Infection prevalence of ovine fasciolosis in small-scale irrigation schemes along the Upper Awash River Basin

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Abstract

From November 2003 to October 2004, the prevalence rate of ovine fasciolosis in small-scale irrigation schemes found in three different agro-ecologic zones of the Upper Awash River Basin was assessed. An overall fasciolosis infection prevalence rate of 56.3% (729/1296) was recorded in examined sheep in the Upper Awash Valley. Statistical comparisons of results revealed that the infection prevalence in the highlands (62.9%) was significantly higher ($p<0.05$) than both mid-altitude (51%) and lowlands (52%). No statistically significant difference ($p>0.05$) was depicted between fasciolosis infection prevalence in mid-altitude and lowland study sites, as well as between age and sex categories of examined subjects. The overall wet season prevalence (59.2%) was significantly higher ($p<0.05$) than the dry season prevalence (53.6%). Similarly, prevalence in irrigated sites (60.8%) was significantly higher ($p<0.05$) than non-irrigated sites (50.4%). However, closer analyses of results showed that these differences between irrigated and non-irrigated sites were not statistically significant ($p>0.05$) in the highland sites and independent of any seasonal influence. On the other hand, irrigation has significantly increased ($p<0.05$) the prevalence of ovine fasciolosis in mid-altitude during the dry season and in lowlands during both the dry and wet seasons. These findings strongly suggest and warrant that special schemes are requires and should be instituted vis the risk level associated with agroecologic variations for the control of fasciolosis and other water-borne animal and human diseases in areas where agricultural development efforts involve irrigation systems..

Keywords: Fasciolosis, infection prevalence, Sheep, small-scale irrigation, Upper Awash River Basin,

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Introduction

Agricultural production that depends on rain is mostly aimed at self-provision and this kind of production system is severely affected by climatic irregularities. An effective method to reduce vulnerability of climatic irregularities is to use irrigation for the agricultural production. Wrongly planned irrigation, however, impedes production and results in wasted effort by favoring the incidence and spread of common water-borne animal diseases such as fasciolosis, which are known to cause significant economic losses (Traoer, 1989). In fact, the shift from a rain-fed to an irrigation agriculture system favors the development and propagation of several water-borne infections to both humans and livestock.

In the highlands of Ethiopia, agriculture is the pillar of the economy and is featured by subsistence crop-livestock mixed farming with considerable dependence on natural rain. The current development trend in the country has principally focused towards food self-sufficiency through the use of irrigation as a means to increase food production and to cope with the needs of the rapidly increasing population. On the other hand, implementation of irrigation projects will be expected to bring about changes in land use patterns, and intensification of labor (Rahmato, 1999). The increasing number of dams and irrigation canals, that arebuilt to boost energy and food production, will also increases the risks to water-borne diseases through creation of favorable potential vector habitats (Traoer, 1989).

Fasciolosis, caused by *Fasciola hepatica* and *F. gigantica*, is one of the most prevalent helminth infections of ruminants in different parts of the world including Ethiopia. It causes significant morbidity and mortality (Okewole, *et al.,* 2000; WHO, 1995). The economic significance of fasciolosis in the highlands of Ethiopia has been reported by several workers (Yilma Jobre, 1985; Yadeta, 1994; Mezgebu, 1995; Molla Wassie, 1995). In recent years, small-scale traditional irrigation schemes are expanding in many parts of Ethiopia. It is anticipated that implementation of irrigated agriculture will create favourable habitat for fluke-transmitting snail vectors and thereby influence the life cycle progression occurrence of fasciolosis. This study, thus attempts to assess the influence of small-scale traditional irrigation on the extent and seasonal variation of ovine fasciolosis prevalence in different agroecologies of the upper Awash River Basin. The output of this study is also anticipated to be of practical use in envisaging a cost-effective and sound disease control strategy in areas experiencing similar environmental changes

Materials and methods

Study areas

From the total Ethiopia' irrigated land (about 161,125 hectares/over 43 %) is found within the Awash River Basin. Out of this, 26.5% are under traditional and modern small-scale irrigation. The remaining potential for irrigated agriculture using Awash River is estimated at 136,220 hectares (Mekonnen and Tarekegne, 2001). The present study was conducted in four selected areas belonging to three different ecological zones in the Upper Awash River Basin areas: Wolemera (highland), Ad'aa (Mid-altitude), Batu Degaga and Boset (lowlands) Districts. Wolemera district (western Shoa Zone some 40km west of Addis Ababa, at 09°02N latitude and 038° 34E longitude) has an altitude of 2390 m.a.s.l. The irrigation scheme uses water from the diverted the Guntuta River earth dam and is located in Berfeta Lemefa peasant association. Ad'aa District (East Shoa Zone, lies at latitude 08°44' N and longitude 38°58' E and ath an altitude of about 2000 m.a.s.l.). Wedecha and Belbela are the two micro-dams constructed by using the water source from Wedecha River. The main sources of water for the dams are the run-off of the surrounding catchments supplying the Wedecha and Belbela streams. Batu Degaga District (located at latitude 08°25'N and longitude 39°25' E in eastern Shoa) is a semi-arid draught prone area. In this irrigation project, water is diverted from Awash River. The elevation at the project area is 1350-1372 m.a.s.l. Boset (Doni Area) District located at latitude 8^{o}30.202'N longitude 39^{o}33.225'E) has an elevation varies from 1240m-1280 m.a.s.l. The source of water for the Doni irrigation scheme is the Awash River. It is located down stream of wonji sugar state farm. The area is situated at an undulating alluvial plain with open vegetation and dominant natural grazing lands.

Study animals

A total of 1296 sheep (529 from highlands, 302 from mid-altitude and 465 from lowland sites) were randomly collected and examined following standard helmentological (coproscoipic) procedures. All these animals were privately owned by smallholder farmers and were managed under traditional extensive system marked with minimum or no supplementary feed and health care.

Households whose animals were involved in the study were both from irrigated and non-irrigated areas.

Sampling and examination procedure

For the purpose of this study, 5% of confidence interval to historical/true prevalence was considered acceptable (Panse and Sukhatme, 1978). Therefore, infection prevalence datasets from previous works were, therefore, considered in the deciding the sample sizes in different study locations. Fresh faecal specimens were collected from a total of 1296 sheep from different agroecolagic areas during two seasons (690 in dry season) and (606 in wet season). McMaster feacal egg counting technique was used to determine fasciolosis infection prevalence and feacal egg output (MAFF, 1986; Soulsby, 1982). During every sampling occasion, information on sex and approximate age individual animals were recorded. Age was determined using dental eruption formula and animals were classified into two age categories as young (<2 years) and adults (>2 years).

Statistical analysis

Raw location-referenced data generated from this study were entered into Microsoft Excel database Other attribute data that were imported into the database system include information on grazing lands, age, sex, EPG. Chi Square (χ^2) statistics was used to determine the significance of the variations in infection prevalence between irrigated and non-irrigated grazing lands, agro-ecologic zones, seasons, age and sex.

Results

Overall prevalence

Of the 1296 faeca samples examined, 56.3% were found positive for fasciolosis. The infection prevalence of ovine fasciolosis in the highlands, mid-altitude and lowland study sites were 62%, 51% and 52%, respectively. The findings suggest that the infection prevalence in the highlands is significantly higher ($p<0.05$) than both in mid-altitude and lowland areas. Similarly, the infection prevalence during the wet season was significantly higher ($p<0.05$) than the results obtained during the dry season. Furthermore, irrigated lands had also significantly higher ($p<0.05$) prevalence rate as compared to the non-irrigated study sites. On the other hand, there was no discernible statistical difference ($p>0.05$) in infection prevalence between age as well as sex groups (Table 1).

Influences of irrigation, agroecologic and seasonal features on fasciolosis prevalence

The overall infection prevalence of ovine fasciolosis was significantly higher ($p<0.05$) in the irrigated sites when compared with non-irrigated lands. However, this variation was markedly pronouncedonly during the dry season (Table 1). The dry and wet season infection prevalence of ovine fasciolosis in irrigated and non-irrigated areas of highland sites were in the order of 64.5% and 57.3%; and 64% and 63.5%, respectively. Closer analysis of the data hence revealed that, irrespective of land use pattern and season, there was no statistically significant difference ($p>0.05$) in fasciolosis prevalence in the highland site. In mid-altitude sites, the infection prevalence during the dry season in irrigated sites (57.3%) was significantly different ($p<0.05$) than the findings in non-irrigated (37.3%) areas. The wet season picture in mid-altitude sites, however, did not show any statistically discernable variation ($p>0.05$) between the two land use types.

Fasciolosis prevalence in the lowland sites during dry season was 58.3% in irrigated areas (and 32.1% non-irrigated areas. In addition, the wet season prevalence picture in irrigated and non-irrigated areas reached 61.5% and 55%. Analysis of these results, hence, showed that significant variations ($p<0.05$) occurredbetween irrigated and non-irrigated grazing lands. Such significant differences were apparent during the dry season in mid-altitude and during both dry and wet seasons in the lowland areas (Table 1).

Discussion

Fasciolosis is widespread ruminant health problems and causes significant economic losses to the livestock industry in Ethiopia. Brook Lemma, *et al. (*1985) and Heinonen, *et al.* (1995) have reported that water logged and poorly drained areas with acidic soils in the highlands are often endemic areas for fasciolosis. In the present study, irrespective of the seasons and irrigation status of the grazing lands, the highest infection prevalence of fasciolosis was reported in the highlands. The findings, therefore, strongly suggest that the bionomic factors in the highland study areas are more favorable for the propagation and activity of the snail intermediate hosts and *Fasciola* life cycle progression for most part of the year. The overall infection prevalence was found to be significantly higher ($p<0.05$) in irrigated grazing lands than the findings in non-irrigated study sites. The difference in prevalence rate between irrigated and non-irrigated sites is more pronounced during the dry season in the mid-altitude and during both dry and wet season in the lowland areas. The above observation, therefore, indicates that irrigation influence and helps to maintain optimal bionomic requirements for the development of both the snail intermediate host and intra-mollsucian parasitic phases within the snail during periods of natural moisture deficiency in the mid-altitude and lowland environments. Similar observations and assertions were previously made by Richter, *et al.* (1999).

On the other hand, the existence of permanent surface water, which is more frequently a feature in the highlands, is associated with increased risk and contributes to higher fasciolosis prevalence. Scott and Goll, (1977); Brook Lemma, *et al.* (1985), and Gebrechristos Asegde (1990) have previously reported that the increased fasciolosis prevalence in the mid-altitude and lowlands are associated with permanent surface water, and the former contributes to the endemicity of the disease in these areas. The present study also concord with these reports and showed that adequate moisture from irrigated channels in these areas created favorable condition required for the progression of the lifecycle of the parasite, survival and multiplication of the snail intermediate hosts and consequently attributed to the increased fasciolosis prevalence.

In Ethiopia, during the dry season, biomass for animal feed are generally scarce, animals tend to graze along the banks of rivers and sides of irrigation channels. This provides an ideal environment for fasciolosis infection transmission to effectively take place. Yilma Jobre and Malone (1998) indicated that losses from fasciolosis in the tropics are relatively severe during dry season as the pathologic consequences are further aggravated due to sub-optimal nutrition during this period. In the present study, small-scale irrigation schemes were shown to heavily influence fasciolosis prevalence in mid-altitude and lowland areas. These findings, therefore, warrant that special schemes need to be instituted for the control and prevention of fasciolosis and other water-borne human and animal disease in agricultural development efforts involving irrigation agriculture in these environments.

Table 1. Infection prevalence of ovine fasciolosis by grazing land, season and altitude along the Upper Awash River Basin (November 2003 – October 2004) (n=1296).

Season	Grazing Land	Agro-ecological Zones											
		Highland			Mid-altitude			Lowland			Total		
		No. examined	No. Positive	Prevalence (%)	No. examined	No. Positive	Prevalence (%)	No. examined	No. Positive	Prevalence (%)	No. examined	No. Positive	Prevalence (%)
	Irrigated land	203	131	64.5[a]	75	43	57.3[a]	144	84	58.3[a]	422	258	61.1[a]
	Non-irrigated land	89	51	57.3[a]	67	25	37.3[b]	112	36	32.1[b]	268	112	41.8[b]
Dry Season	Total	292	182	62.3	142	68	47.9	256	120	46.9	690	370	53.6
	Irrigated land	111	71	64.0[a]	90	49	54.4[a]	109	67	61.5[a]	310	187	60.3[a]
	Non-irrigated land	126	80	63.5[a]	70	37	52.9[a]	100	55	55.0[b]	296	172	58.1[a]
Wet Season	Total	237	151	63.7	160	86	53.8	209	122	58.4	606	359	59.2
	Irrigated land	314	202	64.3[a]	165	92	55.8[a]	253	151	59.7[a]	732	445	60.8[a]
	Non-irrigated land	215	131	60.9[a]	137	62	45.3[b]	212	91	42.9[b]	564	284	50.4[b]
Overall	Grand Total	529	333	62.9	302	154	51.0	465	242	52.0	1296	729	56.3

Different letter (a,b) along columns show the presence of significant difference ($p<0.05$).

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