectin in Tigray Region. This campaign addressed all peasant associations in the region with the objective of reduction of the prevalence of all ectoparasites from 55% to 2-3%. During the campaign program an average of 99%, 85.5% and 63.7% sheep and goats were treated from the target population in the first, second and third round respectively in the three implementation years [13]. The control

and treatment campaign resulted in the reduction of ectoparasites infestation by 29.9%, 18.9% and 10.6% in the 1st, 2nd and 3rd implementation years respectively and costs 10.8 million birr. However, the interaction was interrupted due to lack of integration among stakeholders, neighboring regions and shortage of budget. As a result there was high re-infestation (73%) of sheep and goats to ectoparasites. In 2009 a field assessment based on clinical examination was made in 17 districts of Tigray region and 899 sheep and goats were randomly examined for the presence of ectoparasites, of which 817(90.9%) were found to be positive in which 657(73.08%) for lice, 290(32.3%) for ticks, 130(14.5%) for sheep ked, 39 (4.3%) for fleas and 29 (3.2%) for sarcoptic mange [14]. The control program again started in 2012 in Tigray with the objective of awareness creation and expected output of major ectoparasites prevalence reduction below 10% excluding ticks as well as with clear plan with four round chemical treatments per year at two week interval for four consecutive years [14]. The second control campaign program was accomplished in 2015 in the study district. Despite such long term intervention conducted in the study district, the impact and implementation of this control program was not yet studied, the object of this survey study was to evaluate the impact of the control campaign and its implementation, assess awareness status of farmers about the effect of ectoparasites and their control, this data is important because the outcome contribute to make an objective decision on ectoparasites control strategy.

2. MATERIALS AND METHODS

2.1 Study Area

This study was conducted in Welkait district. The district is found in Western Zone of Tigray region boarded by Tselemti east, Tahtay Adiabo north, Asgede Tsimbla north eastern, Kafta Humera north and north western, Tsegede south and south western districts. Welkait district have three agro-ecological zones which constitutes 3% highland, 37% midland and 60% lowlands areas. The district is found 437 km away from central city of Tigray Regional State and 1220 km far from Addis Ababa. This area lies in the ranges 677-2755 meter above sea level with the annual temperature and rainfall of 17.5-25°C and 700-1800 mm respectively. The district has a total human population of 163,939 consisting of 83,129 men and 80,810 women from the total

population urban inhabitant's number is 14,843 which accounts 9.1% of the total population and total an estimated area of 3811.18 square kilometers. According to [4], the district has about 444,013 cattle, 1,910 sheep, 365,967 goats, 21,753 donkeys, 24 horse, 553 mule, 2,445 camels and 406,899 poultry population. Tekeze River found in the Eastern part of the district and bounded 4,882 k.m. with Zarema, Kaza, Ruwasa and Kalem are the four big rivers that have many tributaries in the district. The vegetation covers of the district is 86,180 hectare from this 4,960 hectares areas are covered by incense tree distributed specially along the big river Tekeze and in low land kebelles. The soil types of the district categories in six groups as chronic soil (181.55 km²), Cromic vertisol (277.1 km²), Dystric combisoils (649.5 km²), Eutric nitosol (987 km²), articulvi soil (225.9 km²) and Eutric combi soil (1,492.7 km²) [15].

2.2 Sample Size Determination and Sampling Technique

Since there was no previous report on survey assessments from Welkait district on ectoparasites of small ruminants and farmers awareness status, sample size was determined based of the formula described by [16].

$$N = 0.25 / SE^2 \\ 0.25 / 0.025^2 = 100$$

Where, N=required sample size, SE=Standard Error (5%) at 5% precision and 95% confidence level. Accordingly, a total of 100 respondents were included; however, to increase the precision of the study 120 individuals was interviewed.

2.3 Study Design

A cross sectional study was conducted from November 2015 to May 2016 and multi-stage sampling procedure (purposive and random) was applied to recruit the study districts. First the eighteen PAs of the study district grouped in to in three according to the agro- ecological zone as highland, midland and lowland and then nine PAs were selected purposively based on their transportation access. Semi-structured questionnaire format was prepared and introduced to address the objective of this study. The survey was focus on husbandry system, awareness level of small ruminant owners on ectoparasites and their effect, seasonal variation in prevalence of the different ectoparasites,

treatment approach to alleviate ectoparasites infestation and assess the implementation and impact of the long term ectoparasites control intervention practiced. Regarding general information on the national and regional ectoparasites control intervention conducted in the districts data was gathered from Welkait district bureau of agriculture and rural development. A total of 120 sheep and goat owners were selected from nine peasant associations and thus individuals were interviewed from different localities: 40 respondents were taken from midland, 40 from highland areas and the rest 40 were from inhabitants of lowland area.

2.4 Study Population

The study was conducted on 120 small ruminant holders which rear their animals under extensive production system in which most of those were participated in free charge governmental ectoparasites control campaign practiced in study district.

2.5 Data Management and Analysis

The collected raw data was entered into Microsoft Excel data sheets and analyzed using SPSS statistical software (SPSS version 20) and prevalence or percentages of the data was summarized by dividing positive/negative samples for the total interviewed.

3. RESULTS

The survey was administered to 120 house hold which comprised 115/120 (95.8%) male and 5/120 (4.2%) female participants. The education status of interviewed individuals indicated that 55/120(45.8) were illiterates, 38/120(31.7) literate, 19/120(15.8) had elementary school's education and 2/120(1.7%) had completed secondary school. Out of the total 120 interviewed 106/120(88.3%) were married, 8/120(6.7%), 4/120(3.3%) and 2/120(1.7%) single, divorced and widowed respectively (Table 1).

The current assessment had showed that the majority of the production system is mixed production with 38/120(31.67%) respondents managed their sheep and goats independently in their own shelter/ house, 7/120(5.83%) reared by mixed sheep and goats together and according to the response of 75/120 (62.5%) sheep and goats had been kept together with other

domestic animal including dog and cat. Similarly, the current assessment indicated that there was constant mixing of sheep and goats with other domestic animals from neighbor Kebeles, District and Region. These animals were mixed in different areas such as grazing, watering points, market place, and vaccination sites, during dipping or spraying as indicated by 105/120 (87.5%) respondents. With regard to the knowledge of the animal owners on the existed type of ectoparasites genera that affect small ruminants, 120/120(100%) clearly indicate that they knew one or more ectoparasites that affect sheep and goats of which 80/120(66.67%) of the interviewed individuals knew lice, tick, flea and mange as ectoparasites of sheep and goats and 40/120(33.33%) tick, lice and flea were listed as common ectoparasites of sheep and goats but, (33.33%) of the respondent did not have knowledge on mange mite. During the interview, the animal owners explained that ectoparasites were serious problem which affect sheep and goats production and productivity. From the total interviewed individual 120/120(100.00%) respondents replied that ectoparasites cause emaciation, stunted growth, itching, poor skin quality and even death in case of heavy infestation within and after the control campaign. Additionally all of them replied that ectoparasites and more of ticks affected production and productivity of sheep and goats through blood sucking, disturbance of sheep and goats during feeding, hair removing and increase breeding interval in the study area (Table 2).

Table 1. Demographic characteristic of the interviewee

Demographic factors	No of respondent (%)
Sex	
Male	115/120(95.8%)
Female	5/120(4.2%)
Educational status	
Illiterate	55/120(45.8)
Read and write	38/120(31.7)
Primary school	19/120(15.8)
Secondary school	8/120(6.7)
Marital status	
Single	8/120(6.7%)
Married	106/120(88.3%)
Divorced	4/120(3.3%)
Widowed	2/120(1.7%)

During the survey the veterinary service delivery and the free charge governmental ectoparasites control program practiced were assessed.

According to the response of 107/120(89.61%) respondent, there had modern veterinary service delivery in their nearby and 13/120(10.83%) did not had modern veterinary service delivery. Out of the total 120 interviewed individuals 118/120(98.33%) respondents had the knowledge of the free charge governmental ectoparasites control program in past four successive years from 2012 to 2015. According the response of the intertwined individual 113/120(94.17%) of the respondents sprayed/dipped their sheep and goats one or more times at different interval and 100/120(83.33%) of the respondents did not use other treatment option rather than spraying or dipping using acaricides whereas 20/120(16.67%) were washing with clean water as treatment option (Table 3).

Concerning the method of acaricidal application during the campaign program out of the 113/120(94.17%) respondents in (Table 3) which had sprayed/dipped their sheep and goats during the ectoparasites treatment and control intervention, 100/113(88.49%) were used knapsack spraying whereas 5/113(4.42%) disinfected their sheep and goats by dipping and 8/113(7.07%) were used both options. During the

survey the interval of treatment was assessed. According the response of interviewed individuals 70/100(70.00%) animal owners were treated their sheep and goats at two week interval whereas 25/100(25.00%) and 5/100(5.00%) of the respondent provided and treated their small ruminants at three and four week interval respectively. An assessment on the level of re-infestation after treated their sheep and goats indicated that there was re-infestation following dipping/spraying as explained by 109/113(96.5%) respondents. Considering the effectiveness of the treatment option 46/113(40.7%) said spraying is more effective than dipping and 66/113(58.4%) indicated dipping was better than spraying. The government long term control and treatment intervention on reduction of ectoparasites infestation and production improvement was evaluated as 64/113(56.6%) respondents responded good impact but not sustainable, 42/113(37.2%) respondent responded well whereas 7/113(6.2%) no change have been brought. From 120 interviewed sheep and goats owners 101/120(84.2%) sell skin of sheep and goats to obtain cash but they complained about the price of sheep and goats skin (Table 4).

Table 2. Awareness status small ruminant owners and production system

	No of respondent (%)
Rearing sheep and goats	
In single shelter/house	38/120(31.67%)
Mixed sheep and goats together	7/120(5.83%)
Mixed sheep and goats with other animals	75/120(62.5%)
Mixing with other domestic animals in different areas	
Mixed	105/120(87.5%)
Not mixed	15/120(12.5%)
Reponses on knowledge of ectoparasites	
Lice flea, tick and mange	80/120(66.67%)
Tick, lice and flea	40/120(33.33%)
Complain on ectoparasites problem	
Ectoparasites are still serious problem	120/120(100.00%)
Ectoparasites problem is minimized	0/120(0.00%)
Complain on type ectoparasites problem	
Lice	31/120(25.8%)
Flea	31/120(25.8%)
Tick	32/120(26.7%)
Tick, lice, mange and flea	26/120(21.7%)
Knowledge on effectiveness of treatment options	
Knapsack spraying	46/120(40.07%)
Dipping	66/120(58.4%)
They did not know	1/120(0.08%)

Table 3. Availability modern veterinary service and other alternative

	No of respondent (%)
Availability of regular veterinary service in nearby	
Available but not regular	107/120(89.61%)
Not available	13/120(10.83%)
Use of modern routine veterinary service	
They knew the program and treated	90/120(75%)
They knew the program but, did not treated	17/120(14.2%)
They did not know any program and did not treat	13/120(10.8%)
Concerning knowledge of the past free charge campaign	
They knew the free charge control campaign	118/120(98.33%)
They did not know the free charge control campaign	2/120(1.7%)
Treatment of sheep and goats during the control campaign	
They treated their sheep and goats	113/120(94.17%)
They knew the control campaign but did not treat	5/120(4.17%)
They did not know the campaign and did not treat	2/120(1.67%)
Use of other treatment option other than using chemicals	
Washing with water as treatment option	20/120(16.67%)
Did not use any treatment option other than chemical	100/120(83.33%)

Table 4. Summary of dipping/spraying activities during the control campaign

	No of respondent (%)
Round of treatment during the control program	
One times	13/113(11.50%)
Two times	24/113(21.12%)
Three times	49/113(43.36%)
Four times	27/113(23.89%)
Interval of treatment	
Two week	70/100(70.00%)
Three week	25/100(25.00%)
Four week	5/100(5.00%)
Use of treatment option during the control program	
Knapsack	100/113/ (88.49%)
Dipping	5/13(4.42%)
Both option	8/113(7.07%)
Number of small ruminants treated using 15 liters sprayer	
10-15	50/113(44.25%)
15-20	43/113(38.05%)
Above 20	20/113(17.69%)
Treatment conducted by	
trained farmers (CAHWS)	58/113(51.32%)
Sending by children	21/113(17.79%)
Small ruminants owner themselves	34/113(28.81%)
Knowledge of respondent about re-infection	
They knew about re-infection	109/113(96.46%)
Did not know about re- infection after treated	4/113(3.54%)
Response on the impact of control campaign	
good impact but not sustainable	64/113(56.6%)
well	42/113(37.2%)
no change have brought	7/113(6.2%)
Concerning use of skin of sheep and goats	
Sell to get cash income	101/120(84.2%)
Did not sell	19/120(15.8%)

4. DISCUSSION

The questionnaire survey results indicated that (89.61%) of the interviewee had availability of routine modern veterinary clinic service in their nearby and (75%) small ruminant owners were treating their sheep and goats and 113/120(94.17%) involved their sheep and goats in the free charge control campaign and (100%) had the knowledge of the existing ectoparasites of small ruminants on contrary had still (100%) complain on ectoparasites problem and (96.46%) respondents were responded there were re-infestation of ectoparasites after the treatment programs conducted. This might be due to rearing of their small ruminants in common house with other species of animals including dog and cat as reported by (61.5%) and also their small ruminates were mixed with wider range of neighbors animals as indicated by (87.5%) respondents which made possibly increase those ectoparasites problems after the control campaign. Additionally the responses of being lower used of dipping (4.42%), (11.5%) and (21.12%) used maximum of one and two times respectively chemical application during the campaign, which were out of the planned program, supports to have still higher prevalence in front of the designed campaign and supported by [17] in case of free movement and by [18,19] as spraying is not efficient.

In this study, (87.5%) of the respondents explained that sheep and goats coming in close contact in communal browsing/grazing, watering points, market place, vaccination sites, during dipping or spraying and because of the feed scarcity sheep and goats move from place to place in searching of feed and water and mixed and contact with untreated sheep and goats and other livestock animals from neighbors' Kebele, Districts and Region might be favorable condition for the re-occurrence and spread of ectoparasites to treated sheep and goats. In addition, absence of animal's movement policy from one place to the other as well as lack of knowledge about quarantine by small ruminant owners for newly introduced animals which created opportunity for the introduction of ectoparasites to the controlled area [17]. Method of acaricide application is other factor which affects the impact of the control program on reduction of sheep and goats ectoparasites infestation. According to the response (88.49%) of the interviewed individuals who involved in control campaign, spraying by knapsacks were used to apply the chemical in the study area. The

spraying equipment is portable and needs only small amounts of acaricides to be mixed for the application. Application chemical by spraying involves the manual spraying and individuals who conduct the spraying responsibility may be exhaust (tired) due to the method requires high level of energy. Therefore, formulated liquid acaricide may not be thoroughly applied to all parts of the animal body hence spraying is less efficient than the dipping method of application [18,19].

Characteristics of ectoparasites and means of breeding (life cycle) and movements are other conditions that can be considering as determinants factor for ectoparasites infestations as in case of flea [20]. Ticks are other ectoparasites that can live on the ground for up to 300 days without feeding in the environments and only spend short period of time on the host animals and re-infection of the host occurs continuously [21,22]. However, the control campaign conducted in the study area focused on the application of the acaricides (diazinon 60%) on sheep and goats' body but no more application to the environment in which sheep and goats live. Control of ectoparasites in many countries of the world becomes less reliable, due to partly development of resistance [23] which might be one reason of the study area. According the complain of small ruminant owners and the information obtained from veterinary experts of study site, sheep and goats treated using acaricides (Diaznone 60%) did not cure the infestation especially for tick during the long term ectoparasites control campaign. Round of treatment and interval between treatments can also affect the effectiveness of ectoparasites control campaign. According the response of (94.17%) who involved in free charge governmental control program, (30.00%) of the interviewee individual treated their small ruminants during the control campaign with interval between two treatment was above three weeks and (11.50%), (21.12%) and (43.36%) one, two and three times round of treatment which was out of the strategic plane, might be contribute for the highest prevalence of ectoparasites after the long term control intervention in the study sites. Louse control is difficult with just a single insecticide application, because louse eggs could not killed by accaricides. A second application is needed two weeks after the initial treatment to allow the eggs to hatch and kill the lice currently available [21], [9]. According to the general information obtained from Welkait District Bureau of Agriculture and

Rural Development, shortage of equipment's (spraying or dipping) and transportation was the major logistic problems that had encountered during the implementation of the control and treatment program, spraying small ruminants than can be sprayed, spraying animals from distance and sending of sheep and goats by children to the treatment site and engaging of farmer in other activity during the campaign might be also other important factors that contribute to an inefficacy of the control intervention practiced. Additionally, according to the response of (51.32%) the treatment campaign was conducted by trained farmers and treatment was interrupted due to unwillingness of the trained farmers because of complained on per-diem.

5. CONCLUSION AND RECOMMENDATION

From this questionnaire survey study was found that (89.61%) new availability of nearby routine modern veterinary clinic service and (75%) were treating their sheep and goats, (98.33%) owners new free charge campaign conducted and (94.17%) involved their sheep and goat in the campaign, and regardless some differences almost all had knowledge of existing ectoparasites of small ruminants on contrary had still all the interviewee complain on ectoparasites problem and most of the respondents responded that re-infestation of ectoparasites after treatment programs was occurred. The questionnaire survey analysis also showed that majority of the small ruminant owners kept their sheep and goats in common shelter with other animals and they mixed their animals with other animals in different area, they did not had regular veterinary service, enough knowledge on the effectiveness of treatment option and Lacks of awareness about the interval and round of treatment to clear all ectoparasites from the body of the animals and also they did not have clear information on the amount of solution needed to rinse all body parts of the small ruminates for effective ectoparasites control. Based on these findings, the following recommendations are made:

- To design and implement proper annual chemical control campaign in relation to the efficiency of periodic interval, increased frequency of application and address efficient chemical application method to reduce the burden of ectoparasites by the responsible agricultural extension services.

- To develop clear animal movement policy and quarantine should be implemented for new animals before they join the main flock.
- Creating awareness should be practiced among animal owners on the issue of effective ectoparasites controlling measures and better animal management activities.

ACKNOWLEDGEMENTS

We would like to say thank Mr. Dawit Tesfay, Hadush Mengesha, Kirors Gebrihiwet, Mr. Tesfy Mamay, Mr. Rtbe G/hiwet and Mr. Fkadu Chaklu for their support in data collection. We also thank Welkait district Bureau of Agriculture and Natural Resource for its financial and transport support.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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