



Study on infestation level of GIT parasites of sheep and antihelminthic drug resistance in Horro District communitybased sheep breeding program

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Abstract

Parasites pose a major threat to animal health and welfare globally, with a greater impact in Africa, particularly Ethiopia, due to diverse agro-ecological factors that support various hosts and helminths. This experiment aimed to estimate parasite infestation levels, identify associated risk factors, and detect anthelmintic drug resistance. Fecal sedimentation and flotation techniques were used to identify trematode and nematode eggs, respectively. Two drugs, Albenda-qk 600 mg and Flukash Sheep (Oxyclozanide 340 mg), were tested for resistance, and associated risk factors were analyzed using STATA (version 13). Results showed nematode and trematode prevalence of 66% and 29% pre-treatment, dropping to 7% and 3% post-treatment. Multivariable logistic regression revealed that age and deworming timing were significantly associated with parasite positivity ($P < 0.05$). Despite significant reductions in parasite prevalence post-treatment, some sheep flocks exhibited resistance. To prevent further development of anthelmintic resistance, the following practices are recommended: avoid frequent or unnecessary treatments, apply strategic and integrated drug use, ensure proper dosages, rotate anthelmintic drugs, and regularly perform efficacy tests.

Keywords: Antihelminthic drug resistance, gastro-intestinal parasite, prevalence, risk factors,

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Introduction

Among many diseases that affect small ruminant, gastrointestinal parasites are a major concern in Ethiopia. Gastrointestinal parasites are a worldwide issue in livestock as well as in agricultural sector, causing significant economic losses. Parasites remain a major threat to the health and welfare of animals all over the globe. Infections with gastrointestinal helminthes have a severe impact on animal health (Luscher *et al.*, 2005). Economic losses associated with parasites occur due to morbidity, mortality, and reduced feed conversion rate (FCR), decreased production efficiency, reduced weight gain, stunted growth, decreased fertility and treatment costs (Perry and Randolph, 1999). Thus, the economic impact of these parasites on the livestock industry substantial. The impact is greater in Africa in general and Ethiopia in particular due to the availability of a wide range of agro-ecological factors suitable for

diversified hosts and types of Helminthes (Sahoo *et al.*, 2002; Nitin *et al.*, 2011).

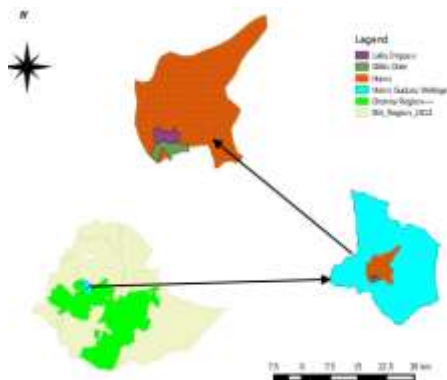
Therefore, the strategic control of parasites is essential to minimize the production losses by reducing transmission of parasites and sustaining reproduction and optimal livestock productivity, but, total dependence on a single method of control has been shown to be unsustainable and cost ineffective in the long term (FAO, 2001; Maqbool *et al.*, 2017). A combination of treatment and management is necessary to control parasitism and prevent economic losses for producers (Scarfe, 1993; Maqbool *et al.*, 2017). Hence, in order to become practically and ecologically sustainable, parasitic control schemes need to be based on strategic and integrated approaches (Waller, 1993; Maqbool *et al.*, 2016). However, nowadays anthelmintic efficacy against nematodes is declining due to rise of parasitic resistance (Sarginson *et al.*, 2001). The anthelmintic resistance has been seen in almost reported in many countries, including

Ethiopia. Actually, there are factors that associated with parasitic anthelmintic resistance such as maturity stage of parasite, sexual phase of parasite, host immune response (which can be age related), infection history of the animal and worm distribution. Therefore, the objectives of the experiment were to estimate the infestation level of parasite, to know the associated risk factors and to identify the presence of anthelmintic drugs resistance in the community-based sheep breeding program of the study area.

Materials and Method

Study area

The experiment was carried out in Horro district (Gitlo-Dole and Laku-Ingu kebeles) which is found in Horro-Gudur Wollega zone of Oromia regional state, Western Ethiopia. Horro District is located at 310 km West of Addis Ababa.



Study animals

The study animals were sampled Sheep population which kept under extensive husbandry systems in the community-based sheep breeding program of Horro District and comprised history of non-dewormed animals for a minimum of 6 months length and consecutive follow up was made based their ear-tag identification number, accordingly.

Experimental designs and methods

In this study, the study population is assumed to be kept under the same management system and equal sample size was considered for the two PAs. To obtain reliable information, the same expert was conducted during pre and post deworming of laboratory fecal sample analysis. The

purpose of the study was fully explained to owners before conducting the study to have owners' agreement and understanding. On each study flock, two visits have been done. Firstly; during pre-deworming stage (before intervention) fecal samples were taken in order to identify the status of small ruminant GIT parasites in the study site. Secondly, post-deworming stage (after intervention) after three weeks fecal sample collection was conducted once again with the objective of identifying the status parasite as well as to know the impact of drugs on GIT parasites in the study area.

Sample size and anthelmintics drugs used

A total sample size of 400 fecal samples were examined during pre and post deworming stage and of the aforementioned sample size 200 samples were tested for nematode and fecal floatation technique used whereas 200 were tested for trematodes and fecal sedimentation technique used. And from each PA 100 fecal samples (50 for nematode and 50 for trematodes) were examined during pre-deworming stage. As well as from each PA 100 fecal samples (50 for nematode and 50 for trematodes) were examined during post-deworming stage. In conclusion, 200 fecal samples were taken from each PA during pre and post deworming stage, which gives a total sample size of 400. In this experimental study type of anthelmintic drugs used were ALBENDA-QK 600 mg to deworm nematode parasite and FLUKASH SHEEP (Oxyclozanide 340 mg bolus) for deworming of *Fasciola* (trematode parasite).

Data collection

Fecal sample of sheep was collected for parasitic eggs test. Therefore, from each sampled animal about 5gm of feces were collected. The collected samples were properly labeled and transported to Bako Agricultural Research Center of Animal Health Laboratory with an ice box and laboratory analysis was conducted, accordingly.

Data Analysis

The fecal sample test result data was stored on Microsoft Excel spread sheet and

analysis was done using SPSS ver. 20 and STATA (version 13) statistical softwares. GIT parasite prevalence was analyzed using SPSS ver. 20 descriptive statistics (crosstabs) while degree of associations between the outcome variable and its potential risk factors were analyzed using STATA (version 13) using logistic regression model. Microscopic feces result was considered as the dependent variable whereas the risk factors like PA, sex, age,

BCS and stage of deworming were grouped as independent variables.

Results and Discussion

The data in Table 1 highlights the prevalence of nematode parasites during the pre-deworming stage across various risk factors. Among the tested kebeles, Gitlo showed a higher prevalence rate compared to Laku.

Table 1. Prevalence of nematode parasite during pre-deworming stage

Risk factors	No Tested	No of positive	% (95% CI)
PA (kebele)			
Laku	50	31	62(0.47-0.75)
Gitlo	50	35	70(0.55-0.82)
Sex			
Female	80	53	66.2 (0.55-0.76)
Male	20	13	65(0.41-0.85)
Age			
Young	25	19	76(0.55-0.91)
Adult	75	47	62.7(0.51-0.74)
BCS			
Good	17	10	58.8(0.33-0.82)
Medium	45	30	66.7(0.51-0.80)
Poor	38	26	68.4(0.51-0.82)
Total	100	66	66(0.56-0.75)

In terms of sex, females had a slightly higher prevalence than males. Age-wise, younger animals exhibited the highest prevalence, which was notably higher than that of adults. Body condition scores (BCS) also played a role, with animals in poor condition showing the highest prevalence, followed by those with medium condition, and good condition animals having the lowest prevalence. Overall, the total prevalence of nematode parasites in the tested population was 66%, indicating that age, kebele, and body condition may significantly influence nematode infections.

Table 2 illustrates the prevalence of nematode parasites during the post-deworming stage across various risk factors. Among the kebeles, Laku showed a higher prevalence compared to Gitlo, which had a significantly lower prevalence. Regarding sex, males exhibited a higher prevalence compared to females. Age analysis revealed that younger animals had a prevalence of, notably higher than adults. Body condition scores (BCS) showed variations, with

animals in good condition having the highest prevalence, followed by medium condition, and poor condition animals showing the lowest prevalence. The overall prevalence of nematode parasites after deworming was reduced to 7%, indicating a significant decrease compared to the pre-deworming stage, although certain groups, such as young animals and males, remain more affected.

The data in Table 3 presents the prevalence of trematode parasites during the pre-deworming stage across various risk factors. Among the kebeles, Gitlo had a higher prevalence compared to Laku. Regarding sex, females exhibited a slightly higher prevalence compared to males. In terms of age, adults showed a higher prevalence than younger animals. Body condition scores (BCS) revealed variations, with animals in poor condition having the highest prevalence, followed by medium condition, and good condition animals with the lowest prevalence. The overall prevalence of trematode parasites in the

population during the pre-deworming stage was, highlighting that adult animals and those in poorer body conditions are more susceptible to trematode infections.

Table 2. Prevalence of nematode parasite during post-deworming stage

Risk factors	No Tested	No of positive	% (95% CI)
PA (kebele)			
Laku	50	5	10(0.03-0.21)
Gitlo	50	2	4(0.005-0.14)
Sex			
Female	80	4	5(0.01-0.12)
Male	20	3	15(0.03-0.38)
Age			
Young	25	4	16(0.05-0.36)
Adult	75	3	4(0.01-0.11)
BCS			
Good	17	3	17.6(0.04-0.43)
Medium	45	3	6.7(0.01-0.18)
Poor	38	1	2.6(0.001-0.14)
Total	100	7	7(0.03-0.14)

Table 3. Prevalence of trematodes parasite during pre-deworming stage

Risk factors	No tested	No of positive	% (95% CI)
PA (kebele)			
Laku	50	12	24(0.13-0.38)
Gitlo	50	17	34(0.21-0.49)
Sex			
Female	77	23	29.9(0.20-0.41)
Male	23	6	26.1(0.10-0.48)
Age			
Young	19	3	15.8(0.03-0.40)
Adult	81	26	32.1(0.22-0.43)
BCS			
Good	14	3	21.4(0.05-0.51)
Medium	55	16	29.1(0.18-0.43)
Poor	31	10	32.3(0.17-0.51)
Total	100	29	29(0.20-0.39)

Table 4. Prevalence of trematodes parasite during post-deworming stage

Risk factors	No tested	No of positive	% (95% CI)
PA (kebele)			
Laku	50	1	2(0.0005-0.11)
Gitlo	50	2	4(0.005-0.14)
Sex			
Female	77	1	1.3(0.0003 0.07)
Male	23	2	4(0.0107-0.28)
Age			
Young	19	1	5.3(0.0013- 0.26)
Adult	81	2	2.5(0.003 0.09)
BCS			
Good	14	1	7.1(0.002-0.34)
Medium	55	2	3.6(0.004-0.13)
Poor	31	0	0(0.001-0.17)
Total	100	3	3(0.006-0.09)

Table 4 shows the prevalence of trematode parasites during the post-deworming stage across various risk factors. Among the kebeles, Gitlo had a slightly higher

prevalence compared to Laku. Regarding sex, males exhibited a higher prevalence than females. Age-wise, young animals showed a higher prevalence compared to adults. Body condition scores (BCS) revealed that animals in good condition had the highest prevalence, followed by medium condition animals, while animals in poor condition showed no prevalence. The overall prevalence of trematode parasites after deworming was reduced to 3%, demonstrating a significant decline compared to the pre-deworming stage. However, certain groups, such as young animals and males, still showed slightly higher susceptibility.

The results of a multivariate logistic regression analysis to assess the degree of

association between significant parameters and the prevalence of nematode parasites. For age, younger animals showed a higher prevalence compared to adults. Adults were less likely to be infected with nematodes, with an odds ratio (OR) of 0.4 (95% CI: 0.16–0.98, $P = 0.045$), indicating a statistically significant protective effect. For the sample type, the prevalence of nematode parasites was significantly lower in the post-deworming samples compared to the pre-deworming samples. Pre-deworming samples had an odds ratio of 28.5 (95% CI: 11.6–70.5, $P < 0.001$), demonstrating a very strong and highly significant association with higher prevalence (Table 5).

Table 5. Multivariate logistic regression degree of association analysis of prevalence of nematode parasite

Significant parameters	Total	% (95% CI)	Report of odds ratios		P-value
			OR (95% CI)	Std. Err.	
Age					
Young	50	46(0.32-0.61)	1		
Adult	150	33.3(0.26-0.41)	0.4(0.16-0.98)	0.18	0.045*
Sample type					
Post-deworming	100	7(0.03-0.14)	1		
Pre-deworming	100	66(0.56-0.75)	28.5(11.6-70.5)	13.2	0.000***

Table 6: Multivariate logistic regression degree of association analysis of prevalence of *Fasciola*

Significant parameters	Total sample	% (95% CI)	Report of odds ratios		P-value
			OR (95% CI)	Std. Err.	
Sample Type					
Post-deworming	100	3(0.01-0.09)	1		
Pre-deworming	100	29(0.20-0.39)	13.2(3.87-45.1)	8.27	0.000***

Multivariable logistic regression model analysis result showed that age and time of deworming were statistically significant association with both nematode and trematode positivity ($P < 0.05$). Such as the likelihood of positivity with nematode parasite in pre-deworming stage (OR=28.5, 95%CI: 11.6-70.5), $p=0.000$) was 25.5 times more likely than post-deworming stage and the likelihood of positivity with trematodes parasite of non-dewormed animals (OR=13.2, CI95%:3.87-45.1, $P=0.000$) were thirteen times positive than dewormed animals (Table 6).

Conclusion

Small ruminant gastrointestinal (GIT) parasite resistance to broad spectrum anthelmintics has been repeatedly reported in different parts of Ethiopia. The distribution pattern of anthelmintics resistance is a significant concern both nationally and globally. Frequent use of the same drug, underdosing, poor regulation of drug marketing and professionally unsupervised drug use tend to increase the risk of multiple anthelmintic resistance development in different areas of the country. In the present study the prevalence of nematode and trematode during pre-

treatment was 66% and 29%, respectively whereas during post-treatment the prevalence were 7% and 3% for nematode and *Fasciola*, respectively. The result revealed that, although a small group of flock remained positive after drug treatment, there was no significant level of GIT parasite resistance development to ALBENDA-QK 600 mg for deworming of nematode parasite and FLUKASH SHEEP (Oxyclozanide 340 mg bolus) to treat *Fasciola*. To prevent further development of anthelmintic drug resistance in this study area, the following practices were recommended the avoidance of frequent usage of anthelmintics drugs, the application of strategic and integrated anthelmintic drugs, the avoidance of under dosage of animals treatment and the application of antihelmintic drugs rotation and anthelmintic efficacy test should also be practiced regularly to manage the development anthelmintic drugs resistance

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