Original article

Prevalence of intestinal parasitic infections among urban dwellers in southwest Ethiopia

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Abstract

Background: Intestinal parasitic infections cause serious public health problem in Ethiopia. They are more prevalent in the poor segments of the population with low household income, poor handling of personal and environmental sanitation, overcrowding and limited access to clean water.

Objective: The purpose of this study was to assess the magnitude and pattern of intestinal parasitism in urban communities of southwest Ethiopia.

Methods: This community-based, cross-sectional study was undertaken in Jimma town from October 2004-January 2005. Study subjects were selected using systematic sampling method. Data were gathered through house to house survey using standardized questionnaire. Stool specimens were examined microscopically for the presence of parasite eggs, cysts and trophozoites using direct saline thin smear and formol-ether concentration methods.

Results: Of the total, 754 (83%) had one or more intestinal parasitic infections. *T. trichiura*, *A. lumbricoides* and *S. mansoni* were detected in single infection in 124 (16.4%), 44 (5.8%) and 11 (1.5%) of the infected study subjects, respectively. Polyparasitism was found in 515 (56.7%) of the total examined. Up to 5 parasites were detected in some individuals. *T. trichiura* with *A. lumbricoides*, hookworm and *S. mansoni* constituted 102 (13.5%), 33 (4.3%) and 17 (2.2%) of the double infections, respectively. *H. nana* and *S. mansoni* predominantly affected males than females (P<0.05). The prevalence of Giardia trophozites and *H. nana* were significantly higher in pre-school children than other age groups (P<0.05). Higher proportions of teenagers were infected by *A. lumbricoides* and *S. mansoni*. Taeniasis was also dominant in teenagers.

Conclusion: Intestinal parasitosis is highly prevalent in the study area. Public education on how to handle personal hygiene and proper use of latrines should be given to reduce the prevalence of infection. [*Ethiop.J.Health Dev.* 2007;21(1):12-17]

Introduction

Intestinal parasites and protozoan infections are amongst the most common infections worldwide. It is estimated that some 3.5 billion people are affected, and that 450 million are ill as a result of these infections, the majority being children (1). These infections are documented as serious public health problems as they cause iron deficiency anemia, growth retardation in children and other physical and mental health problems (2).

Intestinal parasitic infections are more prevalent among the poor sections of population. They are closely associated with low household income, poor personal and environmental sanitation, and overcrowding, limited access to clean water, tropical climate and low altitude. Intestinal parasitic infections are the top global health problems whereas amoebiasis, ascariasis, hookworm infection and trichiuriasis are among the ten most common infections (3). WHO reported that more than 980 million people are infected by *A. lumbricoides* (4), which is one of the most common public health problem in Africa. Invasive amoebiasis is a major health and social problem in western and southern Africa (3).

Intestinal parasitism has been widespread in Ethiopia. Parasitic helminthic infections are the second most predominant causes of outpatient morbidity in the country. Several studies indicated that the prevalence of parasitic infections were high in the lower altitudes including southwestern Ethiopia (5). Ethiopia has one of the lowest quality drinking water supply and latrine coverage in the world. As comparison by 2000, Ethiopia had only 12% latrine coverage while Kenya had 87% (6). The effect of altitude, urbanization, irrigation, and resettlement on the distribution of intestinal parasitism was depicted in previous studies (5, 7-12). Many reports illustrated that *A. lumbricoides* is the most prevalent intestinal parasite in different communities usually occurring together with trichuris infections (13-15). Hookworm infection, strongyloidiasis and enterobiasis are also public health problem though the magnitude is lesser compared to ascariasis. The prevalence of teaniasis alone ranges from 1- 48% and the infection rate with *Hymenolopis nana* is 3- 61% (10, 12, 14, 15). Schistosomiasis is common in northern region as compared to south and south west regions of Ethiopia (16). Amoebiasis and giardiasis are common causes of intestinal protozoal infections throughout the nation. The prevalence of amoebiasis ranges from 0-4% and that of giardiasis is 3-23% (5, 10,14).

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Previous studies gave due attention to the distributions of intestinal parasites in different altitudes, community groups such as school children or other groups confined to camps (5, 8, 10, 15,16) and communities (8-11,15). Hence, the pattern of intestinal parasitism in a community with diverse groups of people as a whole was not illustrated particularly in the study area. The purpose of this study was to assess the magnitude and patterns of intestinal parasitism in Jimma town, Southwestern Ethiopia.

Methods

Cross-sectional study was designed from October 2004 - January 2005 to determine the magnitude and patterns of intestinal parasitism in Jimma town, southwestern Ethiopia.

Jimma has mean altitude of 1780 meters above sea level. It is the largest town in southern Ethiopia characterized by tropical climate of heavy rainfall and warm climate having a mean annual temperature of 24.9^0C (17). During the study period, the population was estimated to be 110,000 (17). According to the report of Ministry of Planning and Economic Development, the average household size was 5.2 and the mean monthly income per household was 271 Birr (about 30 USD) [18]. Seventy five percent of the population had access to piped potable water while the remaining 25% used wells, springs and other sources (19).

All residents of the town were included as the sources of sample population for the study. The study population included residents of Jimma town of all ages and both sexes. Infants with ages less than four months, new settlers less than 2 weeks duration, individuals who were on anti-parasitic drugs at the time of the study or 2 weeks prior to the study were excluded. Multistage sampling technique was employed for the purpose of sampling. The town was divided into three administrative districts (*woreda*) and further into 13 administrative units (*Kebeles)*.

Sample size was determined using a general formula considering the level of significances at 5% and assuming the prevalence of intestinal parasitosis to be 80% (9). In line with it, 239 households for the sample were calculated and of which a total of 908 unit of analysis were selected. Accordingly, 258, 283 and 367 study subjects from *Woreda* 1, 2 and 3 were taken respectively. Two *Kebeles* from each *Woreda* were also selected.

Three well trained persons collected the data through house to house survey to obtain information regarding age, sex, residence, family size, and occupation based on a pre-designed questionnaire. Accordingly, the first household was randomly selected in each *Kebele* and then the remaining households were selected using systematic sampling method. Besides, stool specimens were collected from all study subjects in tight lead plastic containers. The specimens were examined microscopically for the presence of eggs, trophozoites and cysts. All stool specimens were examined by direct saline thin smear and formal-ether concentration methods and the findings were recorded using pre-prepared formats. Direct saline thin smear was chosen because of its cheapness, simple, and reliable qualities. Data collection and microscopic examinations were supervised regularly. In addition, the time required for the procedure was relatively short requiring no sophisticated equipments.

Direct thin wet smear in normal saline and Lugol's iodine solution was done immediately at convenient places for the presence of trophozoites and cysts. In addition, stool specimens were transported to laboratory section using 8% formalin. Formol-ether concentration method was carried out in Parasitology laboratory in Jimma University. Direct smear was done by senior laboratory technicians and the formol-ether concentration method was done by a laboratory technologist.

Data were entered into a computer and analyzed using SPSS windows version 11.5. Descriptive statistics was used to give a clear picture of background characteristics like age, sex, occupation, history of drug intake and distribution of intestinal parasites. The relationships between proportion of intestinal parasitism and determinant factors for intestinal parasitism such as age and sex were analyzed. Chi-square test was used to see crude association of sex and the proportion of intestinal parasitism. P-value less than 0.05 was considered as statistically significant.

Written permission was obtained from town administrative officials prior to start the study. Verbal consent was obtained from each individual before conducting interview and sample collection. The procedure was non invasive and has no harm to the study subjects. Those who had parasites were given a prescription order so that they could purchase appropriate anti parasitic drugs.

Results

A total of 239 households were selected for investigation. Of these 31 (12.9%) were excluded because of inability to provide specimen. For this reason a total of 208 households were included in the study. A total of 940 individuals were selected from these households of which 32 (4.2%) were excluded due to previous drug intake. As a result, 908 individuals from selected households participated in the study. Majority 754 (83%) of the subjects were found to have single or multiple intestinal parasitic infections while 154 (17%) were free of any parasite. Of the entire positive for the parasite, 430 were females and 324 males with female to male ratio of 1:0.8.

The mean age of the participants who had intestinal parasite was 23±16. Slightly less than 50% were students and the share of adults above 18 years of old was 360 (47.8.0%).

Table 1: **Frequency distribution by sex, age, occupation and drug history of the study subjects for positive parasites (n=754), Jimma, 2005.**

Background characteristics	Frequency	Percentage
Gender		
Male	324	43.0
Female	430	57.0
Age Group		
<1	7	0.9
1-4	44	5.8
5-14	215	28.5
15-18	128	17.0
>18	360	47.8
Occupation		
Student	375	49.7
Private business	77	10.2
Housewives	60	8.0
Government employee	56	7.4
House maids	37	4.9
Farmers	28	3.7
No specific jobs	51	6.8
Dependent*	53	7.0
Others**	17	2.3

*****Elderly, small children
****** Not specified

Different types of parasites including protozoans, trematode (flukes), cestodes and nematodes (round worms) were detected from the stool samples of study participants. The prevalence of *T. trichiura* infection was 60.9% followed by 40.9% of *A. lumbricoides.* Of these, trichuriasis, ascariasis and schistosomiasis infections emerged as a single parasite in 124 (16.4%), 44 (5.8%), and 11 (1.5%) individuals, respectively. *T. trichiura* with *A. lumbricoides*, hookworms and *S. mansoni* occurred to share 102 (13.5%), 33 (4.4%) and 17 (2.3%) of double infections, respectively. Ascaris and trichuris were commonly found with hookworms and *S. mansoni* as triple infections. *T. trichiura, A. lumbricoides,* and hookworms were the most common and *Taenia saginata* and *S. stercoralis* were the least common reported intestinal parasites among the residents of Jimma town (Table 2). For both sexes, the proportion of infections was higher for helminths compared to protozoa, i.e., about 4.7 times (Table 2, 3).

H. nana and *S. mansoni* were found to predominantly affect male population than female population (P<0.05, Table 3). Active amoebiasis was relatively common in school children whereas *E. histolytica* was found in 5.6% among school-children. Hookworm ova and *E. histolytica* cysts were higher (28.6%) in children under 1 year of age than in other age groups. Trichuriasis was highly prevalent in all age groups (57%-75%). The highest was found in teenagers. Hookworm infections were common in school children and teenagers. Ascariasis, taeniasis, schistosomiasis and *S. stercoralis* infections (55.5%, 4.7%, 32.0% and 3.1%), respectively were most common in teenagers. Significant proportion of teenagers were infected by *S.mansoni* (P<0.05) and ascaris.

The rate of infection by *H. nana* (20.5%) and *G. lamblia* cysts and trophozoites (29.5% and 18.2%), respectively were higher in preschool children compared to the other age groups (Table 4, P<0.05).

Regarding the types of intestinal parasites per individual, 1, 2, and 3 types of parasites were identified in 239 (31.7%), 270 (35.8%) and 180 (23.8%) of those infected while 4 and 5 parasitic species were found in 59 (7.8%) and 6 (0.8%) respectively (Figure 1). Generally, multiple infections (polyparasitism) were seen in 515 (56.7%) of the total examined and 68.3% of those with intestinal parasites.

Table 2: **Distribution of intestinal parasites among study subjects in Jimma (n = 908), Jimma, 2005.**

Types of Parasites	Frequency	Percentage
Protozoan parasites		
Amoeba cyst	127	14.0
Amoeba trophozoite	28	3.1
Giardia cyst	93	10.3
Giardia trophozoite	33	3.6
Helminths		
Nematodes		
Trichuris trichiura	553	60.9
Ascaris lumbricoides	371	40.9
Hookworms	159	17.5
Strogyloides stercoralis	19	2.1
Cestodes		
Hymenolopis nana	45	5.0
Taenia saginata	21	2.3
Tremtodes(flukes)		
Schistosoma mansoni	134	14.8
Others*	10	1.1

***** *Enterobius vermicularis*
** Multiple infections were found

Table 3: **Distribution of intestinal parasites in relation to sex of residents of Jimma town, Jimma, 2005.**

Type of Parasites	Male (n = 324)		Female (n = 430)	
	No.	Percent	No.	Percent
Protozoans				
Amoeba cyst	52	16.0	75	17.4
Amoeba trophozoite	10	3.1	18	4.2
Giardia cyst	44	13.6	49	11.4
Giardia trophozoite	15	4.6	18	4.2
Helminths				
A. lumbricoides	170	52.5	201	46.7
T. trichiura	243	75.0	310	72.1
Hookworms	72	22.2	87	20.2
S. stercoralis	5	1.5	14	3.3
H. nana	31	9.6	14	3.3
Taenia saginata	8	2.5	13	3.0
S. mansoni	74	22.8	60	14.0
Others*	2	0.6	8	1.9

***** *Enterobius vermicularis*

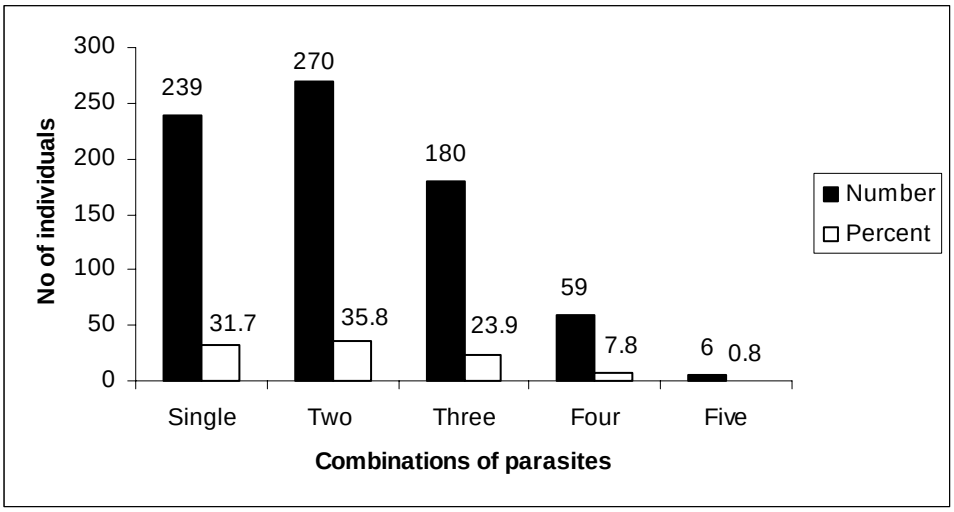

Figure 1: **Types of intestinal parasites identified per individual among residents of Jimma town, Jimma, 2005.**

Table 4: **Distribution of intestinal parasites among different age groups in Jimma town residents, Jimma, 2005.**

Types of parasites	Age group in years (No)				
	<1 * (n=7) No (%)	**1-4 (n=44)** No (%)	**5 -14 (n=215)** No (%)	**15 -18 (n=128)** No (%)	**>18 (n=360)** No (%)
Protozoans					
E. hystolytica cyst	2 (28.6)	8 (18.2)	41(19.1)	19(14.8)	57(15.8)
E. hystolytica trophozoite	0(0.0)	0(0.0)	12(5.6)	3(2.3)	13(3.6)
G. lamblia cyst	2(28.6)	13(29.5)	25(11.6)	16(12.5)	37(10.3)
G. lamblia trophozoite	1(14.3)	8(18.2)	7 (3.3)	3(2.3)	14(3.9)
Helminths					
A. lumbricoides	2(28.6)	14(31.8)	112(52.1)	71(55.5)	172(47.8)
T. trichuria	4(57.1)	32(72.7)	158(73.5)	96(75.0)	263(73.0)
Hookworms	2(28.6)	6(13.6)	55(25.6)	32(25.0)	64(17.8)
S. stercoralis	0(0.0)	0(0.0)	6(2.8)	4(3.1)	9(2.5)
H. nana	1(14.3)	9(20.5)	19(8.8)	9(7.0)	7(1.9)
Taenia saginata	0(0.0)	0(0.0)	5(2.3)	6(4.7)	10(2.8)
S. mansoni	1(14.3)	6(13.6)	28(13.0)	41(32.0)	58(16.1)
Others*	0(0.0)	0(0.0)	2(0.9)	2(1.6)	6(1.7)

<1 year but above 4 months = Infants, = 1-4 years = Preschool children,
5-14 years = School children, 15-18 years= teenagers, > 18 years= Adults;
* *Enterbius vermicularis*; multiple (more than 1) parasitic infections present

Discussion

Of 908 residents, 754 (83.0%) were infected with one or more intestinal parasites. Despite of higher coverage of latrine, this finding shows a significantly higher infection rate. This is because of poor water supply, which is below the standard. According to Planning and Economic Development for Oromyia (19), a quarter (25%) of the population utilized water from sources other than pipes. Poverty may also contribute to the high parasite prevalence (19). Poor environmental sanitation and climatic conditions (hot, wet and humid) favor the persistence of parasite ova in the soil. This finding is consistent with a study done by Yeneneh (9) where a prevalence of 82.7% intestinal parasitosis found in residents of 4 villages in southwestern Ethiopia. Another study conducted by Legesse and Erko among school-children around Lake Langano reported a prevalence of 83.8% (20). This result was higher than another school-based study conducted in Jimma by Haile et al (10) who reported a prevalence of 68.4%. The prevalence in our study was also higher compared to other community-based studies conducted in Saudi Arabia by Al-Shammari et al (21) showing an overall prevalence of 32.2%. This variation could be owing to environmental hygiene differences, economic, educational status of the study subjects and climatic conditions.

In this study, multiple infections (polyparasitism) occured in 515 individuals making 56.7% of the total examined subjects and 68.3% of those who had intestinal parasites. This is similar to a study done in Argentina portraying a polyparasitism of 61.6% among marginally poor people (22). Double infection was frequently seen in more than a third (35.8%) of the study subjects. The prevalence of multiple infections was higher compared to the previous studies (8-12). Sample size determination, study population and the methods used could attribute to this observed difference in detections of various parasites.

The prevalence of amoebiasis and giardiasis in this study was 3.1% and 3.6%, respectively. These are within the range of the nation-wide prevalence rate for amoebiasis and giardiasis (5, 14). The prevalence of giardiasis is nearly similar to that of Birrie and Erko report of 3.1% among non-school children (23). Three hundred seventy one (41.0%) of the study subjects were infected with *A. lumbricoides* and the rate falls just above the upper range for nation wide prevalence rate of ascariasis (which is from 30-40) (13).

The average prevalence of ascaris in most other African countries is reported to be 32%, ranging from 16% to 48% (3). *Trichuris trichiura* was found in 553(61%) of the study subjects. The rate was relatively higher compared to the previous studies (8-11).

The prevalence of hookworm infections in this study was 159(17.5%). The rate is higher to the findings of previous school-based study by Haile et al (10) which was 0.3%. The present findings on prevalences of S. *stercoralis*, *H. nana*, and *T. saginata* were similar to the findings of previous studies reported by Tesfamichael, Kloos et al., McConnel and Armstrong, Woldemichael et al (5, 12, 14, 15).

The overall prevalence rate of schistosomiasis was 14.8%. This result could be considered high taking into account the availability of municipal water system in such a big town like Jimma. However, all persons do not use this source. A quarter of people in the study area use other sources. The presence of insufficient water supply may have forced the people to use other water sources such as the rivers crossing the town.. Reports of various studies revealed that prevalence of schistosomiasis was from 4%-29% around villages near Lake Abaya and Gorgora in north coast of Lake Tana (15, 24), respectively. In these studies, infection rates were higher in communities reside near to the river banks.

H. nana and *S. mansoni* seriously affected males than females and the association was statistically significant ($P<0.01$ and $P<0.05$), respectively. Moreover, *A. lumbricoides* and *S. mansoni* infections were common in teenagers than in the other age groups ($p < 0.05$) in both cases. The reason for the association is not clear but as to schistosomiasis, males may have higher exposure to river water than females. Giardiasis and *H. nana* infections were common in pre school children compared to the other age groups. The association was statistically significant in all cases ($p < 0.05$). The reasons of higher infection rate for that of the study done on pre school-children could be due to modes of transmission. Giardiasis is transmitted through contaminated hands, food etc whereas *H. nana is* by fecal-oral means. Thus, children can be the first vulnerable group to be contaminated.

In this study, protozoan infections were in general higher in children especially in those under 5 years of age while there was reduction as age increased. The reason could be due to slow development of immunity in adults to the protozoan parasites and better awareness in washing hands and other personal hygiene measures. On the other hand, there was no significant difference in the rate of infection due to helminths in relation to age. This is because of different evasion mechanisms to immunity by helminths.

In conclusion, intestinal parasitosis in Jimma town is very high. The proportion of infections was higher for helminthes compared to protozoa. The high prevalence of parasitosis in the study area indicated that much work remains to be done to improve the health of the

people. Measures including education on personal and environmental hygiene should be taken into account to reduce the prevalence.

Acknowledgements
We would like to thank the Office of Planning and Economic Development of Jimma Zone, Jimma town municipality and the respective *Kebele* administrations for providing us the necessary information and helped us during sample collections. Jimma University is acknowledged for financing the study. We are grateful to the data collectors and others who cooperated with us during the study.

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