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PREVALENCE OF SMALL RUMINANTS SCHISTOSOMIASIS AND ITS ASSOCIATED RISK FACTORS IN MECHA DISTRICT, NORTHWESTERN ETHIOPIA

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ABSTRACT: Schistosomiasis is a snail-born trematode infection of man and animal in tropical and sub tropical countries. It is an economically importance diseases caused by *Schistosoma* species and result in economic losses through mortality and morbidity from severe infection. A cross-sectional study was conducted from November 2014 to April 2015 in Mecha district, Northwest Ethiopia. A total of 384 fecal samples were collected from randomly selected sheep and goat in three peasant associations. The sample was processed with sedimentation technique to detect *Schistosoma* eggs by using light microscope. Therefore, the overall prevalence of *Schistosoma* infection irrespective of factors was found to be 9.4% (12.9% in ovine and 5.5% in caprine). In cases of sites where samples were collected, Kurtbahir showed higher prevalence (14.6%) than other two study sites (8.4% for Kudimi, and 4.2% for Enamrt). Age-wise prevalence of *Schistosoma* infection in sheep was significantly (P<0.05) varied. Similarly significant association of *Schistosoma* infection with age and body condition score also observed in ovine population (P<0.05), not in caprine. Species-wise prevalence *Schistosoma* infection in sheep and goat was significantly (P<0.05) varied. However, *Schistosoma* infection did not affect (P> 0.05) by sex in both species. In general, Schistosomiasis is one of the major health concerns of livestock production. Therefore, control of schistosomiasis based on drug treatment, snail control and appropriate sanitation measures were recommended.

Keywords: Small ruminants, Schistosomiasis, Sedimentation, Prevalence, Mecha district, Ethiopia

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INTRODUCTION

Livestock production constitutes one of the principal means of achieving improved living standards in many regions of the developing world. In sub-Saharan Africa countries livestock plays a crucial role both for the national economy and the livelihood of rural communities. It provides draught power and raw material for industry (ILCA, 2007). In Ethiopia, livestock contribute about 30-35 % of agricultural gross domestic product (GDP) and 12-16 % of total GDP (AAPMDA, 1999).

Though Ethiopia is recognized for its vast wealth of livestock, the economic benefit derived from the livestock center does not commensurate with the potential (FAO, 1993). Development of large animal is constrained with certain infectious and non-infectious diseases; among infectious diseases schistosomiasis contributes its own economic losses through reduction of the production and productivity potential of animals. Parasitism is of supreme importance in many agro-ecological zones and still a serious threat to the livestock economy worldwide. Sheep and goats are known to suffer from various endoparasites of which helminthes infection are of great importance (Vercruysse and Claerebout, 2001).

Schistosomiasis is snail-borne trematode infection of man, domestic animals and wild animals in different parts of tropical and sub tropical countries (Singh et al., 2004; Islam et al., 2011). The major transmitting sites are small streams all over the highlands of Ethiopia, lakes like Tana, Zeway as well as irrigation systems, such as sugar state Wonji do also play a similar role (Shibru et al., 1989). *Schistosomes* are dioecious parasitic flatworms, which live in the vasculature of their mammalian definitive hosts. They are the causative agent of schistosomiasis, a disease of considerable medical and veterinary importance in tropical and sub-tropical regions (Rollinson and

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Southgate, 1993). Schistosomiasis is a chronic debilitating infection affecting both humans and animals by different species of *Schistosomes* and hence the disease is of public health importance. Other names given to schistosomiasis are blood fluke disease and Bilharziasis (Parija, 2004).

Although these parasites occur in many tropical and sub-tropical areas, the disease is important in livestock mainly in Eastern Asia, Africa and India. The distribution of schistosomiasis varies from places to places. Example: *Schistosoma bovis* the commonest species in Africa and Mediterranean region (Aemro, 1993). However, *Schistosoma spindale, Schistosoma indicum* and *Schistosoma nasal* have been reported as the major causes of schistosomiasis in Asia (Bont, 1995). Bulinus, Indoplanorbis and Planorbid snail intermediate hosts are transmitting *Schistosomes* to cattle (Solomon, 1985). The major transmitting sites are small streams all over the highlands of Ethiopia, lakes like Tana, Zeway as well as irrigation systems, such as sugar state Wonji do also play a similar role (Shibru et al., 1989). The Districts bordering Lake Tana are relatively potential areas for livestock production due to availability of grazing land and enough water supplies; however, the area is highly infested with helminthes parasites particularly with *Schistosoma* parasite. Koga dam and its surroundings give convenient ground for *Schistosoma* parasites and its intermediate host, snails, due to the water availability almost throughout the year and now days the irrigation practice for tomato, potato, onion and other crop farming practices of farmers. The transmission of schistosomiasis takes place only in the place where fresh water snail vector is present and where there is contact between the host and infested water (Okpala, 2004). The majority of studies done so far were bovine schistomiasis near to the study area (Belayneh and Tadesse, 2014), however, there was no detailed studies on ovine and caprine schstosomiasis in Mecha district. Therefore, the objective of the present study was to determine the prevalence of ovine and caprine schistosomiasis and to identify associated risk factors for the occurrence of schistosomiasis in the Mecha district.

MATERIAL AND METHOD

Study area

The study was conducted from November, 2014 to April, 2015 in Mecha district northwest Ethiopia. Mecha district is bordered with North Achefer, South Achefer and Ylmanadensa districts and having an altitude ranging from 1800-2500 meter above sea level and has a warm humid climate with the annual rainfall vary from 1000-2000 mm. The annual temperature of the area ranges from 12.4^0c -21^0c. The area has poor drainage and there is annual over flooding during the rainy seasons leaving pockets of water bodies for long period during the dry season. Livestock population found in this district includes cattle, sheep, goat, horse, donkey and mule. The number of sheep and goat population in the district are estimated to be 148,971 and 18,659 (MWRDAPO, 2012). Both traditional and modern (semi-intensive) farming are practiced in the study area.

Study population and Study animals

The study animals were sheep and goat randomly selected from randomly selected three peasant associations (kebeles) namely: Enamrt, Kudimi and kurtbahir. The study animals were indigenous breed sheep and goat both sexes (male and female) and two ages categories as described as (young and adult years). The age of animal was estimated by using dentition pattern of animals (young sheep≤ years and adult> 2 years) as described by Getenby (1991), for goat (young≤3 and adult>3 years) (Steel, 1996). The body condition score was described as poor, medium and good. The entire study animals were often allowed to graze the whole days in and around stagnated water and marsh area except Enamrt.

Study design

A cross-sectional study design was conducted to estimate the prevalence of ovine and caprine schistosomiasis and to identify its associated risk factors in Mecha district from November, 2014 to April, 2015.

Sample size and sampling method

Simple random sampling method was applied to select study animals. During sampling informations like origin, species, sex, approximate age of individual animals and body condition was recorded. To calculate the sample size, the expected prevalence of 50% was considered by 95% confidence interval at an absolute precision of 5%. The desired sample size was calculated according to the formula given by Thrusfield (2005).

$$N = \frac{(1.96)^2 \times p_{exp}\,(1-p_{exp})}{d^2}$$

Where, n= required sample size.

P_{exp}= expected prevalence.

d^2= desired absolute precision. Therefore, 384 sheep and goat were required for this study.

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Study methodology

Coprological Study. To determine the presence or absence of small ruminants' schistosomiasis, fresh fecal samples were collected from the rectum of each animal. Collected samples were placed in universal bottles containing 10% formalin for preservation and transported to Merawi veterinary clinic. Then samples were processed using sedimentation techniques (Hansen and Perry, 1994).

Data management and analysis

The collected data was entered and stored into Microsoft Excel spread sheet, 2007. The data were thoroughly screened for errors and properly coded before subjecting to statistical analysis. The data were imported from the Microsoft Excel and analyzed using SPSS software version 16.0. Descriptive statistics was used to determine the prevalence of schistosomiasis and chi-square (x^2) was used to evaluate the association between the prevalence of ovine and caprine schistosomiasis with various risk factors (species, sex, age, origin and origin), p-value less than 0.05 or 5% level of significance were considered significant in this analysis.

RESULT

Coprological examination of 384 samples indicated that 36 (9.4%) were positive for *Schistosoma* eggs. The prevalence of small ruminants' schistosomiasis between two species 12.9% in ovine and 5.5% in caprine was observed. The prevalence was greater in ovine than caprine and there was statistically significance variation (P<0.05) among two species. Similarly, over all infection rate in animals having poor body condition and adult age was significantly (P<0.05) higher than animals which have good and medium body condition and younger age. However, there was no significant association among sex group. In the present study, it was observed that the prevalence of *Schistosoma* in relation with the sites of sample collected was significantly (P<0.05) varied. The prevalence for each kebele was 14.6%, 8.3% and 4.2% in Kurtbahir, kudimi and Enamrt, respectively (Table 1).

Sex-wise distribution of *Schistosoma* infection was not significantly (P>0.05) varied, among sex group of sheep and goat. However, over all infection rate in male caprine (6.2%) was slightly higher than female caprine (4.9%). Whereas, it was slightly higher in female sheep (13.3%) than male sheep (12.5%) (Table 2).

Age-wise distribution of *Schistosoma* infection was significantly varied (P<0.05) in adult and young sheep was found to be 18.9% and 3.8%, respectively. However, in adult and young goat it was found to be 6.9% and 3.6%, respectively. This is significantly varied (P<0.05) in adult and young sheep, but not significantly (P>0.05) varied in adult and young goat (Table 3).

In the present study, it was observed that the prevalence of *Schistosoma* infection in relation with body condition score differ in ovine whereas it was not statically significant in caprine. Sheep with poor body condition score (21.5%) were more infected with *Schistosoma* than sheep with medium (7.7%) and (7.3%) good body condition score. whereas in caprine, the highest prevalence were observed in poor body condition (8.8%) than medium and good body condition (Table 4).

Table 1 - The prevalence of schistosomia infection in small ruminants' and associated risk factors.

Risk factors		Examined animals	Prevalence (%)	X^2 (P-value)
Site	Enamrt	119	5(4.2)	8.52 (0.014)
	Kudimi	121	10(8.3)	
	Kurtbahir	144	21(14.6)	
Species	Caprine	183	10(5.5)	6.29 (0.0012)
	Ovine	201	26(12.9)	
Age	Young	161	6(3.7)	10.41 (0.001)
	Adult	223	30(13.5)	
Sex	Male	168	16(9.5)	0.008 (0.93)
	Female	216	20(9.3)	
Body condition	Poor	147	23(15.6)	11.34 (0.0034)
	Medium	181	11(6.1)	
	Good	56	2(3.6)	
Overall	--	384	36(9.4)	--

*P<0.05 = significant

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Table 2 - The prevalence of sheep and goat schistosomiasis based on sex					
Species	**Sex**	**Examined animal**	**No. Positive**	**Prevalence (%)**	**X^2(P-value)**
Caprine	Female	103	5	4.9	0.17(0.68)
	Male	80	5	6.2	
Ovine	Female	113	15	13.3	0.26(0.87)
	Male	88	11	12.5	
*P>0.05 = insignificant					

Table 3 - The prevalence of sheep and goat schistosomiasis based on age					
Species	**Age**	**Examined animal**	**No. Positive**	**Prevalence (%)**	**X^2(P-value)**
Ovine	Young	78	3	3.8	9.66(0.008)
	Adult	122	23	18.9	
Caprine	Young	83	3	3.6	1.00(0.316)
	Adult	101	7	6.9	
*P<0.05; = significant					

Table 4 - The prevalence of sheep and goat schistosomiasis based on body condition.					
Species	**Body condition**	**Examined animal**	**No. Positive**	**Prevalence (%)**	**X^2(P-value)**
Caprine	Poor	68	6	8.8	3.314(0.19)
	Medium	85	4	4.7	
	Good	30	0	0	
Ovine	Poor	79	17	21.5	8.5(0.014)
	Medium	26	2	7.7	
	Good	96	7	7.3	
*P<0.05 = significant					

DISCUSSION

The diagnosis of *Schistosoma* in animals and human beings is a key step to propose and establish control strategy (Niaz et al., 2010). According to Martin et al. (2008), and Zhou et al. (2008), determining target population for chemotherapy in endemic areas, assessment of morbidity and the evaluation of control strategy all can be built on the result from diagnostic test. Therefore, the present study was conducted to determine the prevalence and to identify risk factors associated with the occurrence of schistosomiasis in ovine and caprine population in the Mecha district, Northwest Ethiopia. Accordingly, the overall prevalence of *Schistosoma* infection in the present study animal was found to be 9.4%. The present finding was higher than the study of Ferede et al. (2013) (1.7%), Maritu et al. (2014) (1.5%) and Lo and Lemma (1973) (5.5%) in Southern and South western Ethiopia, Ravindra et al. (2008), 1.7% in South India, respectively. This difference might be due to the fact that the studies conducted in the previous covered very large area from where sheep could permanently or seasonally or not at all come in contact with water lodged area for dry season grazing and watering, whereas the present study covers small area where animals graze and watering around water lodged area (except for Enamrt which don't have specific stagnated water).

The difference in prevalence between the present study and the study conducted by Ravindra et al. (2008) in South India is due to difference in environmental factors (agro-ecology and climate), sampling time, epidemiological factors (availability of stagnant water body, marshy area and drainage system for irrigation practice which favor the development and multiplication of snail intermediate hosts) and agro-ecology, climatic conditions and animal management practices. However, the prevalence of the present study is lower than another previous study conducted in Lake Tana where in a prevalence of 20% was reported Haile (1987) and Islam et al. (2011). This difference is because the present study included both marshy areas (Kurtbahir and Kudimi) and dry areas (Enamrt) but the current study was restricted only to Lake Tana which has higher stagnant water, lower drainage and predominantly marshy which is more favorable for the development and multiplication of snail intermediate hosts and environmental factor, sampling period, epidemiological factors.

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The site- wise result of this study showed a significantly varied (P<0.05), higher prevalence of ovine and caprine schistosomiasis in Kurtbahir (14.6%) than the other two peasant associations (Kudimi, 8.4% and Enamrt, 4.2%). This difference was due to swampiest and moisture nature of Kurtbahir than the other two. This may indicate that as the site is nearer to large stagnated water body due to this the infection rate becomes higher. Similarly, Urquhart et al. (1996) has reported that water lodged and poorly drained areas with acidic soils are often endemic for schistosomiasis.

Schisotoma infection rate in relation with age in the present study was varied in ovine but, not in caprine. *Schistosoma* infection was dependent on age and it was observed that higher prevalence in adults, this is similar with Islam et al. (2011) might be due to long exposure as because older animals move longer distance in search of scarce pasture and water there by, increase their chance of infection, on the other hand very young animals don't graze extensively as the older so they get less infection of cercaria.

Schistoma infection rate in relation with body condition score in present was varied ovine but, not in caprine. Animals with poor body condition score were more affected than other groups of animal. The reason might be related to the body defense mechanism of sheep and goat. This result agrees with Merawe et al. (2014), in cattle schistosomiasis affirmed that infection rate increases with animals which have poor body condition score. This could be due to acquired immune status of poor body condition score and weak animals become more suppressed and susceptible which may be due to malnutrition and other parasitic infection. So, infected animals may require long period of time to respond against *schisotom*a infection. This gives suitable time for establishment and fecundity of parasites in the animals.

In the current study, there was no statistically significant difference (P>0.05) in the infection rate between male and female animals of both species. This indicates that both sexes were have the same risk to acquire the infection. This is because of equal exposure to the risk factors as there was no restriction on movement for grazing and contact with the parasite in terms of sex. Small ruminants were seen grazing in the area that necessitates more contact times with the larval stage of the parasite and the snail intermediate vector. This creates ideal condition for the multiplication of *Schistosoma* and increases the epidemiology of the disease; Kassaw (2007) also reported that the increased contact time with schistosoma infested habitat increases the rate and endemicity of schistosomiasis.

The prevalence of the *Schistosoma* infection among the two species (ovine and caprine) was vary and statistically highly significant differences (P<0.05) were observed. The prevalence of schistosomiasis was high in ovine (12.9%) than caprine (5.5%). The reason for variation among two species is due to variation in the behavior and feeding system of animals as described by Agrawal and Sahastbudne (1982). Sheep visit regularly contact snail contaminated water when drinking. So, higher propensity for contact with drinking water as a source of contamination could explain high prevalence. Goat show distinct aversion to immersion in water even avoids walking through it. So this may reduce their potential for exposure.

CONCLUSION AND RECOMMENDATION

The prevalence of ovine and caprine schistosomiasis recorded in this study based on coprological examination revealed the presence of schistosomiasis in sheep and goat population of the study area at a considerable level. The study has revealed that occurrence of *Schistosoma* infection in sheep and goat was significantly affected by the origin of the animals, age, species and body condition status of the animals. In addition, the occurrence of the diseases is closely linked to the presence of bio-types suitable for the development and multiplication of intermediate hosts. Therefore, this study revealed that small ruminant's schistosomiasis was one of the major parasitic diseases contributing to loss in productivity and production of sheep and goat in the study area. Based on this study, the following recommendations are forwarded:

- ✓ Schistosomiasis should be taken into consideration as one of the major limiting factor to livestock productivity in Mecha district hence any endeavor towards animal disease control strategy must include it in the priority list.
- ✓ Habitat modification and drainage or increasing of water flow activities should be practiced.
- ✓ Implementation of appropriate control measures for the intermediate host should be encouraged.
- ✓ Strategic use of anti-helminthes should be practiced to reduce pasture contamination with blood fluke eggs.
- ✓ Further and detailed studies on small ruminants' schistosomiasis and its intermediate host should be done in the study area.
- ✓ Ant-helmentic drugs which effectively against schistosoma should be widely available in veterinary clinic.

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Author's contribution

A.Fentanew performed the data collection, laboratory works and write up of the manuscript. S.Derso analyzed the data and revised the manuscript. All authors read and approved the final manuscript.

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Conflict of interests

No conflict of interest

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