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Anthelmintic Utilization Practices and Assessment of Gastrointestinal Helminth Infections in Sheep in and Around Gechi District, Western Oromia-Ethiopia

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Abstract: Helminth parasitism plays a significant role in downgrading the productivity of livestock in Ethiopia. Anthelmintics (AH) are the major tools for minimizing the impacts of helminth infections in sheep. This study was conducted to investigate AH utilization practices and assess the prevalence of gastrointestinal helminth parasites in sheep in Gechi District of the Oromia Regional State (Ethiopia). Questionnaire surveys were undertaken to establish the AH utilization practices of 100 sheep owners at the study area. Three hundred eighty four sheep were also sampled to estimate the status of helminth parasitism using fecal floatation and sedimentation techniques. The questionnaire survey result shows: 1) albendazole (80%) and levamisole (12%) were the most frequently used AH in the area, 2) farmers get the drugs with (48%) or without (52%) prescription from various sources and 3) the choice for the two AH was based on perceived efficacy, accessibility and ease of administration for 52%, 30% and 10% of the respondents respectively. Similarly, fecal egg examination revealed, 1) an overall prevalence of 53.9% with a more strongyle type infections followed by *Fasciola, Trichuris* and mixed infections, 2) there was no significance difference in the prevalence of helminth infections between young (1 year) and adult (>1 year) or male and female sheep (P>0.05). However, variation was observed between the different sampling sites (P=0.0001). In conclusion, widespread prevalence of helminth parasitic infections and the aberrant anthelmintic utilization practices of farmers deserve serious attention and needs expansion of veterinary services.

Key words: Anthelmintic Utilization · Gechi · Gastrointestinal Helminth Parasitism · Questionnaire Survey · Sheep

INTRODUCTION

Helminth parasites are one of the major animal health constraints downgrading livestock productivity worldwide. Many of these parasites are commonly associated with poor production and unthriftiness and can produce acute disease and significant loss of production particularly in sheep and goats [1-3]. The prevalence of gastrointestinal helminthic parasites load and pathogenesis in small ruminants depend on various factors, such as climate, sex and age, physiological status of the animal, breed and management practices [4, 5]. Clinical signs and sequelae are dependent on the parasite fauna present and the intensity of infection. In sheep, these can range from subclinical weight loss to lethal pathologies such as anaemia, diarrhea and severe protein loss [6].

Ethiopia is home for a large and diverse livestock resources and favorable production environments. Particularly, the vast majority of the rural population's livelihood is partly based on livestock production where about 40% of the cash income earned by farm households and 25% of total domestic meat consumption is derived from small ruminants [7]. Although small ruminants are known to play a critical role in Ethiopian agriculture, their productivity and producers' benefits from this segment of the economy are far below expectations. Among the various factors undermining productivity, animal diseases such as helminth parasitism play a most important role. However, small-holders may not easily detect the effects of internal parasites on their animals, because of the generally sub-clinical or chronic nature of the helminth infections [8].

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Previous studies conducted in different parts of Ethiopian have revealed that the most common genera of parasites affecting small ruminants are *Haemonchus*, *Trichostrongylus, Oegophugostomum*, *Bunostomum trichuris*, *Fasciola* and *Moneizia* species [9-12]. However, there is very little information on the helminths of sheep in Buno Bedele zone, particularly, Gechi District of the Oromia Regional State. So it is important to assess the type and level of parasitism in the specified study area and the practice of using anthelmintics to combat the problem.

The objective of this study is therefore, to estimate the prevalence of helminth parasitic infections in sheep with particular emphasis on gastrointestinal nematodes and liver flukes and assess anthelmintic utilization practices of sheep owners in the area.

MATERIALS AND METHODS

Study Area: Gechi is a District in western part of the Oromia Regional State. It is located at 462 Km west of Addis Ababa and has an altitude ranging between 1500 and 2100 meters above sea level. The District is situated at Latitude 8° 16' 48.00"N and Longitude 36° 34' 12.00"E. The climatic condition of the area is sub-humid with mean annual rain fall of 1825 mm and annual minimum and maximum temperatures of 13 and 18°C, respectively. The district has sheep population of about 14,000 heads. Three villages (Gole, Koba and Bido) and the town, Gechi were included as specific sampling sites.

Study Population and Sample Size Determination: Local Horro breed type sheep reared under traditional extensive management system made the study population. To determine the sample size, an expected prevalence of 50% for all gastrointestinal helminth parasite infections was taken into consideration and the desired sample size for the study was calculated using a formula given by Thrusfield [13] at 95% confidence interval and 5% precision level. Accordingly, the computed sample size was 384 animals.

Study Design and Sampling Technique: A cross-sectional study design was employed to assess the problem of gastrointestinal parasites of sheep in the study sites. Farmers were advised to bring their sheep for examination and free treatment to the nearby animal health posts in the selected sites. Sheep were systematically selected for this study in such a way that 10 animals were sampled every work days (Monday-Friday) for three months between January and March 2018.

Questionnaire Survey: A structured questionnaire format was developed to get information on anthelmintic utilization practices so as to assess risk factors for anthelmintic resistance. After introducing the objectives of the study and obtaining their full consent, 100 small ruminant owners were interviewed. A formula given by Arsham [14] was used to determine the number of survey respondents. Major points considered in the interview were: type of anthelmintic (AH) used, frequency and dose of administration, source of the AH, etc. Only those owners who have reared their sheep were included in the study. Animal traders were not included as they keep sheep for short duration and hence are not expected to have enough information about their animals.

Fecal Sample Collection: Fresh fecal samples (approximately 10 g) from sheep were collected directly from the return and placed in plastic containers without any preservative and transported to Gechi veterinary clinic in an ice box after identification number was given corresponding to the order in the list containing the description of the sheep sampled. The samples were examined on the same day. In cases where samples could not be processed on the same day, they were kept at 4 ^{0}C to be analyzed the next morning. For processing, each fecal sample was divided into two parts for sedimentation and floatation techniques.

Simple Floatation Method: This method was employed to float eggs of nematode parasites in a liquid with higher specific gravity than that of the eggs. To make the diluting fluid denser than the eggs, saturated sodium chloride (common salt) solution with a specific gravity of 1.2 was used. For this, 1 kg of salt was dissolved in 3 liters of lukewarm water. Accordingly, 3 g of the fecal material was ground using a mortar and pistil and mixed with 45 ml of floatation fluid. The material was then filtered using a tea strainer. The filtrate was filled into a test tube and more floatation solution added to fill the tube to the top. A cover glass was then placed on top of the surface of the fluid and left for 10 minutes after which the cover-slip was lifted and placed on a microscope slide for examination under 10x or 40 x objective magnifications [8].

Sedimentation Technique: For detection of *Fasciola* eggs, about three grams of fecal material was placed in a container filled with 50 ml of water and homogenized thoroughly. The fecal suspension was filtered through a tea strainer and the filtered material was poured into a test tube which was then allowed to sediment for 5 min. The supernatant was decanted very carefully and the sediment was re-suspended in 5 ml of water. This was allowed to sediment for 5 min, the supernatant decanted again and the remaining sediment stained by adding one drop of methylene blue in each sample. Small amount of the sediment was placed onto a microslide, covered with a cover slip and examined under the microscope using 10x objective magnifications [8].

Statistical Analysis: After the collected data were uploaded to the Microsoft Excel 2007 computer programme, they were coded and imported to STATA for Windows version 11.0 (STATA 2009). The data were then summarized by using tables, graphs, percentages (proportions) and 95 % confidence intervals. Moreover, the effects of different epidemiological risk factors were analyzed by applying x^2 test or Fisher's exact tests. Statistical significance was set at $P < 0.05$.

RESULTS

Questionnaire Survey Responses

Sources of Anthelmintics: All the 100 questionnaire survey respondents confirmed that they have experience of treating sheep with anthelmintics. They ascertained that they take their sheep to the nearby animal health posts for treatment only when the animals show overt clinical symptoms of diseases. However, almost all (98%) have the experience of obtaining anthelmintics without prescription from open market and private veterinary drug stores for deworming purposes. Albendazole and levamisole were the anthelmintic drugs identified to be purchased from open markets.

Choice of Anthelmintics and Treatment Frequency: All respondents have reported that they had treated their sheep at least once with one of the three anthelmintics: albendazole, levamisole or injectable ivermectin in the last 12 months. Overall anthelmintic preference and utilization by respondents showed that vast majority of sheep owners prefer albendazole over levamisole and injectable ivermectin (Figure 1). The number of respondents with experience of prescribed anthelmintic drug usage for their sheep at any time in the past 12 months was 48%. The choice for anthelmintics especially for albendazole and levamisole was mainly based on perceived efficacy (52%= 95% CI: 42.8-63.1%), accessibility (30%= 95% CI: 22.1-41%) and ease of administration (10%= 95% CI: 9.4-24.7) with significant difference between the reasons ($P< 0.001$) (Figure 2). On the other hand, all ivermectin treatments were by prescription and done by animal health personnel.

Treatment Frequency and Dosage: The majority of the respondents indicated that their animals were treated with one of the anthelmintics twice (40%) or trice (57%) per year. Only 3% of them have treated their animals only once in the last 12 months. All respondents indicated that they do not consider the weight of animals during anthelmintic treatments. The vast majority of sheep

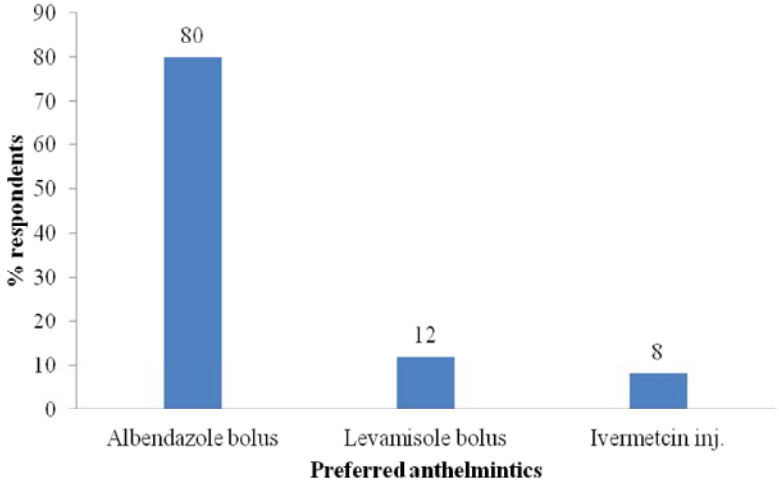

Fig. 1: Anthelmintic preference by questionnaire survey respondents

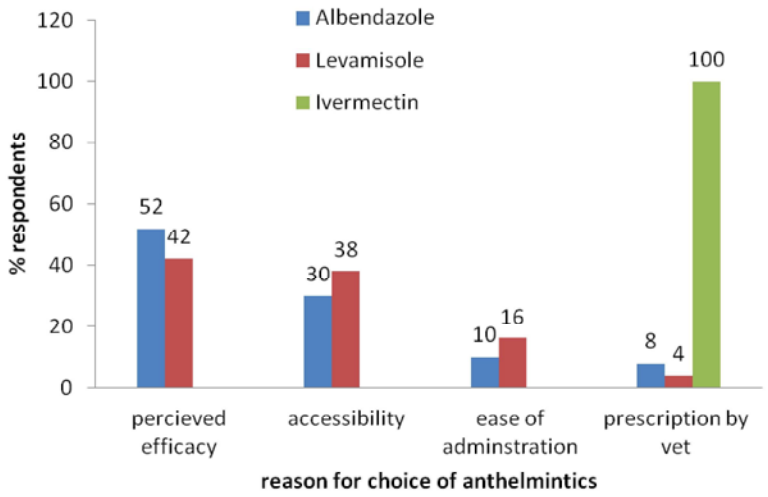

Fig. 2: Reasons given by respondents for choosing specific anthelmintics

Table 1: Prevalence of egg of gastrointestinal helminth parasite recovered from different sites

Study Site	No. of animals examined	% of sheep positive for				% prevalence	95% CI for all infections
		Strongyle only	Trichurs only	Fasciola Only	Mixed infection		
Koba	83	16.9	7.2	10.8	12.0	39 (47)	36.26-57.74
Bido	170	34.1	9.4	10.0	8.8	106 (62.4)	55.12-69.68
Gechi	65	15.4	7.7	7.7	12.3	28 (43.1)	31.06-55.14
Gole	70	17.1	5.7	11.4	14.3	34 (48.6)	36.89-60.31
Overall	384	24.0	8.1	10.2	11.2	207 (53.9)	48.91-58.89

X^2= 10.2849. P=0 .016293

Table 2: Distribution of types of parasite eggs among helminth positive animals

Study sites	Total positive	% Strongyle	% Trichurs	% Fasciola	P- value
Koba	39	43.6	23.1	33.3	χ^2=37.1085 P<0.0011
Bido	106	61.3	18.9	19.8	
Gechi	28	46.4	25.0	25.0	
Gole	34	44.1	20.6	35.3	
Mean		48.9	21.9	28.4	
95% CI		42.09-55.71	16.27-27.53	22.63-34.97	

owners (87.5 %: 95% CL= 81.02-93.98%) give one bolus/sheep (300 mg) of albendazole while all those who have used levamisole administer a bolus (300 mg)/sheep. All ivermectin injections were made by animal health personnel, but respondents had no information about the dosage. For 12.5 % (95% CI. 6.02-18.98%) of the respondents, albendazole was the only anthelmintic reported to be given at half bolus/sheep depending on visual judgment of the size of the animal. As ivermectin was available in the area in its injectable form and hence the owner does not administer, it is assumed that the prescribed dosage was respected.

Fecal Egg Examination

Overall Prevalence of Helminth Infections: In this study which was conducted from January-March/2018, a total of 384 sheep were examined for gastrointestinal nematode (GIN) eggs. Among these, 220 were above one year of age and 164 were below or equal to one years of age, whereas 229 of them were males and 155 were females. The overall prevalence of gastrointestinal helminth parasites was 53.9% (95% CI: 48.91-58.89%) (Table1). There were more strongyle type infections followed by *Fasciola* spp and *Trichuris* spp (Table 2).

Factors Affecting Prevalence of Gastrointestinal Helminthes in Sheep: The overall number of positive cases detected was similar between sheep older than one year and those below (Table 3) with fecal egg floatation technique. Likewise, there was no significant difference in the prevalence of gastrointestinal helminth parasites between male and female sheep (p>0.05).

Table 3: Prevalence of gastrointestinal helminth parasites in different age and sex groups of sheep in Gechi District based on fecal egg floatation technique

Risk factor	Animals examined	% positive	95% CI	χ^2
Age				2.3681
≤1 year	146	59.0	51.02-66.98	
>1years	238	51.0	44.65-57.35	
Sex				0.2603
Male	229	52.8	46.33-59.27	
Female	155	55.5	47.68-63.32	

On the other hand, among the three sampling months of the 2018, the prevalence of gastrointestinal parasites was significantly higher in March than in other months (P<0.01), Table 4).

Table 4: Monthly prevalence of gastrointestinal parasites of sheep in Gechi district based on fecal egg floatation technique

	Month	Animals examined	Number positive	% positive	95% CI
1	January	134	63	47.0	38.55-55.45
2	February	120	59	49.2	40.26-58.14
3	March	130	85	65.4	57.22-73.58
	Total	384	207	χ^2=10.5392. P= 0.005146	

DISCUSSION

Anthelmintic Utilization Practice: The findings of the questionnaire survey on the practice of using anthelmintics in sheep revealed that Albendazole was the most widely used/preferred anthelmintic followed by levamisole. This finding is in agreement with reports from southern Ethiopia by Kumsa and Ajebu [15], from west Ethiopia by Terefe *et al.* [11] and from north-west Ethiopia by Melaku *et al*. [16] and Seyoum *et al*. [17]. Although there are several brands, this result reflects that these drugs are the most commonly available anthelmintics in the local markets especially from the informal sources. Significant percentage of farmers administers anthelmintics to their sheep without prescription suggesting possible prevalence of misuse of the commonly used anthelmintics in the area. This observation agrees with those from previous works [11, 18].

Perceived efficacy and accessibility of the anthelmintics (albendazole and levamisole) are the two major reasons for their frequent use by sheep owners. Farmers believe that efficacy of albendazole was much better probably because this drug acts against both nematodes and trematodes like *Fasciola* [11, 19] resulting in relatively higher clinical improvement over those that do not act on trematodes. A similar finding was reported by Melaku *et al*. [16], Seyoum *et al*. [17] and Terefe *et al.* [11]. Free access to anthelmintics is also another reason for their frequent utilization. The fact that significant percentage of farmers is able to purchase albendazole and levamisole boli from open markets without prescription explains the reason why ease of access to these drugs is more important to the respondents. Such drugs have also been reported from the open markets/illegal dealers in North Gondar [16]. On the contrary ivermectin, which is administered through subcutaneous route and hence more difficult to give than the oral anthelmintics, was accessed by prescription only at animal health posts and hence less frequently used by our questionnaire survey respondents. These findings agree with the reports of Terefe *et al.* and Teklemariam *et al.* [11, 20]. On the contrary, Seyoum *et al.* [17] in their work done in Northwest Ethiopia reported that majority of sheep owners in the area use anthelmintics by prescription. This may suggest differences in access to formal veterinary services between study areas. On the other hand, the questionnaire survey responses revealed that treatment frequency ranged between one and three doses per year per animal. This is in line with the report of Teklemariam *et al.* [20] and Melaku *et al.* [16] which might show lower risk for development of anthelmintic resistance. However, since the three groups of drugs are being used indiscriminately and within the same population of animals, it is possible that the parasites circulating in that specific area have already been exposed to those anthelmintics much more frequently than one might judge from treatment frequency in the animals. Therefore, it is necessary to assess efficacy of these anthelmintics against the locally prevalent helminth parasites.

Prevalence of GI Helminth Parasitism: About 54% of the 384 sheep sampled were found positive for eggs of gastrointestinal helminth parasites. Previous studies from other areas have registered 59.63% [10] in small ruminants from Enemay District of Northern Ethiopia, 59.11% [21] and 47.67% [22] in sheep from North West Ethiopia, 56.25% [23] from North Ethiopia and 64.08% [24] in sheep

from abattoir study in Ganderbal-Kashmir. Variations in prevalence of helminth parasitism could be attributed to differences in agroecology of the study sites [5, 25], breed and physiological conditions of the study animals [26-28] and season of sampling [29, 30]. In agreement with several studies [10, 21, 22, 24], this study revealed that gastronintestinal nematode infections dominated by strongyle type parasites are more prevalent over *Fasciola* infections suggesting the more favorable conditions prevalent in the study areas for nematodes than *Fasciola* that requires suitable habitat for its intermediate hosts.

In this regards, risk factors such as study site/agroecology, sex and age of sheep were assessed to evaluate their influence on the prevalence of gastrointestinal helminth parasites in sheep. Accordingly, it was found that prevalence varied between the sampling sites being highest in Village Koba (at lower altitude) indicating variations in the prevalence of conducive factors for parasite development. Similar findings have been reported by previous studies [22, 30]. On the contrary, Cherinet *et al*. [31] reported that there was no variation in *Faciola* infection in sheep from different study sites.

Age and sex of sheep have also been incriminated for differences in susceptibility to helminth infections in sheep [32-34]. However, this study revealed no significant difference in the prevalence of helminth parasitism between the two sexes and the two age categories. Similar findings were recorded by Mulatu *et al.* [21] and Bayou and Abu [35]. On the contrary, Alade and Bwala [30], Shah *et al.* [36], Lone *et al.* [37], Shime and Derso [10], Lone *et al.* [24] and Dagnachew *et al.* [22] have documented significant variations between age and sex groups. It is generally believed that young animals and intact male sheep are more susceptible to parasitic infections than adult and non-pregnant females. Increased male susceptibility to gut parasitic nematodes may be a direct result of androgenic influences whereas the lower resistance to disease in young ruminants is partly due to immunological hyporesponsiveness [32, 34].

From this study we conclude that gastrointestinal helminthes especially strongyle group are common problem in sheep in the study areas. Limited types of anthelmintics are available locally and they are at risk of development of drug resistance due to the improper utilization by the local farmers. It is recommended that veterinary services should be improved to minimize the impacts of gastrointestinal parasitic infections and the risk of anthelmintic resistance.

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