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Abstract

The aim of this cross-sectional study was to determine the prevalence of intestinal parasites and to evaluate changes in the annual rates by retrospective screening of the data from Mojo Health Center’s laboratory between the period of 2005 and 2010, in Eastern central Ethiopia. To strengthen clinical study, the survey was supplemented with observational study and pre-coded questionnaires for the assessment of awareness level of treatment seeking respondents towards specific health indicators and disease transmission, prevention and control mechanisms and outsourcing and handling of drinking water and food as well as the health Center staff to observe the status of common intestinal parasites across the 6 years. The present study showed that the prevalence of intestinal parasite infection during 6 years ranged from 7.4 to 15.2%. The total average prevalence of parasites was 5007 (9.3%). Of the nine parasites detected, multi-infection was common, especially with the two most prevalent protozoan parasites (E. histolytica and G. lamblia). In 2006, a peak prevalence of 8.3% for E. histolytica/E. dispar and 6.5% for G. lamblia was experienced. The least prevalent intestinal parasite was Trichuris trichiura with about 0.001% prevalence. Even though a slight decline in the annual prevalence of parasitosis was apparent, it was noticed that the parasitic diseases are still a significant health problem in this country. Environmental sanitation improvement and health education promotion at different levels of Mojo district and empowering the laboratory department of the health center can be quite indispensable for control and prevention of parasitic infections in the area.

Keywords: Helminth; Intestinal parasite; Prevalence; Protozoa; Retrospective

Introduction

Intestinal parasitic infections are among the most common infections world-wide. It is estimated that some 3.5 billion people are affected, and 450 million are ill as a result of these infections [1]. Current estimates showed that at least more than one-quarter of the world’s population is chronically infected with intestinal parasites and that most of these infected people live in developing countries [2,3].

Intestinal parasitic infections, as in many developing countries, are common in Ethiopia and cause serious public health problems such as malnutrition, anaemia and growth retardation as well as higher susceptibility to other infections [4]. Several studies indicated that the prevalence of parasitic infections were high in the lower altitudes of Ethiopia [5]. The low economic standard, poor sanitation and ignorance of simple health promotion practices favor the wide distribution of intestinal helminths in Ethiopia [5].

In many of the developing countries including Ethiopia, the most prevalent and important helminths are those of the soil transmitted nematodes. Chronic gut infection in humans commonly results from nematodes, particularly of Ascaris lumbricoides, Trichuris trichiura and hookworms [6]. For instance, it was found that helminthiasis is the second most common cause of outpatient morbidity next to malaria in Ethiopia [7,8] where Children are the most affected group and serve both as source of infection and as victims, thus contributing to transmission of most parasitic infections within the community [9].

Besides factors such as socio-economic status, poor sanitation, inadequate medical care and absence of safe drinking water supplies, it has also been reported that unsanitary sewage disposal, the habit of eating raw or semi-raw fish and the practice of allowing untreated infected sewage to drain in fresh water lakes are responsible for the establishment and maintenance of the parasite [10]. It is well known that eggs of some intestinal parasites like that of Ascaris lumbricoides and Enterobius vermicularis are carried by blowing dust particles and transmitted by inhalation [11] as Mojo town appears to be highly favorable for such mode of transmission.

Environmental factors also play a role in the incidence of intestinal parasitic infection as hot and humid tropical climate favour increased parasite prevalence [12]. Based on variation in climatic and geographic zones in Ethiopia, it should be evident that there are macro and micro-environmental factors contributing to the differences in prevalence of intestinal parasites [13]. Varying degrees of prevalence of intestinal parasites have been reported depending on the climatic, altitudinal and micro-environmental factors of different ecological zones in different communities, 93% prevalence among Falasha immigrants in Israel being the highest ever reported [14].

From preliminary observation it was found that no study has so far been conducted on intestinal parasites in Mojo town. In order to investigate the prevalence, distribution and status of common intestinal parasites, this study was initiated.

Methods

The study area

The study was conducted in Mojo town which is located in
the Eastern Shewa Zone of Oromia Regional State, Lume district, Ethiopia (8° 36' 0" N / 39° 7' 0" E). Mojo has an average temperature of 23°C/73.4°F. The monthly mean maximum and minimum temperature for Mojo station ranges from 25.6°C-30.8°C and 8.5°C to 13.5°C, respectively [15].

Data collection

A retrospective laboratory analysis of stool specimens was carried out for intestinal parasite examination. The records were collected from outpatients in Mojo Health Center laboratory department of the past 6 years between January 2005 and December 2010. Specimens were carefully examined by medical laboratory technologists for the presence of parasites and/or their respective stages (cysts, trophozoites, ova and larvae). The stool specimens were examined using parasitological analysis like direct and 10% formalin concentration method [16,17]. The age, sex and other demographic information of the patients were recorded.

Careful observational studies on service provision qualities for treatment seeking persons and disease management skills were conducted in the health center. On top of this, pre-coded and open ended questionnaires on specific health issues were administered to treatment seekers and health center staff members to further strengthen the study. Mojo health center consists of 14 professional health workers that include health officers, nurses, laboratory technicians and pharmacy technicians.

Data analyses

Data collection was followed by proper data organization, analysis and interpretation. Retrospective data obtained from the health center and data from questionnaire were qualitatively and quantitatively analyzed to check the frequency and strength of associations of variables using SPSS version 12. For descriptive data, rate (percentage) was used to describe the characteristics of the studied population, including the prevalence of intestinal parasites based on selected demographic parameters like age and gender. A Pearson’s Chi-square (X²) on proportion was used to test the associations between each variable. In univariate statistical model in KAPs survey, the dependent variable (prevalence of intestinal parasites) was cross tabulated with variable. In univariate statistical model in KAPs survey, the dependent variable (prevalence of intestinal parasites) was cross tabulated with variable. In univariate statistical model in KAPs survey, the dependent variable (prevalence of intestinal parasites) was cross tabulated with variable. In univariate statistical model in KAPs survey, the dependent variable (prevalence of intestinal parasites) was cross tabulated with variable.

Results

Retrospective data obtained from Mojo Health Center (2005-2010)

In the present retrospective study nine parasites were identified. A total of 5007 intestinal parasite were diagnosed and treated microscopically during 2005-2010 with about 835 annual average cases.

The number of intestinal parasites showed a sharp increase from 7.4% in 2005 to 15.2% by 2006 and then declined to 10.8% by 2007. From the period 2007 to 2008, the proportion showed a decreasing trend and then a slight escalation between 2008 and 2009 up to 2010, a slightly sharp decline of parasite rate was observed. The total number of outpatients registered at Mojo health center during 2005-2010 was 53,942 of which intestinal parasites cases accounted for 9.3% (n=5007; 95% CI=7.4-15.2%) of samples were positive for intestinal parasites. Of these positive samples 4.4% and 4.9% were males and females, respectively. The total prevalence of protozoan infection was 8.8%, which showed statistically significant difference when compared with the total prevalence in helminths infection, 0.5% (p<0.05).

There was no significant variation between males and females regarding parasitic infections, with a female: male ratio of 1.1:1. There was a higher average prevalence in patients above 14 years of age (6.5%), followed by patients aged 5-14 and 0-4 years with prevalence of 1.8% and 1.0%, respectively (Table 3).

KAPs surveys (Knowledge Attitude Practices surveys)

Various questions were raised in the questionnaires to assess service provision and facilities as well as to measure awareness level of treatment seekers. For question raised about the presence of adequate skilled human power in each health service provision department, all health center staff respondents replied that there was enough skilled human power and 71.4% of them replied that the health center laboratory setup is equipped with necessary laboratory facilities and qualified man power.

When the staff respondents were asked about the frequency of intestinal parasites examination and detection in the health center from a total of 14 respondents, 93% replied that they were examined frequently. Concerning the types of intestinal parasites encountered in the health center, 85% of the staff respondents replied G. lamblia and E. histolytica and very insignificant number of respondents forwarded A. lumbricoides, T. taenia species and Pinworm.

Regarding questions raised about the past five years trend and status of intestinal parasites all replied that there was a decreasing trend due to proper provision of health education. Concerning the possibility of control of common intestinal parasites in relation to the awareness level of the society and the prevailing condition, all the respondents replied that it is possible to control.

Out of a total of 40 selected treatment seeking respondents, 62.5% were males and 37.5% females and their age ranged from 14 to 62 with mean of 29 (Table 1). When these selected treatment seeking respondents were asked if they were provided general health care education at their residences, out of 40 respondents, 70% replied yes and 30% no. Similarly, only 20% of the selected respondents were found to have been educated at Mojo Health Center and the remaining 80% didn’t experience any sort of health education at the health center. Concerning latrine, 92.5% of the respondents replied they have toilet and also wash their hand after visiting latrine. Only 7.5% of the respondents replied that they do not have toilet.

When the respondents were asked about the source of their drinking water and way of utilizing water, 47.5% replied that they obtained water from pipe and the rest 52.5% replied to have fetched water from different sources such as pond, wells, streams or rivers. Regardless of

<table>
<thead>
<tr>
<th>Sex</th>
<th>Age (in year)</th>
<th>Educational Status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>14-24</td>
<td>25-49 above 49</td>
</tr>
<tr>
<td>Male</td>
<td>11</td>
<td>6</td>
</tr>
<tr>
<td>Female</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Total</td>
<td>18</td>
<td>14</td>
</tr>
</tbody>
</table>

Table 1: Demographic information of treatment seeking respondents visiting Mojo Health Center, 2011/2012.
the source of water, 95% of the respondents replied that they used the water for domestic purpose directly and only insignificant respondents 5% replied to further process the fetched water before consumption either by boiling or filtering.

Concerning appropriate waste disposal sites, from 40 answers, 90% replied that they managed to dispose wastes properly and 10% respondents replied that they didn’t exercise proper waste management practices yet.

When treatment seeking individuals were asked about the habit of eating uncooked or undercooked food, among 40 respondents 85% replied that they did have the habit of feeding uncooked or undercooked food and 15% replied that they do not have the indicated habit.

Regarding the exposure of treatment seekers to common intestinal parasites, 67.5% of which (42.5% male and 25% female) respondents indicated as they experienced intestinal parasites at least once in their life and the above respondents who experienced intestinal parasites said that they preferred visiting health facility immediately after they feel intestinal discomfort. And common symptoms reported by the majority (90%) of treatment seekers who experienced intestinal parasites included intestinal discomfort, non-bloody diarrhea and nausea. However, insignificant number of respondents reported bloody diarrhea and fatty stool as major symptoms of infection.

On the other hand, when respondents were asked about mode of transmission of intestinal parasites, the majority (80%) replied that food and water contamination as well as soiled finger would be the major route of transmission. Others (10%) responded that they prefer visiting health facility immediately after they feel intestinal discomfort. And common symptoms reported by the majority (90%) replied to have good experience of waste disposal in appropriate site. These perhaps appear to be an implicative for the less prevalence of parasites in Mojo town and its surroundings.

In the present retrospective study from Mojo Health Center nine parasites with average prevalence of 9.3% (7.4-15.2%) were detected. As reported by Teklehymanot [18], in the prospective study conducted among Kara and Kwego semi-pastoralist tribes in lower Omo Valley, nine parasites with prevalence of 104 (51.7%) and 83 (41.5%) was identified, respectively. In the same way, a retrospective study conducted in Palestine using 10 years data showed 32.0-41.5% prevalence range of seven intestinal parasite infections with Entamoeba histolytica (8.2-18.2%) and Enterobius vermicularis (15.6-28.9%) [19].

In the present study, Entamoeba histolytica, with peak annual prevalence of 8.3% was found to be the most prevalent of all intestinal parasites detected by 2006, followed by Giardia lamblia with 6.5% annual prevalence in the same year (Table 2). More recently, similar study in Saudi Arabia reported a 6.2% overall prevalence of intestinal parasites; the majority of patients being infected by Entamoeba histolytica and Giardia lamblia with prevalence of 4.7% and 1.3%, respectively [20]. Similarly, a prospective parasitological study on prevalence of Giardiasis among children in relation to water sources in Selected Village of Pawi Special District in Benishangul-Gumuz Region, Northwestern Ethiopia showed 26.6% infection rate [21].

By 2009, with annual prevalence of 6.3%, Giardia lamblia was found to be the top prevalent intestinal parasite and Entamoeba histolytica, with 2.0% annual prevalence was the second in prevalence as shown in table 2. It has been reported that Giardia lamblia is considered to be

### Discussion

In the present retrospective study, it has been observed that a total dominance of prevalence of protozoan infections owing to significant difference when compared with the total prevalence in helmint infection i.e. about 8.8% of protozoan parasites and about 0.5% of helmint parasites were detected.

A relatively low prevalence of intestinal parasites (9.3%) was observed in the present study. About 92.5% of treatment seeking respondents in KAPs survey replied to have toilet and also wash their hands after visiting latrine. Moreover, the majority respondents (90%) replied to have good experience of waste disposal in appropriate site. These perhaps appear to be an implicative for the less prevalence of parasites in Mojo town and its surroundings.

### Table 2: Overall prevalence of intestinal protozoan and helmint parasites from 2005 to 2010 in Mojo Health Center, Eastern Ethiopia [n (%)], 2012.

<table>
<thead>
<tr>
<th>Year</th>
<th>Entamoeba histolytica</th>
<th>Giardia lamblia</th>
<th>Taenia species</th>
<th>Hookworms</th>
<th>Ascaris lumbricoides</th>
<th>Strongyloides stercoralis</th>
<th>Enterobius vermicularis</th>
<th>Hymenolepis nana</th>
<th>Infected cases/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>11259</td>
<td>465(4.13)</td>
<td>352(3.12)</td>
<td>-</td>
<td>4(0.04)</td>
<td>6(0.09)</td>
<td>4(0.04)</td>
<td>-</td>
<td>15(0.13)</td>
</tr>
<tr>
<td>2006</td>
<td>6319</td>
<td>526(8.32)</td>
<td>408(6.46)</td>
<td>2(0.03)</td>
<td>4(0.06)</td>
<td>5(0.08)</td>
<td>-</td>
<td>-</td>
<td>13(0.2)</td>
</tr>
<tr>
<td>2007</td>
<td>8593</td>
<td>363(4.22)</td>
<td>518(6.0)</td>
<td>12(0.14)</td>
<td>1(0.01)</td>
<td>1(0.01)</td>
<td>5(0.06)</td>
<td>3(0.03)</td>
<td>21(0.24)</td>
</tr>
<tr>
<td>2008</td>
<td>6696</td>
<td>228(3.4)</td>
<td>308(4.6)</td>
<td>4(0.06)</td>
<td>6(0.09)</td>
<td>15(0.22)</td>
<td>8(0.12)</td>
<td>6(0.09)</td>
<td>22(0.33)</td>
</tr>
<tr>
<td>2009</td>
<td>8590</td>
<td>172(2.0)</td>
<td>541(6.3)</td>
<td>7(0.08)</td>
<td>3(0.03)</td>
<td>6(0.07)</td>
<td>12(0.14)</td>
<td>2(0.02)</td>
<td>10(0.1)</td>
</tr>
<tr>
<td>2010</td>
<td>12485</td>
<td>411(3.3)</td>
<td>454(3.64)</td>
<td>4(0.03)</td>
<td>1(0.01)</td>
<td>6(0.05)</td>
<td>9(0.07)</td>
<td>2(0.02)</td>
<td>28(0.22)</td>
</tr>
</tbody>
</table>

### Table 3: Prevalence of intestinal parasites stratified by age, year and host gender, Mojo Health Center, 2012.
one of the leading causative agents of diarrhoea in both children [22] and adults [23,24].

In the present study of KAPs survey, about 95% of the respondents replied that they used water for domestic purpose including drinking directly without further processing (filtering, boiling) implying it to be the major route of transmission. Studies revealed that water supply is an important risk factor for amoebiasis and giardiasis, and several large outbreaks have resulted from the contamination of municipal water supplies with human waste [25] and diarrhoeal disease alone amounts to an estimated 4.1% of the total DALYs (disability-adjusted life years) global burden of disease and is responsible for the deaths of 1.8 million people every year [26].

_Hymenolepis nana_ exhibited the third highest infection rate following _G. lamblia_ and _E. histolytica_ during the past six years of the present survey. Studies showed that parasites transmitted via contaminated hands or feco-oral route such as the present survey. Studies showed that parasites transmitted via parasites [28].

hookworms and 83.8% of the students harbored one or more intestinal surveys among school children in a rural area close to the southeast 2006 and 0.01% by 2007 and 2010. On the contrary, parasitological this retrospective parasitological survey, with no record by 2005 and

H. nana possessed high prevalence in children especially in those less than 5 years at adults [27]. However, the present study revealed higher prevalence of _G. lamblia_ and _E. histolytica_ in adults. This may be due to higher interpersonal interaction by going away from one’s own area, feeding of raw or undercooked vegetables and improperly washed vegetables and such practices were stated by 85% treatment seeking respondents in KAPs surveys.

Hookworms were among the least prevalent intestinal parasites in this retrospective parasitological survey, with no record by 2005 and 2006 and 0.01% by 2007 and 2010. On the contrary, parasitological surveys among school children in a rural area close to the southeast of Lake Langano, Ethiopia showed the highest (60.2%) prevalence of hookworms and 83.8% of the students harbored one or more intestinal parasites [28].

_Ascaris lumbricoides_ and _Trichuris trichiura_, commonly co-existing helminth parasites by the year 2007 and 2009, showed the least prevalence (0.01%), respectively. This low prevalence might have been associated with climate of the study area which is semi-arid. In line with the present study, studies have shown that low prevalence of ascarisiasis in arid climate is associated with the fact that dry conditions inhibit embryonation of the ova in the soil [29].

Regarding distribution of the intestinal parasite among age groups, more infection rate was observed in the age of 15 years and above followed by 5-14 years and below 5 years through the years 2005 to 2010, respectively (Table 3). This situation of more infection rate among adults than children is in agreement with study results in Nigeria [30]. With regard to the sex distribution of the intestinal parasites it was found that more (4.9%) females were infected as compared to males with 4.4% infection rate although there was no significant variation between sex of individuals and intestinal parasitic infection (p=0.18) [27] found that _H. nana_ predominantly affected males than females among dwellers of Jimma town, south western Ethiopia. In the present study, it showed no significant variation in relation to sex of individuals.

With regard to _Taenia_ species, whose transmission is associated with eating beef or pork, it was found to be exclusively detected among 15 and above age groups. This can be explained in terms of cultures of the society in which raw meat or undercooked meat is more commonly consumed by adults than children. Results from KAPs survey showed that 34 (85%) treatment seeking respondents replied to have the habit of consuming uncooked or undercooked food implying that _Taeniasis_ can obviously be expected.

### Conclusions

1. _Entamoeba histolytica_ and _Giardia lamblia_ were found to be the most prevalent intestinal parasites among individuals visited the health center during the past six years (2005-2010).
2. Most intestinal parasites were more prevalent among individuals 15years old and above than individuals less than 15 years.
3. Although retrospective data of the present study showed mixed figure for the prevalence of most of the intestinal parasites, there was a sharp increasing trend for some intestinal parasites like _E. histolytica_ throughout the past six years (2005-2010).

### Acknowledgements

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### References


