Gastro-intestinal nematodes of sheep and goats in three districts of Kaffa and Bench Maji Zones, Southwest Ethiopia

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Abstract

A cross-sectional study was conducted to estimate the prevalence and to identify the genera of gastrointestinal strongyles infecting sheep goats in Chena and Gimbo (Kaffa Zone) and Semen-Bench (Bench Maji zones) districts, Southwest Ethiopia. A total of 800 faecal samples were collected from sheep (n=492) and goats (n=308), and then examined by floatation technique. Positive faecal samples were pooled and cultured and third stage larvae (L_3) were harvested and identified. From 800 examined faecal sample 433 (54.1%) were positive for gastrointestinal parasites eggs. Among the risk factors considered in this study age, body condition and history of previous deworming showed significant ($P < 0.05$) association with gastrointestinal parasites prevalence. Strongyle type eggs dominated the spectrum of infections, where by 73.1% sheep and 72.8% goats were positive for strongyles infection. From the pooled faecal sample culture seven nematode genera were identified in all the study districts (Chena, Gimbo and Semen-Bench) and both in sheep and goats. These genera include Bunostomum, Chabertia, Cooperia, Haemonchus, Oesophagostomum, Teladorsagia and Trichostrongylus. Among these Trichostrongylus, Bunostomum, Haemonchus and Cooperia were the dominant genera in all the three districts. This study indicated that gastrointestinal parasites were among the serious health problem both in sheep and goats in Kaffa and Bench Maji zones. Further study is required to identify the prevailing parasite species and assess the seasonal dynamics of the gastrointestinal parasites in the study areas and thereby to design appropriate control methods that enable to overcome the existing problem.

Keywords: Coproculture, Bench Maji, Ethiopia, Gastrointestinal parasites, Goats, Kaffa, Prevalence, Sheep

http://dx.doi.org/10.4314/evj.v19i2.6

Introduction

Sheep and goats represent an important component of the farming system; because they require smaller investment, have shorter production cycles, faster growth rate and greater environmental adaptability than cattle (Lebbie, 2004; Anon, 2005). In the subsistence sector farmers and pastoralists depend on sheep and goats for much of their livelihood (Adane Hirpa and Girma Abebe, 2008).

Despite the large number of sheep (24.2 million) and goats (22.6 million) population in Ethiopia (CSA, 2012), the economic benefits remain marginal due to prevailing diseases, poor nutrition, poor production systems, reproductive inefficiency, management constraints and general lack of veterinary care. Diseases have a major impact on morbidity and mortality rates, with annual losses as high as 30–50% of the total value of livestock products of Ethiopia (Mukasa-Mugerwa et al., 2000). It is also estimated that approximately 5 to 7 million sheep and goats die from diseases and malnutrition each year in Ethiopia, which is accounting for a great annual financial loss (Anon, 1992; Tilahun Getachew, 1993).

Diseases caused by helminth parasites in livestock continue to be a major productivity constraint, especially in small ruminants in the tropics and subtropics (Perry *et al.*, 2002). Sheep and goats under intensive and extensive production systems are extremely susceptible to the effects of wide range of helminth endoparasites (Abebe Wossene and Esayas Gelaye, 2001). Impacts of helminths could be reduced through implementation of appropriate control strategies that require knowledge of epidemiology and ecology of parasites under local conditions (Demelash Biffa *et al.*, 2007; Boomker *et al.*, 1994). Moreover, it is important to know which groups are present in a flock or herd in an area or region for effective control measures (Urquhart *et al.*, 1996).

Therefore, the aim of this study is to estimate the prevalence and identify gastrointestinal nematode parasites in sheep and goats in Kaffa and Bench Maji Zones.

Materials and Methods

Study area and animals

This study was carried out from November 2010 to April 2011 in Chena and Gimbo (Kaffa Zone), and Semen-Bench (Bench-Maji Zone) districts, South-western Ethiopia. The altitude of Chena, Gimbo and Semen-Bench districts was range from 500 to 2500, 1400 to 2400, and 1200 to 2200 meters above sea level, respectively. The area has a mean annual rainfall of 1284 to 1780 mm, 900 to 1150 mm and 1500 to 2000 mm, and the mean annual temperature is11-28°C, 14-28°C and15-28°C, respectively. The study areas are characterized by mixed crop-livestock production system.

The study sheep and goats were selected by systematic random sampling method from local indigenous breeds that were kept by traditional extensive management system and owned by smallholder farmers. The study animals were managed by communal free range grazing systems. A total of 800 animals (492 sheep and 308 goats) were examined over the study period. Age, sex, body condition and deworming history of the study animals were recorded during faecal sample collection. The study animals were categorized into two age groups: young (< 1 year) and adult (≥ 1 year).

Sampling method and sample size

A cross-sectional study method was employed to estimate the prevalence gastrointestinal nematodes and to identify the nematode genera prevailing in the areas. The sample size for the study was determined by considering 25% expected prevalence and based on the formula given by Thrusfield (2005). The study considered 95% level of precision.

Study methodology

Faecal samples were collected directly from the rectum of each studied animal. Then the samples were packed and labelled with all required information and transported to Mizan Regional Veterinary laboratory using ice box. The samples were kept at 4^{0}C and processed within twenty four hours of collection. The faecal samples were examined qualitatively for the presence of strongyle eggs and quantitatively to assess the number of strongyle eggs per grams of faeces following the procedure described by Hansen and Perry (1994).

Coproculture: From about 10% of positive faecal samples for strongyle eggs from animals of the same species and districts were pooled and cultured for larval identification. About 3gms of faeces from each positive animal were pooled and incubated at 27°C for 7 to 10 days. Then third stage larvae (L_3) recovered using modified Baermann technique was identified using the standard key for morphological feature (MAFF, 1979; van Wyk et al., 2004).

Data analysis

All collected data were entered into Microsoft Excel spread sheet, and then summarized by using descriptive statistics like mean and percentage. Pearson's chi-square test was employed to test the effect of risk factors on the prevalence of gastrointestinal nematodes.

Results

Coproscopic results

From a total of 800 examined animals 433 (54.1%) were harboured gastrointestinal nematodes. The prevalence of gastrointestinal parasites in sheep (n=492) and goats (n=308) were 55.1% and 52.6%, respectively (Table 1).

Table 1 Frequency of faecal nematode egg findings relative to the risk factors

Risk factors and levels		No examined	No positive (%)	95% CI	$\chi 2$	P- value
District	Chena	200	102 (51.0%)	44.0-58.0	1.49	0.475
	Gimbo	301	162 (53.8%)	48.2-59.5		
	S/ Bench	299	169 (56.5%)	50.9-62.2		
Species	Sheep	492	271 (55.1%)	50.7-59.5	0.47	0.493
	Goats	308	162 (52.6%)	47.0-58.2		
Sex	Male	283	143 (50.5%)	44.7-56.4	2.28	0.131
	Female	517	290 (56.1%)	51.8-60.4		
Age	Young	240	95 (39.6%)	33.4-45.8	29.2	0.000
	Adult	560	338 (60.4%)	56.3-64.4		
Body condition	Good	497	200 (40.2%)	35.9-44.6	114.42	0.000
	Medium	129	84 (65.1%)	56.8-73.5		
	Poor	174	149 (85.6%)	80.4-90.9		
Deworming	Yes	54	20 (37.0%)	23.7-50.3	6.81	0..009
	No	746	413 (55.4%)	51.8-58.9		
Total		800	433 (54.1%)	50.7-57.6		

In the coproscopic examination using floatation techniques an overall 73.0% Strongyles type, 4.8 % Strongyloides, 3.7 % Trichuris, and 18.5 % mixed (i.e. Strongyles, Strongyloides and Trichuris) types of eggs detected. The types of eggs observed for each of the study districts indicated in Table 2.

Table 2. The analysis for the egg types and their frequency in the study districts

District	Egg types	Frequency (%)	95% CI	$\chi 2$	P-Value
Chena (n= 200)	Strongyle type	80 (74.4%)	70.3-86.5	120.00	0.000
	Strongyloides	7 (6.9%)	1.9-11.9		
	Trichuris	5 (4.9%)	0.6-9.2		
	Mixed infections	10 (9.8%)	3.9-15.7		
Gimbo (n=301)	Strongyle type	112 (69.1%)	62.0-76.3	153.04	0.000
	Strongyloides	6 (3.7%)	0.8-6.6		
	Trichuris	9 (5.6%)	2.0-9.1		
	Mixed infection	35 (21.6%)	15.2- 28.0		
Semen Bench (n= 299)	Strongyle type	124 (73.4%)	66.6-80.1	162.97	0.000
	Strongyloides	8 (4.7%)	1.5-8.0		
	Trichuris	2 (2.1%)	-0.5- 2.8		
	Mixed infection	35 (20.7%)	14.5-26.9		

The coproscopic examination revealed that from sheep and goats positive for gastrointestinal nematodes 73.1% and 72.8% were found to harbour strongyle type eggs, respectively (Table 3).

Table 3. Types of egg and their frequency in sheep and goats.

Species of host	Egg types	Frequency	Percentage	95% CI
Sheep (n= 492)	Strongyle type	198	73.1	67.8-78.4
	Strongyloides	13	4.8	2.2-7.4
	Trichuris	12	4.8	2.0-6.9
	Mixed infections	48	17.7	13.1-22.3
Goats (n= 308)	Strongyle type	118	72.8	65.9- 79.8
	Strongyloides	8	4.9	1.6-8.3
	Trichuris	4	2.5	0.1-4.9
	Mixed infection	32	19.8	13.6-26.0

Coproculture results

From pooled faecal culture 80, 112 and 124 larvae (L_3) harvested from animals examined in Chena, Gimbo and Semen-Bench districts, respectively. Examination of harvested L_3 revealed a total of seven genera gastrointestinal nematode, namely: *Bunostomum*, *Chabertia*, *Cooperia*, *Haemonchus*, *Oesophagostomum*, *Teladorsagia* and *Trichostrongylus*. The observed proportion of L_3 in each district is shown in Table 4.

Table 4 Gastrointestinal nematodes genera identified in the three study districts

District	General	Frequency	Percent (%)	95% CI
Chena (n= 200)	Bunostomum	18	25.50	13.14-31.85
	Chabertia	2	2.50	-0.99-5.99
	Cooperia	11	13.75	6.04-21.46
	Haemonchus	14	17.50	8.99-26.00
	Oesophagostomum	2	2.50	-0.99-5.99
	Teladorsagia	16	20.00	11.04-28.95
	Trichostrongylus	17	21.25	12.09-30.41
Gimbo (n=301)	Bunostomum	26	23.21	15.27-31.15
	Chabertia	1	0.89	-0.87-2.66
	Cooperia	29	25.89	17.65-34.13
	Haemonchus	17	15.18	8.43-21.92
	Oesophagostomum	1	0.89	-0.87-2.66
	Teladorsagia	3	2.68	-0.36-5.71
	Trichostrongylus	35	31.25	22.53-39.97
Semen Bench (n= 299)	Bunostomum	22	17.74	10.92-24.56
	Chabertia	6	4.84	1.01-8.67
	Cooperia	16	12.90	6.92-18.89
	Haemonchus	19	15.32	8.89-21.75
	Oesophagostomum	12	9.68	4.40-14.95
	Teladorsagia	9	7.26	2.63-11.89
	Trichostrongylus	40	32.26	23.91-40.60

From pooled faecal culture of sheep and goats a total of 198 and 118 L3 harvested, respectively. Examination of recovered L3 revealed seven genera of gastrointestinal nematodes both in sheep and goats (Table 5).

Table 5 Gastrointestinal nematodes genera identified in sheep and goats

District	Parasite genera	Frequency	Percent (%)	95% CI
Sheep (n=492)	*Bunostomum*	37	18.69	13.21-24.16
	Chabertia	7	3.54	0.94-6.13
	Cooperia	35	17.68	12.32-23.03
	Haemonchus	37	18.69	13.21-24.16
	Oesophagostomum	9	4.55	1.62-7.47
	Teladorsagia	13	6.57	3.09-10.05
	Trichostrongylus	60	30.30	23.84-36.76
Goats (n=308)	*Bunostomum*	29	24.88	16.69-32.46
	Chabertia	2	1.69	-0.67-4.06
	Cooperia	21	17.80	10.79-24.79
	Haemonchus	13	11.02	5.28-16.75
	Oesophagostomum	6	5.08	1.06-9.11
	Teladorsagia	15	12.71	6.61-18.81
	Trichostrongylus	32	27.12	18.98-35.26

Discussion

This study revealed an overall coproscopic prevalence of 54.1% gastrointestinal parasites infection in sheep and goats (i.e. 55.1% in sheep and 52.6% in goats). This finding is comparable with some reports from Ethiopia (Fikru Regassa *et al.*, 2006; Rahmeto Abebe *et al.*, 2010; Jalelie Datiko et al., 2013; Diriba Lemma and Birhanu Abera, 2013). Similar to the report of Rahmeto Abebe *et al* (2010) the prevalence of strongyle infection in sheep and goats showed no significant (P >0.05) variation. This might be due to similarities in agro-ecology and in management of both sheep and goats, kept by traditional extensive management system (Zalac, 2006). The study area characterized by communal grazing area, and hence, both sheep and goats have equal chance to acquire the infective larvae of strongyles.

The prevalence of strongyle infection was significantly higher (P <0.01) in adult, poor body condition and not dewormed animals than in young, medium and/or good body condition and dewormed animals. The lower prevalence of strongyle infection in younger animals could be most likely due to the tradition of keeping young animals homestead than letting them to travel distance in search of grass, which could be due to fears for wild predators and young animals are unable to walk long distances in search of grass.

Animals with poor body condition tend to harbour a significantly higher strongyle infection rate than others, which is in agreement with the previous works (Fikru Regassa *et al.*, 2006; Rahmeto Abebe *et al.*, 2010). In fact the poor body condition could be due to the strongyle itself or other diseases or nutritional problems. Whatever the cause, there is compromised immune response to infection in poor body condition animals (Skyes, 2010).

Based on the egg types, the proportion of strongyle is significantly higher ($P < 0.05$) both in sheep and goats. This observation is in agreement with Fikru Regassa *et al* (2006) and Diriba Lemma and Birhanu Abera (2013).

From coproculture and third stage larvae identification seven genera of nematodes were identified in all the study districts and both animal species, namely Trichostrongylus, Bunostomum, Haemonchus, Cooperia, Teladorsagia, Oesophagostomum and Chabertia. Among these Trichostrongylus, Bunostomum, Haemonchus and Cooperia were the dominant genera in all the three districts. Reports from various parts of Ethiopia indicated that the genera Trichostrongylus, Haemonchus and Bunostomum are widely spread (Abebe Wossene and Esayas Gelaye, 2001; Tembely *et al.*, 1997; Amenu Asha and Abebe Wossene, 2007; Bersissa Kumsa and Ajebu Nurfeta, 2008; Rahmeto Abebe *et al.*, 2010; Molalegne Bitew *et al.*, 2011; Tesfaheywet Zeryehun, 2012; Gonfa Shankute *et al.*, 2013).

Conclusion

Further investigation involving wider areas, larger sample size and seasonal dynamics of gastrointestinal nematodes should be required. But based on the result of this study appropriate strategic control should be designed to overcome the problem.

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