Individual, Household and Environmental Variables In Relation To Some Neglected Tropical Diseases In Hara Health Center, South Wollo, Northeast Ethiopia

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Acronyms

AOR	Adjusted Odds Ratio
CDC	Center for Disease Control and Prevention
COR	Crude Odds Ratio
CSA	Central Statistical Agency
HHC	Hara Health Center
IPIs	Intestinal Parasitic Infections
KAP	Knowledge, Attitude, and Practices
MOH	Ministry Of Health
NTDs	Neglected Tropical Diseases
Spp	Species
SPSS	Statistical Package For Social Science
STHs	Soil-Transmitted Helminths
Syn	Synonym
UNICEF	United Nations International Children's Emergency Fund
WHO	World Health Organization

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Abstract

Intestinal parasitic infections (IPIs) are common health concerns in low-income countries like Ethiopia. Current information on the magnitude of the problem in a locality is vital to devise appropriate control strategies. The objective of this study was, therefore, to assess the prevalence of IPIs and associated risk factors among patients visiting Hara health center, northeast Ethiopia. A cross-sectional study was conducted from November 2015 to April 2016 involving participants recruited through the convenience sampling method. A structured questionnaire was used to determine environmental, socio-demographic and behavioral factors related to IPIs. Stool specimen were collected and examined for the existence of IPIs using the direct-saline wet mount technique. Bivariate and multiple logistic regression analysis were done with p-value less than 0.05 considered statistically significant. The overall prevalence of intestinal parasites was 42.3% (n=430). A total of seven intestinal parasite species were detected. The predominant parasite was *Entamoeba histolytica/dispar/moshkovskii* (142(33.02%), followed by *Giardia lamblia* (26(6.0%), *Enterobius vermicularis* (5(1.2%), Taenia species (5(1.2%), *Trichuris trichiura* (2(0.5%), *Hymenolepis nana* (1(0.2%) and *Ascaris lumbricoides* (1(0.2%). The study showed that source of drinking water (adjusted odds ratio (AOR) 2.954, 95% confidence interval (CI) 1.410-6.192, p<0.0001), hand washing before meal (AOR 2.647, 95% CI 1.194-5.871, p 0.017) and hand washing after toilet (AOR 3.396, 95% CI 1.454-7.931, p 0.005), way of using water (AOR 2.745, 95% CI 1.137-6.626, p 0.025), type of toilet (AOR 2.517, 95% CI 1.037-6.109, p 0.041), residence (AOR 2.157, 95% CI 1.178-3.950, p 0.013), garbage disposal mechanism (AOR 0.180, 95% CI, 0.055-0.589, p 0.005), awareness about IPIs (AOR 0.137, 95% CI 0.074-0.256, p<0.0001) and age (AOR 7.984, 95% CI 4.346-14.667, p<0.0001) were significantly associated with IPIs-positivity. IPIs were a common health problem in the study area. Health education on personal and environmental hygiene coupled with improved accessibility to safe drinking water is needed.

Keywords: logistic regression, intestinal parasites, *Entamoeba histolytica/dispar/moshkovskii, Giardia lamblia, Enterobius vermicularis, Taenia spp, Trichuris trichiura, Hymenolepis nana, Ascaris lumbricoides*, prevalence.

1. Introduction

Neglected Tropical Diseases (NTDs) are a group of parasitic and bacterial diseases that cause substantial illness for more than one billion people globally (WHO 2006). They impair physical and cognitive development. They are called neglected as they have been largely wiped out in the more developed parts of the world and persist only the poorest, more marginalized communities and conflict area (WHO 2009).

A parasite is any organism that resides on/in another organism to get its life-requirements at the expense of the latter. But from technical point of view the term 'parasite' largely refers to parasitic protozoa and helminths which are eukaryotes, unicellular or multicellular, microscopic or macroscopic, without a cell wall and the ability to neither synthesize their own food nor get it freely from the environment. While parasitic protozoa are microscopic, unicellular organisms and able to multiply in their hosts, most helminths are macroscopic and multicellular, at least as adults, and normally do not complete their development in one host requiring at least open-environmental transit stage.

Intestinal parasitic infections (IPIs) are among the most common infections worldwide affecting the poorest and most deprived communities. The most predominant intestinal helminths and protozoa are *Ascaris lumbricoides,* the hookworms, *Trichuris trichiura, Giardia lamblia* and *Entamoeba histolytica* which respectively accounting for 800-1000, 700-900, 500, 200 and 500 million cases globally (WHO 2016). The helminths mentioned here are recognized as soil-transmitted helminthes (STH) and school-age children represent the most important risk group for them. High worm loads and repeated infections with intestinal protozoa have influence on the nutritional status of children and can cause severe anemia and chronic diarrhea. This has negative impacts on growth, fitness and learning ability of children (WHO 2001); and then societal long- or short-term impact is huge and yet the above infections are among neglected tropical diseases (NTDs).

IPIs are widely distributed in tropical areas, particularly sub-Saharan Africa primarily for economic reasons. Poverty and its manifestations such as shortage of health facilities, poor toilet coverage, overcrowding, illiteracy and thus poor personal and environmental hygiene are the

reasons. Depending on the relative spatial and temporal prevalence of these known risk factors the prevalence of intestinal parasites varies in different settings.

Ethiopia like any other low-income country in the tropics is heavily affected by IPIs due to very poor personal and environmental hygiene, and thus poor water quality and toilet coverage, and overall low awareness of IPIs. Currently some efforts are underway to reduce the burden of these infections. Ethiopia developed a multi-year national strategic plan for the control, elimination and eradication of NTDs (MOH 2013). The strategies are: strengthening government ownership, advocacy, coordination and partnerships, enhance planning for results and development of policy guidelines, community empowerment, scaling up access to NTDs interventions, treatment and service delivery capacities and enhancing NTDs monitoring and evaluating surveillance and operational research. Control interventions include mass drug administration, case detection and management and transmission control. Moreover, public awareness raising initiatives have been strengthened through the development and dissemination of the NTDs manual for health extension workers and so as to educate the community (WHO 2015).

To this end current information on the status and magnitude of individual, household and environmental/climatic risk factors for IPIs is vital to evaluate the effectiveness of ongoing strategies and scale-up or modify in a locality-specific manner. Thus, the aim of this study was to detect IPIs and evaluate the extent of individual, household and environmental/climatic risk factors among patients visiting Hara health center (HHC), northeast Ethiopia.

2. Objectives

2.1 General objective

The objective of the study was to estimate the prevalence of IPIs and associated risk factors for IPIs among patients visiting HHC.

2.2 Specific objectives

The specific objectives of the study were

1. To detect human intestinal parasites among patients visiting HHC,
2. To identify the type of parasites prevalent among patients and their sex- and age-based distribution, and
3. To evaluate coverage of toilet, safe drinking water and sanitary practices in the population

3. Literature review

Intestinal parasitic infections are among the most common infections worldwide. They are estimated to affect 3.5 billion people, most of whom are children residing in developing countries (WHO 2000).

3.1 Intestinal protozoa

3.1.1 Giardia

G. lamblia (syn. *Giardia intestinalis*, *G. duodenalis*) is a parasite of human small intestine causing enteritis. Infection occurs by ingestion of Giardia cysts which are excreted in stool, feco-orally. Various species of mammalian animals are reservior hosts (Thompson and Monis 2004, Smith et al. 2007). The parasite has worldwide distribution with prevalence rate of 2-7% (Scotti et al. 1996) in industrialized countries to 40% (Odoi et al. 2004) in low-income tropical and subtropical regions with poor sanitation and hygienic conditions. Although the underfive children are frequently infected and giardiasis affect approximately 2% of adults and 7% of general children worldwide (CDC 2011).

Giardia cysts remain viable for up to three weeks in moist surrounding at 21^{o}C and up to about three months in cool water (8^{o}C). The trophozoites, by contrast, die off soon outside the host (Kayser et al. 2005). Ingestion of food and water contaminated with the cyst is the most common mode of infection (fig.1). Giardiasis can be diagnosed by direct observation of the trophozoites or cysts in the feces. Either stained preparations or unstained wet mounts can be used. Because they are small and can resemble other fecal components, Giardia cysts and trophozoites can sometimes be difficult to identify by morphology alone. Infections can also be diagnosed by enzyme-linked immunosorbent assays and immune chromatographic tests to detect *G. lamblia* antigens in the feces, as well as by direct-immunofluorescence (Fever et al. 2012). Several drugs can be used to treat Giardia infection including paromomycin (*humatin*), quinicrine hydrochloric USP (*atabrine*) and furazolidone (*furoxone*), metronidazole (*flagyl*) or tinidazole (*fasigyn*) the latter two being often used most in humans (Escobedoo and Cimerman 2007).

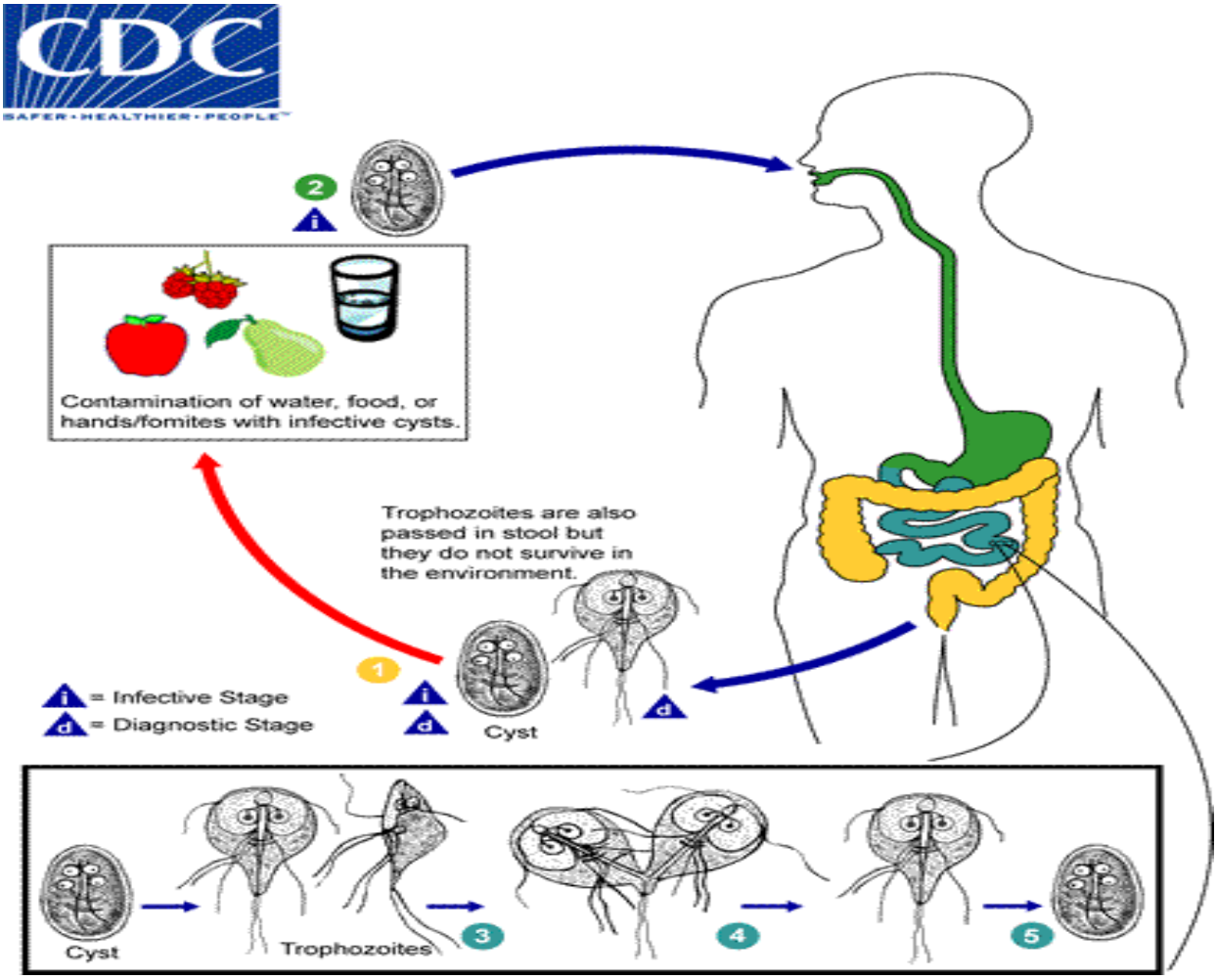

Figure 1: A typical life cycle of *Giardia lamblia* (Source: http://www.dpd gov/dpdx.cdc).

3.1.2 Entamoeba

Several species of the genus *Entamoeba* dwell in the human body. *Entamoeba histolytica*, *E. dispar*, *E. coli*, *Endolimax nana*, *E. hartmanni*, *Iodamoeba butschlii*, *Entamoeba polecki* and *E. moshkovskii* are found in the large intestine. *E. gingivalis* is commonly found in mouth where the oral hygiene is poor. Amebiasis is a disease caused only by *E. histolytica,* so far all other species are commensals occupying the same niche. It is the invasive pathogenic and *E. dispar* and *E. moshkovskii* have been designated the non-invasive (non-pathogenic) species. But they are morphologically identical. The amoebae are transmitted by ingestion of contaminated food and drink by infective tetra-nucleated mature cysts (fig.2). *E. histolytica* feeds on cells from damaged capillaries. *E. histolytica* can affect anyone, although it is more common in people who live in tropical areas with poor sanitary conditions. It occurs in endemic areas in Africa, Asia and Central

and South America up to 70-90% of the population are carriers of *E. histolytica/E. dispar/moshkovskii*, in the USA and Europe about 1-4% (CDC 2015). Worldwide annual number of new cases is estimated at 48 million, with about 70000 lethal outcomes (WHO 1998).

Clinical features of amoebiasis range from asymptomatic colonization to amoebic colitis (dysentery or diarrhea) and invasive extra-intestinal amoebiasis (Fotedar et al. 2007). The most common features of amoebic infection are dysentery and liver abscess (hepatic amoebiasis), but other extra-intestinal amoebiasis such as that of the lungs, heart, and brain also occur (Haque et al. 2003). The *E. histolytica* parasite can invade right through the gut wall, get into bloodstream and pass to the liver. Once situated in the liver, it can cause an amoebic liver abscess to form. An amoebic liver abscess contains pus and liquefied, dying liver tissue. Only 3-4 out of 10 people with an amoebic liver abscess have symptoms of amoebic colitis at the same time. However, many people with a liver abscess may recall an episode of bloody diarrhea within the previous year (Ximenezet et al. 2011). Laboratory diagnosis of *E. histolytica/dispar/moshkovskii* is made by finding the characteristic cysts in an iodine stained, formol-ether concentration method or by detecting the characteristic trophozoites in a wet preparation or a permanent stained preparation by taking fresh stool. If visceral or hepatic amoebiasis is suspected, serological tests should be done as microscopic methods do not always reveal the characteristic trophozoites. The test of choices are: indirect fluorescent antibody test, counter immunoelecrophoresis, enzyme linked immunosorbent assay. Amoebiasis is commonly treated by metronidazole (*flagyl*).

3.1.3 Coccidia

Coccidia are apicomplexan protozoa. They are intracellular parasites attacking the epithelial cells of human and animal small intestine. The most notable intestinal coccidian pathogenic species include *Cryptosporidium parvum*, *Cyclospora cayetanensis* and *Isospora belli*. Most of the coccidian infections in man are zoonoses. *C. parvum* which is the most important coccidian pathogen is found in many species of birds such as chicken, turkey and of animals including cattle, sheep, swine, goats and cats besides humans (Donoghue 1995, Tzipori and Griffiths 1998, Plutzer and Karanis 2009, Fayer and Xiao 2008). The parasite does not appear to be host specific and infection can spread from one host species to another. Infections acquired by ingesting the oocysts in contaminated food or drink. The oocyst contains four sporozoites which are released in the

intestine. They infect the intestinal epithelial cells and develop in to trophozoites which undergo asexual multiplication (schizogony) and release merozoites. These, intern infect the neighboring epithelial cells and repeat schizogony. Some develop into micro and macrogametocystes. After fertilization, the zygote develops into the oocyst, which is shed in feces and is the diagnostic stage. It is fully mature on release and is infective immediately without further development **(**Painker 2007). In immunocompromized patients, symptoms include frequent episodes of watery diarrhea, cramping, abdominal pain, weight loss, weakness, malaise, anorexia and low grade fever (Smith and Corcoran 2004). Anti-diarrheal medicines like Nitazoxaride may help to slow down diarrhea in people with healthy immune systems which is provided by prescriptions. However, the effectiveness of Nitazoxaride in immunosuppressed individuals is unclear (CDC 2015). A 7.6% Prevalence of Cryptosporidium spp has been reported from Ethiopia (Adamu et al. 2010).

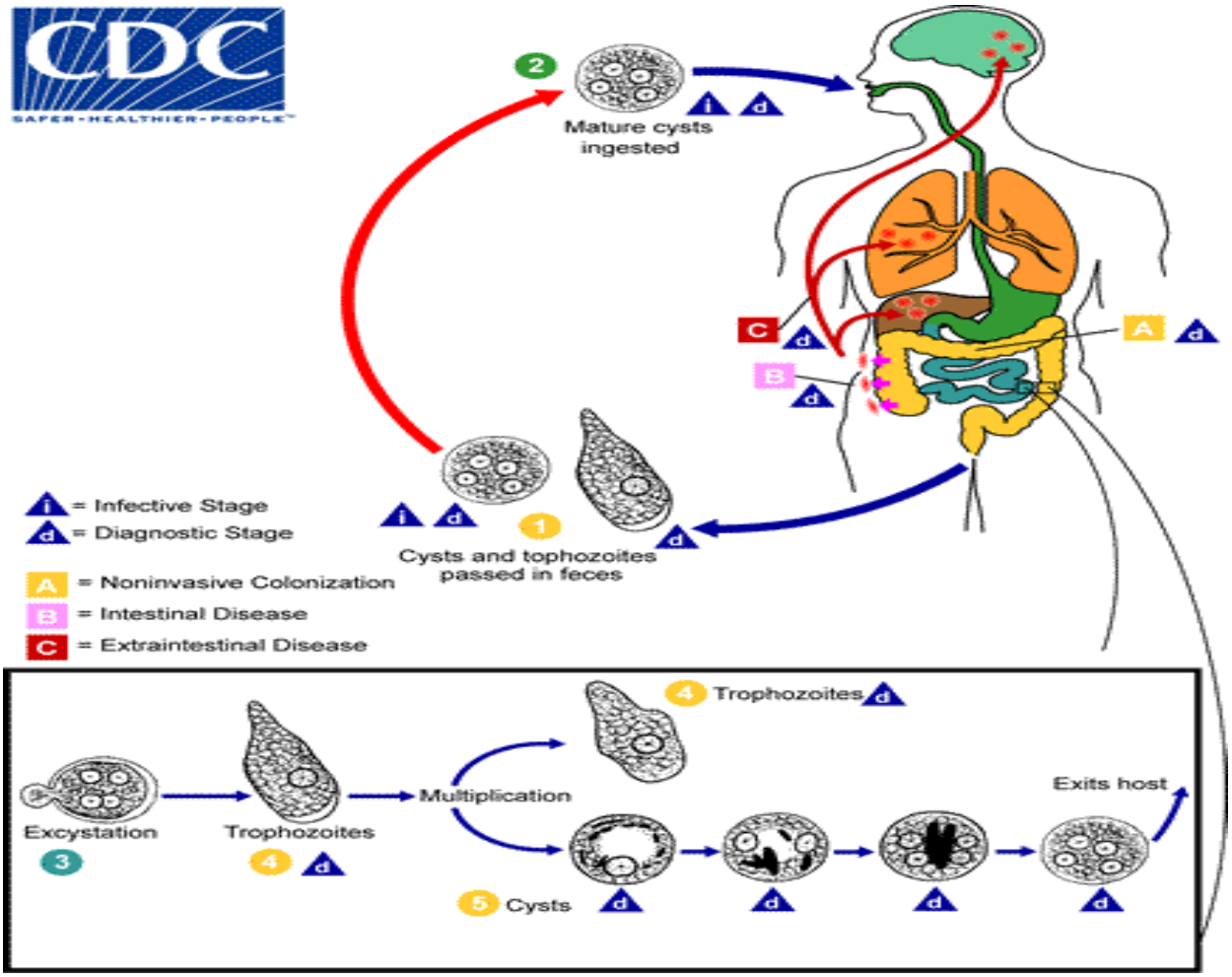

Figure 2 A typical life cycle of *Entamoeba histolytica* (source:http://www.dpd.cdc.gov/dpdx).

3.2 Intestinal helminths

Intestinal helminth infections, particularly STHs are among the most common infections occurring throughout low-income regions and are among 'neglected tropical diseases' (NTDs).

3.2.1 *A. lumbricoides*

A. lumbricoides, the cause of ascariasis, is the largest nematode (roundworm) parasitizing the human intestine. It is the most common STH in that more than 1.3 billion people worldwide have ascariasis and 250 million suffer from associated morbidity (WHO 2012). The transmission of ascariasis is due to contamination of mouth with hands since it is found together with poor personal hygiene, poor sanitation and in situations where human feces are used as fertilizers. It can be treated by albendazole, mebendazole and pyrantel pamoate. Ascaris can be eliminated if fecal contamination of soil can be prevented. Clinical manifestation in ascariasis can be caused by either the migrating larvae or the adult worms. In small burden of worms in the intestine cause pneumonitis with cough low grade fever during the migration of larvae through the liver and lungs. In heavy worm burden, the adult worms actively migrate in the intestine resulting in intestinal blocking, vomiting and abdominal pain (Assafa et al. 2006).

3.2.2 *T. trichiura* (whipworm)

Whipworm infection or trichuriasis is caused by *T. trichiura* which is the second or third STH after ascaris or ascaris and the hookworms, and is estimated to infect more than one billion people worldwide (Bogitsh et al. 2013). It is caused by ingesting embryonated eggs. Colonized eggs hatch and enter the small intestine as larvae. After 1-3 months of maturation, the parasite migrates to the cecum. In the cecum, the parasite matures, mates, and lays eggs. Adult worms are 3-4 cm in length and have thin, tapered anterior regions (Elliott 2006).

T. trichiura occurs in humans and monkeys. Although this parasite has a worldwide distribution, it is found most frequently, like *A. lumbricoides*, in moist, warm areas with low hygienic standards. The number of infected persons worldwide is estimated at one billion (WHO 1998) with prevalence varying between 2 and 90%. The presence of other concurrent disease among patients with chronic trichuriasis may give misleading clinical features of a combined disease. Thus, this clinical scenario may subject the patients to various invasive and expensive investigations while

the cheapest test will give result and confirm the diagnosis. Certain cases with mild infection will be an exception. In this case, a combined effort of clinical suspicion, endoscopic findings, and histopathological identification of worm in tissue section may improve the diagnosis and hence, facilitate the correct treatment of the infection (Sharif 2011). Albendazole and Mebendazole are effective in treatment.

3.2.3 The hookworms

Human hookworm infection is caused by blood-feeding nematode parasites of the genus *Ancylostoma* and the species *Necator americanus*. Worldwide, ***N. americanus*** is the predominant etiology of human hookworm infection, whereas *Ancylostoma duodenale* occurs in more scattered focal environments (Hotez et al. 2004). The hookworm is a second or third STH and is the leading cause of iron-deficiency anemia worldwide (Eddleston et al. 2005). The hookworms infect 1.25 billion people throughout the world (WHO 2012). The prevalence of hookworm in Ethiopia also estimated 16% (Tadesse et al. 2008).

Eggs in the feces of an infected person deposited on soil, mature and hatch, releasing larvae. The larvae mature into an infective filariform that can penetrate the skin of humans. In areas where both temperature and rainfall are generally suitable for the development of hookworm larvae, the intensity of infection show marked regional or local differences because of climatic factors. In rural areas of the tropics and subtropics, where there is little or no sanitation, the prevalence of hookworm infection in a country may vary considerably, from 10-20% in the drier zones to 80-90% where humidity and rainfall are high (WHO 1991). Control depends on the prevention of soil pollution with feces and use of foot wear prevents entry of larvae through the skin of the foot. Concerning on treatment, Mebendazole and pyrantel are the drug choices and oral iron is effective for relief of anemia.

3.2.4 *E. vermicularis* (pinworm or thread worm)

E. vermicularis is another common STH worldwide, particularly in children. The infection is estimated about 795 million persons worldwide (de Silva 2003). Infection occurs through the oral-fecal route caused by the ingestion of infective eggs from contaminated foods, hands or water. Transmission can also occur from contaminated surfaces such as toilets, clothing, and toys and the

most common symptom is peri-anal itching (CDC 2013). It can be diagnosed by looking for the worms in the peri-anal region 2-3 hours after the infected person is asleep, touch the peri-anal skin with transparent tape to collect possible pinworm eggs around the anus in the morning. If a person is infected, the eggs on the tape will be visible under a microscope and analyzing samples from fingernails under a microscope. An infected person who has scratched the anal area may have picked up some pinworm eggs under the nails that could be used for diagnosis. Health education on personal and community hygiene and group chemotherapy are among the control measures. Pinworm and all other STHs are effectively treated with albendazole (*albenza*), mebendazole (*vermox*), or pyrantel pamoate (*antiminth*) (CDC 2013).

3.2.5 Cestodes (tapeworms)

3.2.5.1 *H. nana* (dwarf tapeworm)

Hymenolepis infection is found worldwide especially in children with about 36 million people (Chiodini et al. 2003). The infection rate of *H. nana* in Ethiopia ranges from 3-61% (Haile et al. 1994, Kloos et al. 1980). Infection occurs by ingestion of the eggs, through fecal oral transmission from person to person or in the same individual. Internal auto infection may also occur when eggs released in the intestine hatch there itself. The eggs that are released from the mature proglottids in the upper ileum are usually passed out in the feces. If swallowed by another human, they develop in to hexacanth oncospheres and burrow in to the villi of the small intestine and develop in to tailless cysticercoids and then migrate towards the ileum and attach to commence the formation of proglottids. Prevention is made by proper personal hygiene. If symptoms occur, which is rare, they are abdominal pain and diarrhea (Mekete and Adem 2003). Anemia and nervous symptoms including dizziness and irritability can occur in children. The symptoms can be misdiagnosed for pinworm infection (CDC 2012). Parasitologically, it is diagnosed by observing ova or adult in the feces. The adult is very small, only a few centimeters long. The egg is unique in its appearance. It is small, measuring 30-47μm in diameter with a thin, colorless shell. The membrane surrounding the hexacanth embryo has 4-8 filaments arising from each pole that fill much of the space between the embryo and the shell (WHO 2004).

3.2.5.2 *Taenia saginata* (beef tapeworm)

Taenia saginata which is commonly refers to as the beef tapeworm is a segmented tapeworm infecting humans that can reach 35-60cm in length, and is the most common large tapeworm in humans (Bogitsh et al. 2013). Humans become infected by ingesting inadequately cooked beef containing cysticerici larvae. *T. saginata* can be diagnosed by observing gravid segments, ova and scolex in feces. Uterine branches of the mature segments may be seen in a crush preparation between two glass slides. Ova are also found on the peri-anal skin (on clear adhesive tape slides). It is found in beef eating areas especially in the tropics. Its clinical features include vague alimentary upset. Regarding to prevention, beef should be subjected to effective inspection for cysticerci and should be eaten only after proper cooking. The prevalence rate of Taeniasis in Ethiopia covers 1-48% (Woldemichael et al. 1999).

3.2.6 Trematodes (flukes)

Trematodes are unsegmented helminths which are flat and broad, resembling the leaf of a tree or a flatfish. These are hermaphrodites except for schistosomes in which the sexes are separate. They have two muscular cup-shaped sucker. The body is covered by integument which often bears spines, papillae. There are several trematode species having complex developmental stages and causing food-borne trematodiasis mostly implicated in liver disease. Schistosomes are snail-borne pathogens residing in the veins of the intestine or urinary bladder. *Schistosoma mansoni* is widely distributed in Africa, South America and the Caribbean islands (Paniker 2007). *S. japonicum* which is clinically graver intestinal schistosomiasis is limited to the Oriental Region. Regarding the life cycle of schistosomes, humans are infected by skin penetrating cercariae which emerge from a snail intermediate host and molt in to schistosomulae. The schistosomulae reach the liver and mature. The adults move against the blood stream in to the venules of the inferior mesenteric group in the sigmoidorectal area. Eggs penetrate the gut wall, reach the colonic lumen and are shed in feces. Patients develop abdominal pain and diarrhea. Eggs with lateral spines may be demonstrated microscopically in stools. Tapeworms and trematodes can be treated with praziquantel (*biltricide*) or niclosamide (*yomesan*). Schistosomiasis affects 200 million individuals worldwide in rural and peri- urban areas. Among these, 85% of schistosomiasis cases and most of the sever cases are found in Africa (Tayler 2008, WHO 2007).

4. Materials and Methods

4.1 Study area

Tehuledere is one of many *woredas* in the Amhara Region of Ethiopia which is located at the northeastern edge of the Ethiopian highlands in the South Wollo Zone. The *woreda* is bordered on the south by Dessie Zuria, southwest by Kutaber, northwest and north by the Mille River, northeast by Wore Babo and on the southeast by Kalu (fig. 3). The *woreda* has a total population of 117,877 (CSA 2007). The majority of the inhabitants (90.43%) Muslims and 9.35% profess the Ethiopian Orthodox Christianity.

The altitude of Tehuledere ranges from 500m above sea level along the boundary with South Wollo Zone to 2700 meters along its southwest border. Its hydrology includes two lakes: Hayk, which is entirely within it, and Ardibo which lies to the south of Hayk, defining part of border with Kalu. The present study was conducted at Hara health center which is found around Ardibo Lake. Hara is a village (Kebele 010) in Tehuledere *woreda*.

4.2 Study design, population and fecal samples

A cross-sectional study design was employed. Patients from Hara town and its surroundings visiting HHC from November 2015-April 2016 suspected of IPIs were invited to participate in the study and consenting ones were recruited. Thus the sampling technique was convenience sampling method. Data on socio-demography and personal, household or environmental sanitary conditions as well as knowledge, attitude and practice (KAP) of the participants about IPIs were captured using a structured questionnaire. Direct observations were made to verify verifiable information. Participants were given a specimen cup and asked to provide a stool sample. Patients who could not provide sufficient samples were excluded. The samples were examined by the direct saline (0.85% NaCl) and iodine staining wet-mount technique. Ova, cysts, or trophozoites were detected and identified.

4.3 Data quality control

To ensure the quality of data, the questionnaire was pretested in 5% of the participants at randomly selected from HHC. Every day after data collection, questionnaire were reviewed and checked for completeness, accuracy and clarity. Similarly, laboratory materials were checked for proper

functioning, specimen were collected, processed and examined by following standard operational procedures and stool examination results were reported after confirmed by laboratory technicians.

4.4 Data analysis

Data were recorded in Microsoft excel spreadsheet. For analysis SPSS version 16 was used. The prevalence of IPIs was determined with frequency counts and percentage. To assess the association of different variables with IPIs, univariate logistic regression analysis was done and to identify the independent risk factors the multivariate model was used. P-value of less than 0.05 was considered statistically significant.

4.5 Ethics

The study was approved by the Department of Zoological Sciences, Addis Ababa University and appropriate permission was obtained from Tehuledere woreda health office. Informed consent or assent was obtained from each participants or guardians for their participation in the study. Specimen collection was done using sterile and disposable materials. Individuals diagnosed positive for IPIs were treated free of charge.

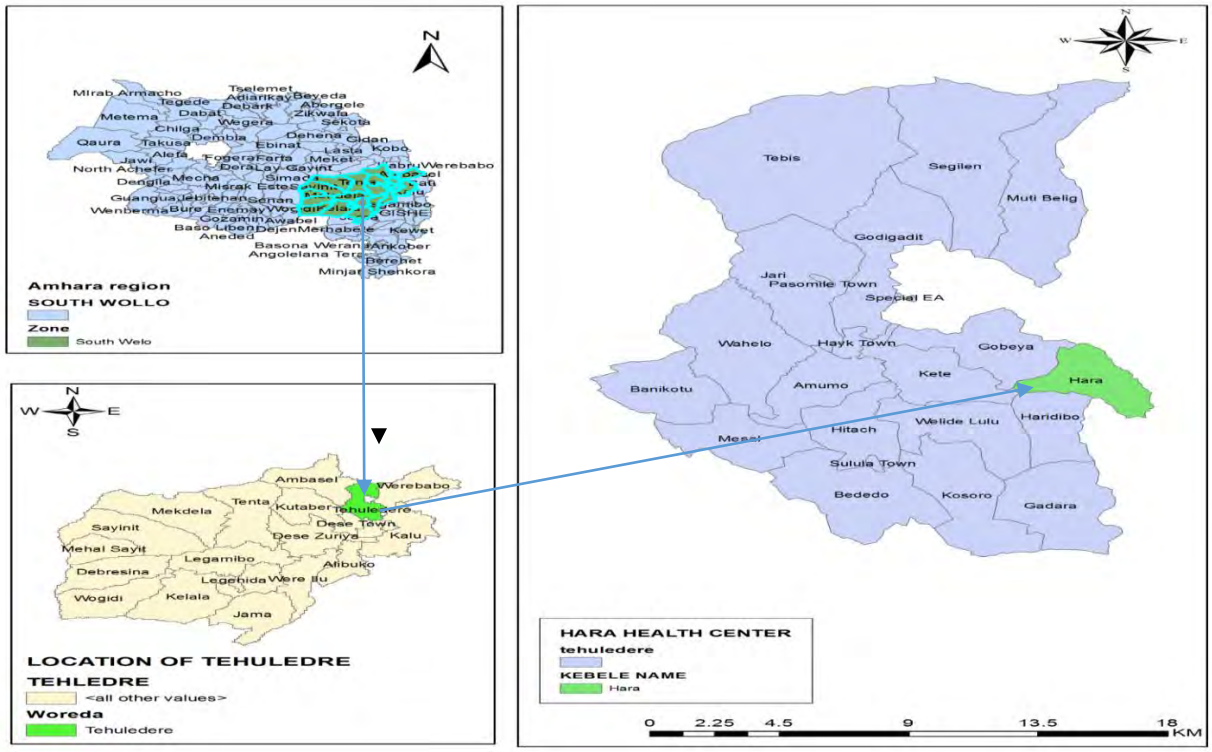

Figure 3: Location map showing the study area (Source: Endris 2016)

5. Results

5.1 Study population

A total of 430 individuals from November 2015-April 2016 participated in the study. Among these, 251(58.4%) were males and 179(41.6%) females. On the whole 213(49.5%) individuals were in the age group ≥15 years, 190(44.2%) 6-14 years and 27(6.3%) 1-5 years. Regarding occupation, 193(44.9%) were students, 162(37.7%) farmers, 44(10.2%) unemployed, 16(3.7%) government employees and 15(3.5%) were daily workers. Most participants (209(48.6%) had primary school education, 83(19.3%) able to read/write, 56(13.0%) in preschool stage for instance kindergarten and satellite school, 48(11.2%) were illiterate, 34(8.0%) high school and above.

5.2 Parasitology

Hundred eighty two (42.3%) individuals were positive for IPIs. Seven different intestinal parasites (2 protozoa, 5 helminths) were identified, all single infections (no polyparasitism). *E. histolytica/dispar/moshkovskii* was the most common (142(33.0%) followed by *G. lamblia* 26(6.0%), *E. vermicularis* 5(1.2%), *Taenia spp* 5(1.2%), *T. trichiura* 2(0.5%), *H. nana* 1(0.2%) and *A. lumbricoides* 1(0.2%) were the least prevalent species (table 1).

Table 1 Distribution of intestinal parasite species among patients in HHC northeast Ethiopia, November 2015-April 2016 (N=430).

Parasite species	**no. (%)**
Protozoa (single)	
E. histolytica/dispar/moshkovskii	142(33.0)
G. lamblia	26(6.0)
Helminths (single)	
A. lumbericoides	1(0.2)
E. vermicularis	5(1.2)
H. nana	1(0.2)
T. trichiura	2(0.5)
Taenia species	5(1.2)
Overall	182(42.3)

5.3 IPIs and socio-demography

The prevalence of IPIs positives for male was 46.6% and females 36.3%. Individuals in 6-14 age groups (67.9%) were highly affected by IPIs followed by 1-5 years old (37.0%) and then those ≥15 years old (20.2%). The proportion of IPIs among farmers, governmental employee, students,

unemployed and other were 30.3%, 12.5%, 60.1%, 18.2% and 46.6% respectively. On the other hand, the proportion of IPIs positivity among the illiterate 22.9%, able to read/write 25.3%, primary school 58.9%, high school 5.9%, above high school 17.6% and 'others' 41.1%. Similarly, other necessary variables are summarized below (table 2).

The analysis was done by focusing on the socio-demographic characteristics of the study participants. After adjusting for confounding variables, age, residence, source of drinking water, way of using drinking water, garbage disposal, pre-meal-hand-wash, post-toilet-hand-wash, awareness of the study participants and type of toilet usage were significantly associated with IPIs in multivariate logistic regression (table 3).

Age is a significant predicator of IPIs with children aged 6-14 years having the highest burden (129(67.9%) compared to other age groups (adjusted odds ratio (AOR) 7.984, 95% confidence interval (CI) 4.346-14.667, p<0.0001). Similarly, the odds of being IPIs-positive was 2.157 times higher for patients from rural area than urban dwellers (95% CI, 1.178-3.950, p 0.013). Individuals who consumed river/stream water for drinking purpose had significantly higher prevalence of IPIs than those who used tap water (AOR 2.954, 95% CI 1.140-6.192, p< 0.0001). Concerning home garbage disposal practice, participants who burnt/buried were at significantly lower risk of IPIs (AOR 0.180, 95% CI, 0.055-0.589, p 0.005) than those that used other methods. Patients who responded as using water directly without treatment were at significantly increased risk of IPIs than those who used other alternatives like boiling (AOR 2.745, 95% CI, 1.137-6.626, p 0.025).

Furthermore, individuals who reported to have awareness of IPIs transmission and prevention had significantly lower risk of acquiring IPIs than those who did not know (AOR 0.137, 95% CI, 0.074-0.256, p<0.0001). Individuals who replied as they rarely washed their hands before meal had significantly higher risk of IPIs than those who claimed to practice that habit always (AOR 2.647, 95% CI, 1.194-5.871, p 0.017). Likewise, patients who responded to never wash their hands after using toilet, had significantly higher risk of IPIs than others who consistently washed their hands after toilet (AOR 3.396, 95% CI 1.454-7.931, p 0.005). The odds of IPIs in patients who defecated outside or in the field had 2.517 times higher risk of infection by intestinal parasites than those who used proper latrine (95% CI, 1.037-6.109, p 0.041).

Table 2 Univariate logistic regression analysis of socio-demographic factors in relation to intestinal parasite positivity of patients visiting HHC from November 2015-April 2016(N=430).

Variables	Options	n	Positive n, (%)	COR	95% CI	P- value
Sex	Male	251	117(46.6)	1.531	1.034-2.268	0.033*
	female	179	65(36.31)	1.00	-	-
Age (year)	1-5	27	10(37.04)	2.326	0.994-5.440	0.052
	6-14	190	129(67.89)	8.361	5.318-13.144	0.000*
	≥15	213	43(20.19)	1.00	-	-
Garbage disposal	Burn	50	20(40.00)	1.00	-	-
	open ground	175	85(48.57)	0.417	0.748-2.683	0.285
	river/ravine	85	41(48.20)	1.398	0.689-2.837	0.354
	Bury	58	22(37.90)	0.917	0.422-1.991	0.826
	bury/burn	62	14(22.58)	0.438	0.192-0.995	0.049*
Self-reported previous IPIs	Yes	226	96(42.48)	1.00	-	-
	No	204	86(42.16)	1.013	0.691-1.486	0.946
Way of using water	boiled	101	35(34.65)	1.00	-	-
	filtered	67	23(34.30)	0.986	0.515-1.888	0.965
	untreated	101	70(69.30)	4.258	2.363-7.673	0.000*
	other	83	22(26.50)	0.680	0.360-1.286	0.235
	no idea	78	32(41.02)	1.312	0.713-2.413	0.383
Residence	urban	184	49(26.60)	1.00	-	-
	rural	246	133(54.10)	3.243	2.148-4.896	0.000*
Awareness about IPI	yes	259	61(23.55)	1.00	-	-
	No	171	121(70.76)	0.127	0.082-0.197	0.000*
Toilet type	indoor toilet	69	17(24.64)	1.00	-	-
	field	183	103(56.30)	3.938	2.117-7.325	0.000*
	public/shared	109	34(31.20)	1.387	0.702-2.740	0.347
	private outdoor	69	28(40.58)	2.089	1.008-4.328	0.470
Pre-meal hand wash	never	127	56(44.09)	1.504	0.904-2.502	0.116
	rarely	101	45(44.55)	1.532	0.894-2.626	0.120
	occasional	77	38(49.35)	1.858	1.041-3.317	0.036*
	always	125	43(34.40)	1.00	-	-
Post-toilet hand wash	never	119	73(61.34)	3.862	2.199-6.780	0.000*
	rarely	91	35(38.46)	1.521	0.835-2.769	0.170
	occasional	117	44(37.60)	1.467	0.833-2.584	0.185
	always	103	30(29.10)	1.00	-	-
Eat raw foods	yes	315	152(48.25)	2.642	1.649-4.233	0.000*
	No	115	30(26.09)	1.00	-	-
Shoes-wearing	never	48	19(39.58)	0.810	0.434-1.512	0.508
	rarely	45	18(40.00)	0.824	0.434-1.564	0.554
	sometimes	53	18(33.96)	0.636	0.344-1.176	0.149
	always	284	127(44.70)	1.00	-	-
Drinking water	tap water	113	26(23.00)	1.00	-	-
	community well	71	23(32.39)	1.606	0.827-3.110	0.163
	Lake	58	22(37.90)	2.045	1.028-4.068	0.042*
	river/stream	188	111(59.04)	4.824	2.851-8.160	0.000*

CI: Confidence interval, COR: Crude odds ratio, n: number of people, %: percentage, *statistically significant, HHC: Hara health center.

Table 3 Multivariate logistic regression analysis for factors independently associated with IPIs in patients visiting HHC from November 2015-April 2016 (N=430).

Variables	Options	n	Positive, n (%)	COR	AOR	95%CI	P-value
Age (year)	1-5	27	10(37.04)	2.326	2.191	0.713-6.735	0.171
	6-14	190	129(67.89)	8.361	7.984	4.346-14.667	0.000*
	≥15	213	43(20.19)	1.00	-	-	-
Sex	male	251	117(46.61)	1.531	1.050	0.573-1.922	0.875
	female	129	65(36.31)	1.00	-	-	-
Residence	urban	184	49(26.60)	1.00	-	-	-
	rural	246	133(54.10)	3.243	2.157	1.178-3.950	0.013*
Drinking water	tap water	113	26(23.00)	1.00	-	-	-
	community well	71	23(32.39)	1.606	1.495	0.594-3.767	0.393
	Lake	58	22(37.90)	2.045	0.790	0.278-2.248	0.658
	river/stream	188	111(59.04)	4.824	2.954	1.410-6.192	0.000*
Way of using water	boiled	101	35(34.65)	1.00	-	-	-
	filtered	67	23(34.30)	0.986	0.798	0.311-2.046	0.639
	untreated	101	70(69.30)	4.258	2.745	1.137-6.626	0.025*
	other	83	22(26.50)	0.680	0.377	0.140-1.019	0.055
	no idea	78	32(41.02)	1.312	0.737	0.294-1.845	0.514
Garbage disposal	burn	50	20(40.00)	1.00	-	-	-
	open ground	175	85(48.50)	0.417	0.604	0.244-1.496	0.276
	river/ravine	85	41(48.57)	1.398	0.456	0.166-1.249	0.127
	bury	58	22(37.9%)	0.917	0.505	0.160-1.596	0.244
	burn/bury	62	14(22.58)	0.438	0.180	0.055-0.589	0.005*
Toilet type	indoor toilet	69	17(24.64)	1.00	-	-	-
	field	183	103(56.30)	3.938	2.517	1.037-6.109	0.041*
	public/shared	109	34(31.20)	1.387	1.767	0.691-4.517	0.235
	private outdoor	69	28(40.58)	2.089	1.342	0.437-4.119	0.607
Eat raw foods	Yes	315	152(48.25)	2.642	0.536	0.271-1.062	0.074
	No	115	30(26.08)	1.00	-	-	-
Awareness about IPIs	yes	259	61(23.55)	0.127	0.137	0.074-0.256	0.000*
	No	171	121(70.76)	1.00	-	-	-
Pre-meal hand wash	never	127	56(44.09)	1.504	1.732	0.803-3.738	0.161
	rarely	101	45(44.55)	1.532	2.647	1.194-5.871	0.017*
	occasional	77	38(49.35)	1.858	2.155	0.898-5.171	0.085
	always	125	43(34.40)	1.00	-	-	-
Post-toilet hand wash	never	119	73(61.34)	3.862	3.396	1.454-7.931	0.005*
	rarely	91	35(38.46)	1.521	1.159	0.476-2.826	0.745
	occasional	117	44(37.60)	1.467	0.737	0.737-0.316	0.481
	always	103	30(29.10)	1.00	-	-	-

CI: Confidence interval, AOR: Adjusted odds ratio:*Statistically significant, HHC: Hara health center.

6. Discussion

The 42.3% IPIs prevalence is within the WHO category of 'moderate' (WHO 2006). The comparison of this study with another findings which comprise similar variables showed variations. It was comparable with the research reported by Gebru et al. (2015) from east Wollega (37.80%) and Yihenew (2011) from north Gondar (44.1%). However, it was lower than the prevalence rate reported by Mengistu et al. (2007) from southwest Ethiopia (83%), Abate et al. (2013) from northwest Ethiopia (62.3%) and Endris et al. (2010) from northwest Ethiopia (72.9%). On the other hand, it was higher than the prevalence rate reported by Haftu et al. (2014) from Arba Minch (27.7%) and Andargie et al. (2008) from Gondar town (29.1%). The observed apparent variation might be due to difference in sampling technique, laboratory method used, drinking water source, environmental sanitation, personal hygienic status, economic status, socio-demographic status, geographical location and climatic conditions.

As 93.3% of the total positives were accounted by the protozoa, waterborne transmission is suspected. Although previous baseline (reference) is lacking, the current observation demonstrates a dramatic decrease in prevalence of STH compared to intestinal protozoa. This may evidence the success of health education and improved sanitary practices with respect to STH. May be preventive chemotherapy intervention (deworming) in the area and climate or soil-type was affecting embryonation of some helminth eggs. The study design and laboratory method used may also contribute to the reduction in prevalence of STH. If concentration methods were used possibly extra parasites would have been identified.

On the other hand, the increased prevalence of the protozoa implies poor drinking water quality in the study area. A considerable number of the study participants (23.5%) were using water for drinking without treatment. Moreover, 317(73.7%) of the study population was utilizing totally unprotected water (well, lake, river) for drinking. The study has provided that the common practice of defecation was open ground and further increases the risk of high prevalence of IPIs around HHC. At least 183(42.6%) release their excreta outside a latrine and these could frequently contaminate various water bodies that the community use. Evidences showed that Ethiopia had only 12% latrine coverage while Kenya had 87% as comparison by 2000(Kumie and Ali 2005, WHO and UNICEF 2010). Similarly, from 1990-2011, 38.1 million people of Ethiopia practice

open defecation live in rural areas (UNICEF 2014). Therefore, this practice may play a crucial role in drinking water contamination.

Individual variables such as hand washing practices (post-toilet, pre-meal) may contribute more to protozoan than helminthic infections. For instances, except the self-reported 103 and 125 patients who practiced post-toilet or pre-meal hand wash, respectively, the major lacked that habit. This is a main risk behavior for autoinfection by amoeba and giardia whose cysts are mature and infective immediately after defecation. Helminths necessarily require environmental phases to be infective.

Five cases of Taenia species were detected. Likely it was *Taenia saginata* as raw meat (*Kurt)* is habitually consumed in Hara. Out of 430 people only 115 reported that they had no habit of eating uncooked food. The rest 315(73.3%) reported that they enjoy raw food and beef is definitely included.

Although the overall helminth infection was low, the total absence of hookworm infection could be explained by the fact that most participants (66.0%) were practicing shoes-wearing. Although the number of those who had no shoes was sizeable (34%), the study did not detect hookworms perhaps for a number of other reasons.

More than half of the study participants (57.2%) were living in rural communities. There was a statistically significant association between residence and IPIs. It is clear that urban dwellers are better protected because of relatively better facilities and increased awareness.

The prevalence of IPIs did not show statistically significant difference between males and females although relatively more males (251) than females (179) were examined. This is expected as there is no biological factor predisposing more males than females or vice-versa to IPIs based on sex as long as the two sexes share common environment and practices. However, observing more number of IPIs-positives among children aged 6-14 years than the under-6 might have been affected by care of the adults in the latter category. It was unclear why the number of suspects among the under 6 was very low.

In general, the study witnessed high prevalence of individual, household and environmental factors that are suitable for easy perpetuation and dissemination of IPIs, both protozoa and helminths. The results support this statement: waste was disposed on open ground (n=175), unprotected water was used (n=262), unawareness about IPIs was prevalent (n=171), no latrine usage is there (n≥183), no pre-meal hand wash (n=310), no post-toilet hand wash (n=327), feeding raw food was rampant (n=315), no shoe-wearing (n=146) and no access to tap water (n=317) were reported. Some reports showed that in 2010, about 46 million of the Ethiopian population were without improved water supply and sanitation (WHO/UNESCO 2012) and overall in rural Ethiopia, only 8% have access to adequate sanitation facilities (WHO 2000). Similarly, in rural area of Amhara region only 21% of latrines had hand washing facilities, none of which contained soap and less than 4% of households had access to adequate sanitation facilities (O'Loughlin 2006).

Therefore, the actual prevalence of intestinal parasites in the present study might have been affected by climatic conditions and seasonal fluctuations, the study design and laboratory method used. If concentration methods were used possibly extra parasites would have been identified.

7. Conclusion and recommendation

The result showed that the high public health burden of IPIs in Hara and its surroundings with higher magnitude of protozoan than helminthic infections suggesting more of waterborne transmission. This calls for concerned bodies to take appropriate measures to reduce the impact of these parasites in the area. Improved accessibility to safe drinking water, public health education on personal and environmental hygiene should be emphasized, treatment of infected individuals and administer regular drug treatment of high risk groups, establishing health related clubs in schools, creating awareness regarding the importance of individual practices like pre-meal and post-toilet hand wash and impact of using contaminated water to have a crucial role on transmission and constructing public toilets and garbage disposing areas. Further research to understand the epidemiology and clear picture of IPIs in the area based on large sample size and using advanced diagnostic methods is recommended.

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9. Annexes

Annex 1 Patients' information sheet

Part one: General information:

Name of investigator: Nuru Endris Yimam

Name of the university: Addis Ababa University College of Natural Science

Title: Individual, household and environmental variables in relation to some neglected tropical diseases in Hara health center (HHC) South Wollo, northeast Ethiopia.

Background: Neglected tropical diseases (NTDs) are a group of parasitic and bacterial diseases that cause substantial illness for more than one billion people globally. Intestinal parasitic infections (IPIs) are among the most common infections worldwide affecting the poorest and most deprived communities. The most predominant intestinal helminths and protozoa are *Ascaris lumbricoides,* the hookworms, *Trichuris trichiura, Giardia lamblia* and *Entamoeba histolytica*.

Objective: to estimate the prevalence of IPIs and associated risk factors for IPIs among patients visiting HHC.

Procedure: in order to achieve the objective, microscopic stool examination of ova, cysts or trophozoites by normal saline and iodine staining will be taken.

Role of the study participants: study participants who will fulfill the eligibility criteria are expected to give stool specimen.

Right to withdraw: it is your right to agree or to refuse to participate or withdraw from the study at any time. It will not have any impact on your normal diagnosis.

Risks: risk concerned in trying to obtain a fecal sample, the patient may have contaminated their hands with fecal material and possibly passed on diseases to other healthy individuals if hands were not properly washed. The risks from completing the survey included emotional replay, because some questions refers to socio economic status, educational background, life styles.

Benefits: if you are positive for IPIs during diagnosis, you will be treated free of charge.

Consent: participants will give their consent/assents on voluntary basis.

Confidentiality: from medical ethics point of view and research ethics every part of your personal information will be kept confidentially. Information to be collected and variable expressing your identity will be coded secretly. Results will not be given to anyone else without your permission. However, other researchers can see your clinical information without your identity. Your result and information will be used only for the mentioned purpose.

If you are interested to obtain further information, you are kindly requested to contact me by the following addresses.

Nuru Endris Yimam, Mobile: +251914075545, E-mail: nuruendris22@gmail.com

Annex 2 Patients' information sheet (Amharic version)

የታካሚዎች መረጃ ቅጽ

ክፍል አንድ፡ አጠቃላይ መረጃ

የዩኒቨርሲቲዉ ስም፡ አዲስ አበባ ዩኒቨርሲቲ የተፈጥሮ ሳይንስ ኮሌጅ

የአጥኚው ስም፡ ኑሩ እንድሪስ ይማም

የጥናቱ ርዕስ፡ በሃራ ጤና ጣቢያ ከተገኙ ሁሉም ህመምተኞች መካከል ግላዊ፣ ቤተሰባዊና አካባቢዊ አጋላጪ ሁኔታዎች ቸል ከተባሉ በሀሩር ሞቃታማ ክልል ከሚገኙ በሽታዎች ጋር ያላቸዉ ተዛምዶ (ከሀዳር-ሚያዚያ 2008).

መግቢያ፡ ቸል የተባሉ በሀሩር ሞቃታማ ክልል የሚገኙ በሽታዎች ማለት በተያዩ ጥገኞች፣ ቫይረሶች እንድሁም በባክቴሪያዎች የሚመጡ ሲሆኑ በአለም ላይ አንድ ቢሊዮን ሰዎችን ለህመም ዳርገዋል፡፡ በዋነኝነት በኢኮኖሚ ደካማ የሆኑ አገሮችን የሚያጠቁ ሲሆን ወስፋት፣ የመንጠቆ ትል፣ጃርዲያ፣ አሜባ ወዘተ. ይገኙባቸዋል፡፡

አላማ፡ በሀራ ጤና ጣቢያ ከተገኙ ታካሚዎቸ መካከል የአንጅት ጥገኞችን መለየትና አጋላጮቹ ያሉበትን ደረጃ ማሳየት ፡፡

የአሰራር ቅደም ተከተል፡ አላማዉን ለማሳካት የሰገራ ናሙና በመዉሰድ የአንጀት ጥገኞችን እንቁላልና ሌሎች መዋቅሮችን ጨዉና አዮዲን በመጠቀም በማይክሮስኮፕ መመርመር፡፡

የተሳታፊዎች ሚና፡ መስፈርቱን የሚያሟሉ ታካሚዎች የሰገራ ናሙና ይሰጣሉ፡፡

ከጥናቱ የመዉጣት መብት፡ ተሳታፊዎች ከጥናቱ ያለምንም ቅድመ ሁኔታ በማንኛዉም ሰአት መዉጣት ይችላሉ፡፡

የሚያጋጥሙ አደጋዎች፡ የሰገራ ናሙና መሰጠት መሰረታዊ እዉቀት የሚጠይቅ ቢሆንም የእጅ መበከል ሊከሰት ይችላል፡፡ በዚህ አጋጣሚ እጅ ካልታጠበ በሽታ ወደ ሌላ ጤነኛ ሰው ሊተላለፍ ይችላል፡፡ በሌላ በኩል ደግሞ ተሳታፊዎች መጠይቁን ስሜታዊ ሆነዉ ሊሞሉ ይችላለሉ፡፡ ስለሆነም በጥናቱ ምሉእነት አሉታዊ ተጽዕኖ ሊፈጥር ይችላል፡፡

ከጥናቱ የሚገኝ ጥቅም፡ በአንጀት ጥገኞች የተያዙ ሰዎች በነጻ ይታከማሉ፡፡

የስምምነት ዉል፡ ተሳታፊዎች በፈቃደኝነት የስምምነት ዉል ይወስዳሉ፡፡

ምስጢር መጠበቅ፡ ከህክምናና ጥናትና ምርምር ስነ ምግባር አኳያ ከተሳታፊዎች የሚሰጡ መረጃዎች በምስጢር ይያዛሉ፡፡ ተጨማሪ መረጃ ማግኘት ከፈለጉ በሚከተሉት አድራሻዎች እኔን ማግኘት ይችላሉ፡፡

ኑሩ እንድረስ ይማም፣ ሞባይል፡ +251914075545፣ ኢሜይል፡ nuruendris 22@ gmail.com.

Annex 3 Written consent form

Name of participant…….....

Card number…….

Slide number…….

Study site…….....

I have been informed about a study that plans to investigate "individual, household and environmental variables in relation to neglected tropical diseases among patients visiting HHC" which helps in understanding the prevalence of intestinal parasitic infection in relation with knowledge, attitude and practice of the participant. Similarly, it enables concerned body in designing better control and preventive measures of parasitic diseases in the study. For this study, I was requested to give stool sample for intestinal parasites identification. The investigator informed me that all laboratory results would be kept in secret and I was clearly informed that my participation in this study is completely voluntarily and I have right to withdraw from participating in this study. I was given enough time to think over before I signed this informed consent. It is therefore; with full understanding of the situation that I gave informed consent and cooperate at my will in the course of the study.

Signature……..Date……..

Annex 4 Written consent form (Amharic version).

የውል ስምምነት ቅፅ

የተሳታፊው ሰም.....

የካርድ ቁጥር.....

የመለያ ቁጥር.....

የጥናቱ ቦታ፡.....

እኔ የጥናቱ ተሳታፊ ግለሰብ በሀራ ጤና ጣቢያ ለህክምና ከመጡ ሰዎች እና ፈቃደኛ ግለሰቦች መካከል ስለ አንጀት ጥገኞች ሰርጪት ከእውቀት፣ አመለካከት እና ክህሎት አንፃር ጥናትና ምርምር እንደሚካሄድ ተነግሮኛል፡፡ ይህ ጥናት የሚመለከታቸው አካላት የተሻለ የመከላከያና የመቆጣጠሪያ መንገዶችን ለመንደፍ ያስችላል፡፡ በዚህ ጥናት የሰገራ ናሙና እንድሰጥ ስጠየቅ አጥኝው የላቦራቶሪ ዉጤቱ በሚስጥር የሚያዝና በጥናቱ የምሳተፈዉ በሙሉ ፈቃደኝነት መሆኑን እና በማንኛዉም ጊዜ ከጥናቱ ተሳታፊነት መዉጣት የምችል መሆኑን በቂ ጊዜ ተሰጥቶኝ አስቤበታልሁ፡፡ ስለዚህ ስለ ጥናቱ በቂ ግንዛቤ ኖሮኝ በጥናቱ ለመተባበረ በራሴ ፍላጎት ይህንን ስምምነት ወስጃለሁ፡፡

ፊርማ..... ቀን.....

Annex 5. Questionnaire

Name of the health center……

Card number……. Slide number…….

Introduction

The investigator wishes to carry out a research to assess the individual, household and environmental variables in relation to neglected tropical diseases (NTDs) among patients visiting in HHC. The survey will seek personal views from patients on Knowledge, attitudes and practices concerning on intestinal parasites. So that, you are kindly requested to complete the following questionnaire honestly.

Name……Name of residence……..Kebele……..Age……..

Sex: Male ……. Female……..

I. **Information about occupation and educational status**

1. What is your occupation? A. Farmer……..B. Government employee…….. C. Student……
   D. Unemployed……E. Other……..
2. What is your educational status? A. Illiterate…….B. Able to read and write……C. Primary School…….. D. High school…… E. Above high school…….

II. **Information about knowledge, attitude and practice towards intestinal parasites**

3. Do you have an awareness (transmission and prevention) of IPIs? Yes ……No……..
4. Have you ever been infected with intestinal parasites? Yes……..No…….
5. In which residence you are living? A. Urban…… B. Rural……
6. Where do you get your drinking water? A. Community well……..B. Tap water…....
   C. Lake…….. D. River or stream…… E. Rain water collected…….
7. How do you use drinking water? A. boiling..... B. filtering.....C. without treatment…....
   D.other(specify)..... E. No idea.....
8. How do you dispose home garbage? A. Burn……B. open ground.....C. River or ravine.....
   D.Bury..... E. Burning and burying.....
9. What type of toilet do you use at home? A. Indoor flushable toilet……B. Out side…….
   C. Public/shared out door latrine…….. D. Private outdoor latrine……
10. How often do you wash your hands with soap and water after toilet? A. Never……
    B. Rarely…….C. Sometimes……..D. Usually…… E. Always……
11. How often do you wash your hands with soap and water before eating? A. Never…….

B. Rarely…….C. Sometimes……..D. Usually……. E. Always…….

12. Do you eat raw foods at home? A. Yes……B. No……

13. How often do you wear shoes? A. Never…….B. Rarely……..C. Sometimes……

D. Usually……. E. Always…….

Annex 6

Questionnaire (Amharic Version).

የጽሁፍ መጠይቅ

የጤና ጣቢያው ሰም.....

የካርድ ቁጥር..... የመለያ ቁጥር.....

መግቢያ : እኔ የዚህ ጥናት አጥኚ በሀራ ጤና ጣቢያ ከተገኙ ሁሉም ህመምተኞችና ፈቃደኛ ግለሰቦች መካከል የአንጀት ጥገኞችን ስርጭት ለማጥናት እፈልጋለሁ:: ይህ የጽሁፍ መጠይቅ ህመምተኞች ስለ አንጀት ጥገኞች ያላቸዉን እዉቀት፣ አመለካከት፣ እና ክህሎት የሚዳሰስበት ነው:: ስለሆነም የሚከተሉትን መጠይቆች በጥንቃቄ ይሞሉለኝ ዘንድ በትህትና እጠይቃለሁ ::

ስም..... የመኖሪያ ቦታ ስም .....

ቀበሌ..... እድሜ.....ፆታ: ወንድ.....ሴት.....

I.የተሳታፊዎች የትምህርትና ስራ ሁኔታ መረጃ

ነ. ሥራዎ ምንድን ነው? ሀ.አርሶ አደር..... ለ.የመንግስት ሰራተኛ..... መ.ተማሪ.....

ሠ. ስራ ፈላጊ.....ረ. ሌላ.....

2. የትምህርት ሁኔታዎ ምን ይመስላል? ሀ. ያልተማረ..... ለ. ማንበብ አና መፃፍ የሚችል.....መ.1 ኛ ደረጃ.....

ሠ. 2 ኛ ደረጃ..... ረ. ከ 2 ኛ ደረጃ በላይ.....

II. **ተሳታፊዎች ስለ አንጀት ጥገኞች ያላቸውን እውቀት፣ አመላካከት አና ክህሎት የሚያሳይ መረጃ**

3.ስለ አንጀት ጥገኞች መተላለፊያና መከላከያ ያውቃሉ? አዎ.....አላውቅም.....

4.በአንጀት ጥገኞች ተይዘው ያውቃሉ? አዎ .....አላውቅም.....

5.የመኖሪያ አካባቢዎ የትኛው ነው? ገጠር.....ከተማ.....

6. የመጠጥ ዉሃ ከየት ያገኛሉ? ሀ. ከምንጭ.....ለ. ከቧንቧ.....መ. ከሐይቅ.....ሠ. ከወንዝ.....

ረ. ከተጠራቀመ የዝናብ ዉሃ.....

7. የመጠጥ ዉሃን አንዴት ይጠቀማሉ? ሀ.ማፍላት..... ለ.ማጣራት.....መ.ሳይታከም መጠቀም.....

ሠ.ሌላ.....ረ. ሃሳብ የለኝም.....

8.የቤት ዉስጥ ቆሻሻን እንዴት ያስወግዳሉ? ሀ. ማቃጠል..... ለ. ጉድጓድ በመቆፈር ማጠራቀም.....

መ. ወደ ወንዝ በመጣል.....ሠ.መቅበር..... ረ.ማቃጠል አና መቅበር.....

9. በመኖሪያ ቦታዎ አካባቢ ምን አይነት መፀዳጃ ቤት ይጠቀማሉ? ሀ. በቤት ዉስጥ የተሰራ.....ለ.ሜዳ ላይ.....

መ. የጋራ መፀዳጃ ቤት.....ሠ. ግቢ ዉስጥ የተሰራ የግል መፀዳጃ ቤት.....

10. መፀዳጃ ቤት ከተጠቀሙ በኋላ እጅዎን በውሃና በሳሙና ለምን ያህል ጊዜ ይታጠባሉ? ሀ. በጭራሽ አልታጠብም------

ለ. በጣምአልፎ አልፎ.....መ. አንዳንድ ጊዜ.....ሠ.በአብዛኛው.....ረ. ሁልጊዜ.....

11. ከምግብ በፊት እጅዎን በዉሃና በሳሙና ለምን ያህል ጊዜ ይታጠባሉ? ሀ. በጭራሽ አልታጠብም.....

ለ. በጣም አልፎ አልፎ..... መ.አንዳንድ ጊዜ.....ሠ. በአብዛኛው..... ረ. ሁልጊዜ.....

12.በቤት ዉስጥ ጥሬ ምግቦችን ይመገባሉ? ሀ.አዎ..... ለ.አልመገብም.....

13.እርስዎ ከቦታ ቦታ ሲንቀሳቀሱ ለምን ያህል ጊዜ ጫማ ያደርጋሉ? ሀ.በጭራሽ አላደርግም-----ለ. በጣም አልፎ አልፎ----

መ.. አንዳንድ ጊዜ..... ሠ.በአብዛኛው..... ረ.ሁልጊዜ.....

10. Declaration

I, the undersigned, declare that this Thesis is my own original work and has never been presented for a degree and all source materials used are dully acknowledged.

Name Nuru Endris Yimam

Signature _____

Date _____

11. Statement of the supervisor(s)

This Thesis has been approved for submission to the department of Zoological Sciences for public defense.

Name Hassen Mamo (PhD)

Signature _____

Date _____