Intestinal Parasitic Infections and Associated Determinant Factors among Patients Visiting Kutaber Health Center, South Wollo, Northeast Ethiopia

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Acronyms

AOR	Adjusted Odds Ratio
CFSPH	Center of Food Security and Public Health
CDC	Center of Disease Control and Presentation
CI	Confidence Intervals
COR	Crud Odds Ratio
CSA	Central Statistical Agency
ELISA	Enzyme-Linked Immune Sorbent Assay
IPIs	Intestinal Parasitic Infections
IPI	Intestinal Parasitic Infection
KAPs	Knowledge Attitude Practices
KHC	Kutaber Health Center
MoH	Ministry of Health
NaCl	Sodium Chloride
PAHO	Pan American Health Organization
SPSS	Statistical Package for Social Science
STHs	Soil Transmitted Helminths
UNICEF	United Nations Children's Fund
W HO	World Health Organization

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Abstract

Intestinal parasitic infections (IPIs) are one of pronounced health problems in Ethiopia. The objective of this study was, thus, to assess the prevalence of IPIs and associated determinant factors among patients visiting Kutaber health center (KHC). Across-sectional study was conducted from October 2017-March 2018 using convenient sampling technique. Structured questionnaire was prepared and used to identify, socio demographic, behavioral and other related risk factors. Stool specimens were collected from all study participants and were examined for intestinal parasites identification using direct saline smear-method. Finally, data entry and analysis were done using SPSS software (21vertion). Univariate and multivariate logistic regression analysis was done. P value < 0.05 was considered statistically significant. In this study 450 patients were participated in the final analysis, of those, 216 were males and 234 females. Majority of study participants 264 live in surrounding rural place of the study area, while the rest 186 live in the urban area. The proportion of age group, 5-14 years old (36.4%), 15 -24 years old (18.9%) and the majority of the study participants (44.7%) were ≥ 25 years old. Out of 450 samples examined 179(39.8%) patients had one or more intestinal parasites belonging to six different types(species) including mixed intestinal parasites. From the different intestinal parasites identified in the study area, protozoan infection was the most predominant. Among the intestinal protozoan parasites Entamoeba histolytica/dispar/moshkovskii was found to be 99(22%) and Gardia lamblia 46(10.2%). The prevalence of other intestinal helminths was Hymenolepis nana 12(2.7%), Entorbius vermicularis 10(2.2%), Ascariasis lumbricoides 7(1.6%), and Trichuris trichiura 2(0.4%). Among the 450 samples examined 176 (39.1%) of the cases had single infection and only 3(0.7%) were mixed parasites. Intestinal parasitic infections were prevalent among the study participants specially in the aged group 5-14 years old and those living in rural areas. Therefore, control measures including, health center and school-based education on personal hygiene and environmental sanitation, water supply and treatment should be taken in to account to reduce the prevalence of intestinal parasites in the study area, because IPIs will be difficult to control by drugs alone. Periodic evaluation of community is also necessary to provide useful information for appropriate control and management of these infections.

Keywords: Kutaber, intestinal parasites, prevalence, determinant factors, Ethiopia

1. Introduction

Intestinal parasitic infections (IPIs) caused by Soil transmitted helminths (STHs) and protozoan are serious public health problems in people living under developed countries. STHs are among the most common infections worldwide and affect the most deprived communities. More than 1.5 billion people are infected with STHs infections worldwide. Over 267 million preschool-age children and over 568 million school-age children live in areas where these parasites are intensively transmitted, and need treatment and preventive interventions (WHO, 2018). IPI is a major public health problem in children of developing countries and they become significant in this age group (Sah *et al*., 2013).

The wide distribution and occurrence of IPIs might be poor personal hygiene, environmental sanitation, limitation of awareness about source of infections and less access to protected water (Gelaw *et al*., 2013). Intestinal parasites are mainly distributed from one person to others through the fecal- oral route, either directly, through contact with contaminated hands, or indirectly, via contaminated of food, water, or living environment. The main causes of fecal-oral disease transmission include lack of adequate sanitation, and poor hygiene practices (WHO, 2018). Different reviews suggested that the impact of sanitation and hygiene interventions reduce diarrhea morbidity in young children from 22% to 36% (Fewtrell *et al*., 2005).

The consequences of IPIs contribute to a significant health and social problems. Symptoms of IPIs depend on the type of infections and which might lead to malnutrition, abdominal pain, growth retardation, anemia, dysentery, dehydration, and other health concerns (Azam *et al*., 2007). Even though, there are more studies carried out to assess the situation of IPIs in different parts of Ethiopia, there are still several localities for which epidemiological information is not available including the study area. Therefore, this study was aimed to assess the prevalence of IPIs and associated determinant factors among patients visiting KHC.

1.1. Statement of the problem

Intestinal parasitic infection is one of the major health problems in developing countries and peoples living in warm, humid areas around the world (Khanal *et al*., 2011). The most common soil-transmitted helminths are *Ascaris lumbricoides, Trichuris trichiura*, and hookworms. Recent worldwide estimates suggest that *Ascariasis lumbricoides* infects 1.2 billion people, Trichuris trichiura 795 million, and Hookworms 740 million. The greatest numbers of STHs occur in the Americas, China and East Asia, and Sub-Saharan Africa (PAHO, 2011).

Communities in developing countries live in conditions that are highly favorable to the occurrence of parasitic infection. In Ethiopia, there is inadequate water supply and poor sanitation conditions. Most of the populations in urban and rural areas do not have access to safe and adequate water supplies and sanitation conditions. The community members, were not giving attention about the factors for IPIs, only few households show sufficient understanding of environmental sanitation or hygienic practices (Gabbad and Elawad, 2014). In the study area, I have observed the situation which exposed the population to IPIs and I saw individuals who visit KHC to take treatment for IPIs. Due to this reason and others I initiated to do my investigation in such title and selected study site.

1.2. Research Objectives:

1.2.1. General objective:

The overall objective of the study is to assess the prevalence of intestinal parasitic infections and associated determinant factors among patients visiting Kutaber Health Center (KHC).

1.2.2. Specific objectives:

The specific objectives of the study are:

1. To determine the prevalence of common human IPIs among patients visiting KHC.
2. To identify the type of parasites prevalent among patients in the study population.
3. To determine the demographic, knowledge, attitudes and practices (KAPs) of the study participants towards IPIs.
4. To find the relationship between IPIs and associated determinant factors of the participants.

1.3. The research hypothesis:

1. Protozoan parasitic infection is the most predominant in the study area.
2. Poor sanitation and hygiene has significant association with high rates of parasitic infection.
3. Rural community participants are more infected with IPIs than urban ones.
4. School aged groups are more vulnerable with IPIs than older ones.

1.4. Significant of the study

The significance of this study is to provide information about the prevalence of human IPIs and determinant factors among the participants. It will also encourage individuals, households and other stakeholders to implement skill-full and awareness-based prevention programs to control identified parasitic infection in the study population.

2. Literature Review

2.1. World -wide distribution and prevalence of intestinal parasites

From the ancient time to the present day human beings have been exposed to many types and species of intestinal parasites. There are different species of protozoan parasites that cause diseases on people globally. In the cause of *Entamoeba histolytica* infection around 40,000–100,000 deaths recorded in each year and *giardiasis* due to *Giardia intestinalis* might affect 200 million people per year (Obaid, 2014).

IPIs are amongst the most common infections globally. These infections are most prevalent in communities with low source of income, unhygienic personal and poor environmental sanitation conditions, overcrowding, and limited accesses to potable water. Access to basic sanitation facilities in Ethiopia, especially in rural areas, is very poor. Only 11% of the total population has accessed to permanent sanitation facilities, and less than 42% have access to a source of clean drinking water (Nguyen *et al.*, 2012).

2.2. Intestinal protozoan infections

Protozoan parasites are the most common cause of gastrointestinal infections related to helminths, particularly, in developing countries. In different parts of the world a number of intestinal protozoan parasites were reported. The most common intestinal protozoan parasites were *Entamoeba histolytica/dispar/moshkovskii*, *Giardia lamblia* and *Cryptosporidium* spp. The diseases caused by these intestinal protozoan parasites are known as *amoebiasis*, *giardiasis* and *cryptosporidiosis* respectively, and all are associated with diarrhea (Davis *et al*., 2002). Protozoan parasites are single celled organisms and can rapidly multiply inside the body of the host for the development of serious infection. Most of the protozoan infections tend to be asymptomatic. However, the symptoms related with it include, abdominal discomfort, vomiting and dysentery (Abdullah *et al*., 2016).

2.2.1. *Entamoeba histolytica/dispar/moshkoviskii*

It is a protozoan parasite that colonizes and reproduces in large intestines of humans, which leads the disease amoebiasis. The prevalence of amoebiasis varies from place to place within the population, between countries and areas due to different environmental and socioeconomic conditions. In some areas up to 50% of the population is affected those living in unsanitary conditions. Studies have shown that low source of income and unsanitary conditions are associated risk for IPIs (Caballebro *et al.*, 1994).

The majority of amoebic infections are reported to occur in Central America, Africa and Asia. These are often associated with poor water and sanitary practice. The life cycle of *Entamoeba histolytica* includes the motile and invasive trophozoites and the infective cyst. Infection is occurred primarily through the ingestion of infective cyst forms present in fecal contaminated water and food. After ingestion the human intestine the cysts transform in to trophozoites, which are motile forms inhabiting the intestinal tract. During this phase the parasite increases its size and undergoes asexual reproduction. Some of the trophozoites will develop in to cysts and passed in to the faeces from here further spread is occurs (Petri and Singh, 1999).

The parasite mainly restricted to intestinal lumen or invades the wall of lining and causing amoebic dysentery. It is not only cases severe diarrhea but can also result in other intestinal infections including rectal bleeding, toxic colitis, and abscesses in the intestine, liver, lung and other organs. According to the previous reports *Entamoeba histolytica* was responsible for deaths of approximately 100,000 persons per year, which is the only second protozoan infection, next to malaria. About 10% of the global population, is exposed to *Entamoeba histolytica*, the majority of them in developing countries (Abdulah *et al*., 2016).

Diagnosis of the infection is microscopically to identify the presence of trophozoites and cysts in the stool samples. Trophozoites are readily detected in sub-mucosal tissue or fecal samples. Asymptomatic infection with *Entamoeba histolytica* is referred to as the presence of cysts in human faeces in the absence of colitis or additional intestinal infection. Individual looks like healthy can be pass millions of cysts in the stool day to day as the trophozoites multiply in the intestinal wall. Nearly, 90% of all intestinal *Entamoeba histolytica* infection is asymptomatic (Fotedar *et al*., 2007).

Management of the fecal-oral spread of the infection cyst stage of the parasite help to prevent *ameobiasis*. Cysts are resistance to some chemicals like chlorine or iodine. In developing countries water must be boiled before it is used for drinking purposes, and raw vegetables also should be washed properly before they can be eaten. All symptomatic patients with bloody stools containing motile trophozoites should be treated according to the severity of the disease. Metronidazole is given to treat colitis and liver abscess (Neva and Brown, 1994).

2.2.2. *Giardia lamblia*

Giardia lamblia is a protozoan parasite of the small intestine. It has a worldwide distribution. However, the prevalence is higher in tropical and developing countries and its infection rates between 2-5% in the developed countries and 20-30% in under developed nations. Infection occurs when infected cysts of *Giardia lamblia* are ingested in the alimentary canal through contaminated water, food or direct person-to-person contact. It is the most common protozoan isolated from human hosts. In developing countries, about 200 million peoples have symptomatic giardiasis and around 500,000 new cases are reported per year (Suman *et al*., 2011).

Giardia exhibits a typical fecal-oral transmission cycle and infection is acquired by ingesting cysts. Its life cycles consist of two stages: fecal-orally transmitted cyst and the disease-causing trophozoites. Cysts are passed in human faeces, remaining viable in a moist environment for months. Ingestion at least 10 - 25 cysts can cause infection in humans. When a cyst consumed by other host, the host's acidic stomach environment stimulates encystations. Each cyst produces two trophozoites and migrates to the duodenum and jejunum, where they attach to the mucosal wall and replicated by binary fission. The growth of giardia in the small intestine is stimulated by bile, carbohydrates, and low oxygen tension. Some trophozoites transform to cysts and pass in the faeces (Katz and Taylor, 2001). Clinical presentation of *Giardiasis* is varying greatly. After an incubation period of 1-2 weeks, symptoms of gastrointestinal distress may develop, including nausea, vomiting, malaise, cramping and diarrhea are important to indicate giardiasis (Procop, 2001).

Diagnosis of *Giardia* infection has been carried out using microscopic identification of cysts and trophozoites present in stool specimens. Modern diagnostic techniques like enzyme-linke immunosorbent assay (ELISA) applied by some researchers. (ELISA) has greater sensitivity and specificity than the direct microscopic examination. It can detect soluble antigens in the faeces (Suman *et al.*, 2011).

There are effective treatments against *Giardia*, but preventive measures are of great important to control the disease. It can be prevented by testing of purified and unpurified water to check for the presence of cysts of the parasites, boiling water used for consumption, washing hands properly before handling food and after toileting, properly disposing waste materials and awareness creating to the community about the dangers of *giardiasis* (Backer, 2000).

Currently there are different groups of drugs available to treat *giardiasis* in stools. Based on different age group, endemicity of parasite, pregnancy etc, the use of antimicrobial therapy varies. The most common anti-*giardia* drugs include Metronidazol, Furazolidone and Paromomycin. Metronidazole is the most common drug used for the treatment of *giardiasis* globally (Gardner and Hill, 2001).

2.2.3. *Cryptosporidium* spp

Cryptosporidium species were considered rare in human infection. However, this organism has been shown to infect in a number of animal species (Nimri and Batchour, 1994). It was the leading cause of all waterborne outbreaks in the United States. An estimated 748,000 *cryptosporidiosis* cases occur annually, although less than 2% are reported. Lifelong symptomatic infections may develop in immunosuppressed individuals, particularly AIDS patients (Painter *et al*., 2015).

The most common symptoms of *Cryptosporidiosis* in patients are chronic diarrhea, which exposed to sever dehydration, vomiting, abdominal pain and weight loss. *Cryptosporidium* has been isolated from untreated and treated water supplies, swimming pools, rivers and streams in different parts of the world. The infection is acquired through the ingestion of sporulated oocysts. Each oocyst contains four sporozoites. After passage through the stomach the sporozoites emerge from the oocyst and attach to intestinal epithelial cells (Iqbal *et al*., 2012). *Cryptosporidium* species can be diagnosed by observing the size and oocyts structure found in stool samples. The drug Nitazoxanide has been used for the treatment of diarrhea caused by *Cryptosporidium* (CDC, 2010).

2.3. Intestinal Helminths

Intestinal helminths are widely distributed in tropical and sub-tropical regions of Asia, specially China, India, and South East Asia as well as sub-Saharan Africa. More than 1.5 billion people, or 24% of the populations are infected with STHs worldwide (WHO, 2018). The most important factors which exposed to intestinal worm infections are poor sanitary condition like open field defection and faecal contamination of water bodies, but the spread is due to lack of personal hygiene (Mengistu *et a*l., 2014).

2.3.1. *Hymenolepis nana* (Dwarf tapeworm)

Hymenolepiasis is caused by *Hymenolepis nana*. It is the most known intestinal tapeworm infection of humans. *Hymenolepis nana* infection has worldwide distribution and most commonly infects humans, especially school-aged children, mostly from 1-10 years old, in the developing world. Humans become infected with *Hymenolepis nana* when they ingest infective eggs, most commonly by direct faecal-oral exposure. Millions of people were exposed with *Hymenolepis nana* globally. In poor communities, the prevalence can reach up to 50%. The infection is particularly common in children living in areas lacking sanitation and safe water (Cabada *et al*., 2016).

Hymenolepis nana is widely distributed in countries with warm climates including those Africa, South America, Mediterranean Region, and South East Asia. The disease is common in Ethiopia. The highest recorded prevalence (60%) was reported for school children in Kemises in South Wollo. Among students in 50 communities in central and northern highlands of Ethiopia, 78% had positive cases with a mean prevalence of 12% (Anteneh *et al*., 2008). The adult worm of *Hymenolepis nana* found in the intestine. It is very small, only a few centimeters long. The eggs are round or slightly oval at about 40-60 micrometers. Ova of *Hymenolepis nana* are immediately infective when passed with the stool and cannot survive more than 10 days in the external environment. When ova are ingested by an arthropod intermediate host, they develop into cysticercoids, which can infect humans or rodent after ingestion and develop into adults in the small intestine (Sadaf *et al*., 2013).

The infection does not always have symptoms, but usually symptoms like abdominal pain, loss of appetite, itching around the anus, and diarrhea may be observed. Examination of the stool for ova and parasites confirms the diagnosis. The ova and proglottids of *Hymenolepis nana* are smaller than *Hymenolepis diminuta*. Proglottids of both are relatively wide. Identifying the parasites to the species level is often unnecessary from a medical perspective as the treatment is the same for both. The two drugs that are used to for the treatment of *Hymenolepiasis* are Praziquantal and Niclosamide. Praziquantal as a single- does (25mg/kg) is the current treatment of choice for *Hymenolepiasis* and has an efficacy of 96% (Ortiz *et al*., 2002).

2.3.2. *Entrobius vermicularis* (Pinworm)

Entrobiasis is an infection of the human intestinal tract by *Entrobius vermicularis* (pinworm). *Entrobius vermicularis* is a spindle shaped parasite of man and attaches to the mucosa of the lower ileum, ceacum and ascending colon. Pinworm eggs are infective shortly after being excreted. After ingestion, the eggs hatch in the upper intestine and liberate larvae which migrate to the region of the ileum (Anteneh *et al*., 2008). *Entrobiasis* is still one of the major helminthic diseases. It affects approximately 1 billion people worldwide particularly in school age children (Cazorla *et al*., 2006).

Infection occurs through the oral-faecal route caused by the ingestion of infected eggs from contaminated foods, hands or water (Stephenson *et al*., 2000). Based on the past reports, Ethiopia has low prevalence of *Entrobius vermicularis*. Around Gonder, 5% of school children were found to contain *Entrobius vermicularis* eggs under their nails, but only 0.5% of them shed eggs in the stool (Anteneh *et al*., 2008). Even if many infections are asymptomatic, perianal itching, especially at night, is the most common symptom. Typically, the diagnosis rests upon applying cellophane or scotch tape to the perianal skin in the morning, the tape is then transferred to microscopic slide to examine It can be treated by using benzimidazole and mebendazole compounds (Johansson *et al*., 2013).

2.3.3. *Ascariasis lumbricoides*

Ascariasis is a helminthic disease caused by *Ascaris lumbricoid*, which is the largest and the most prevalent round worm. The intestinal nematode *Ascaris lumbricoides* infects approximately 25% of the world's population annually (Carneiro et al., 2002). It is found in association with poor personal hygiene, unsanitary conditions and in place where human faeces are used as fertilizer (CDC, 2018). The highest prevalence of this infection occurs in tropical countries where warm and wet climate. Recent studies suggest that over a billion humans are infected with *Ascaris worldwide* (Galgamuwa *et al.*, 2016).

Ascaris lumbricoides infections occurs, when an ingested infective egg releases a larval worm that penetrates the wall of the duodenum and enters the blood stream and travel in to the liver and heart, and also entered in to the pulmonary circulation to reach in the alveoli, where it grows and molts. In 3 weeks, the larvae pass from the respiratory system to be coughed up, swallowed, and thus returned to the small intestine, where they mature to adult male and female worms. Fertilization can now occur and the female produces as many as 200,000 eggs per day for a year. These fertilized eggs become infectious after two

weeks in the soil; they can persist in soil for 10 years or more (Murray et al., 2005). Most of the time, no symptoms are seen with an *Ascariasis lumbricoides* infection. If symptoms do occur they can be light include abdominal discomfort. However, during heavy infection, symptoms may include blood sputum, cough, fever, intestinal ulcer, and releasing worms. Diagnosis is by identifying ascaris eggs in a stool sample using a microscope (CDC, 2018).

Albendazole or Mebendazole that kill several species of intestinal worms at the same time would only result in a short-term reduction of infection in a target population. Re-infection is quite frequent within a relatively short period of time. However, the long -term key preventive methods help to break the intestinal worm transmission routes and life cycles are, providing safe drinking water, building and using sanitary latrine for safe disposal of human excreta, washing hands with soap before eating or feeding children and after defecation and washing and cooking vegetables thoroughly (UNCEF, 2002).

2.3.4. Hookworm

Hookworm infection in humans is caused by two species of nematodes, *Necator americanus* and *Anclostoma duodenale*. These parasites are considered as important blood feeding nematodes. Among the parasites STHs groups, hookworm is predominant. In Africa, Pacific Islands, India, Asia, America and Caribbean 576 million people infected by hookworm (Hossain and Bhuiyan, 2016). Currently it is estimated that 1.3 billion people are suffer from hookworm infection worldwide. In areas of very intense transmission, heavy worm burdens can be built up in early children and exposed them to retardation of mental and physical development (UNICEF, 2002).

Human acquires hookworm infection by skin penetration of filarial worm larva during contact with contaminated soil when they went with bare foot or water or by ingestion of contaminated water. The infection occurs in areas where the standard of living of the population is low. Sanitary and environmental conditions favor the development of filarial worm larvae and infections of hosts (Jemaneh and Tadesse, 1985). Hookworms contribute to iron deficiency by actively feeding on blood from the intestinal mucosa, resulting in significant gastro-intestinal hemorrhage, loss of serum proteins, and intestinal inflammation. Most of the people infected are asymptomatic and many rural communities in developing countries affected where hookworm is endemic (Abah and Workem, 2016)).

Symptoms or signs of hookworm infection are abdominal pain, nausea, headache, dysentery and gastro-intestinal blooding. Diagnosis of hookworm infection is by microscopic identification of eggs or larvae in fresh stool samples. Since the eggs of *Necator americanus* and *Anclostoma duodenale* appear identically on microscopic examination, species recognition requires. Available anti -helmintics for the treatment of hookworm are Albendazole, Levamisole, Mebendazole and Pyrantel Pamoate (Hossain and Bhuiyan, 2016).

2.3.5. Trichuris trichiura (Whipworm)

Trichuris trichiura is commonly known as whip worm, due to the whip- like form of the body. *Trichuris trichiura* infection is estimated to affect around 1049 million persons worldwide. Of these, 144 million are children of pre-school age and 233 million are of school age. These nematodes are mostly seen in tropical climates and areas where sanitation is poor (Chan, 1997). Infection with *Trichuris trichiura* occurs via the oral-faecal route by the ingestion of infective eggs from contaminated food, hands or water. These then pass through the stomach to the small intestine where they hatch. The larvae penetrate the cell of the small intestine coming to lie above the Lumina to undergo four molts. The immature adults emerge and transported to the large intestine where they mature and embed their thin whip-like anterior into columnar cell. (Stephenson *et al*., 2000).

According to Center of Food Security and Public Health, (2005) *Trichuriasis* is often asymptomatic in humans but heavy infections can cause chronic diarrhea, which may be bloody. Other symptoms may include abdominal pain and distention, nausea, vomiting, headache, malnutrition and anemia weight loss. Keeping personal hygiene can help to prevent infections or severe disease.

2.3.6. *Taenia saginata* (Beef tapeworm)

Taenia saginata is a very long tapeworm parasite whose adult form is found attached to the small intestinal tracts of human beings (Assefa *et al*., 2015). High prevalence of *Taenia saginata* /*Cysticercus bovs*/ occurs in Africa where cattle are kept in community in grazing lands. *Taenia saginata* is distributed globally, where cattle are raised and beef is eaten as raw or under cooked. Humans become infected with tapeworms when they eat raw or undercooked beef containing infective cysticerci. Once inside humans, *Taenia cysticerci* migrate to the small intestine and mature to adult tapeworms from 5 - 12 weeks, which produce segments and eggs that are passed in faeces. (Gebrie and Alemneh, 2015).

Humans pass the tapeworm segments or eggs in faeces and contaminate the soil in areas where sanitation is poor. *Taenia* eggs can survive in a moist environment and remain infective for days to months. The adult tapeworms produce proglottids that mature, detach and migrate to the anus to pass with human faeces. After feeding in areas that are contaminated with infected faeces, cows also exposed to be infected. *Taeniasis* can be diagnosed by observing gravid segments, ova and scolex that are found in faeces. The most widely used systemic drugs for the treatment of *Taenia saginata* in Ethiopia is Niclosamide and Prasiquantel (Assefa *et al.,* 2015).

2.4. Human intestinal parasitic infection in Ethiopia

In Ethiopia, Intestinal parasites are widely distributed as in most of African countries. They are more prevalent in the poor segments of the population with low household income (Amare *et al*., 2013). Based on Ministry of Health reports, (1997) from the outpatient services of the health institutions, more than half a million annual visits are exposed to IPIs. The prevalence of individual parasite varies in different parts of the Country (Tefera, 2015). Based on previous findings, the prevalence of IPIs in Jimma, Ethiopia was as high as 86%; whereas in Tigry, the overall prevalence was 48%. In southern Ethiopia, it was found that the prevalence of infection for *Ascariasis lumbricoides* and *Trichuris trichiura* among school children were 83.4% and 86.4%, respectively (Nguyen et al., 2012). The prevalence of *Entamoeba histolytica*/*dispar* was 53.8% followed by *Gardia lamblia* 23%, in southern Ethiopia. Generally, the prevalence of IPIs in different parts of Ethiopia was varying due to climatic conditions, availability of safe drinking water, environmental sanitation and personal hygiene (Tefera, 2015)

3. Materials and Methods

3.1. Description of the Study area

This study was conducted in Kutaber woreda, at Kutaber Health Center, in Amahara regional state, north part of Ethiopia, it is located at 11^0 19 N latitude 39^0 14 E longitude and about 420 km North of Addis Ababa. Elevations in this Woreda range from 800m - 3200m a.s.l. Kutaber is one of the Woredas in the south wollo zone which is border on the West by the Adila River which separates it from Tenta, on the North by the Walano which separates it from Ambasel, and on the East by Tehuledere. Based on the 2007 national census conducted by the Central Statistical Agency of Ethiopia (CSA), this Woreda has a total population of 95,410, of whom 47,341are men and 48,069 are women; only 4940 or 5.18% are urban inhabitants. The majority of the inhabitants 87.83% are Muslim, while 12.01% of the population are Orthodox Christians. Agriculture is the source of income in the area, and farming is practiced for the production of mixed crop including livestock and trades.

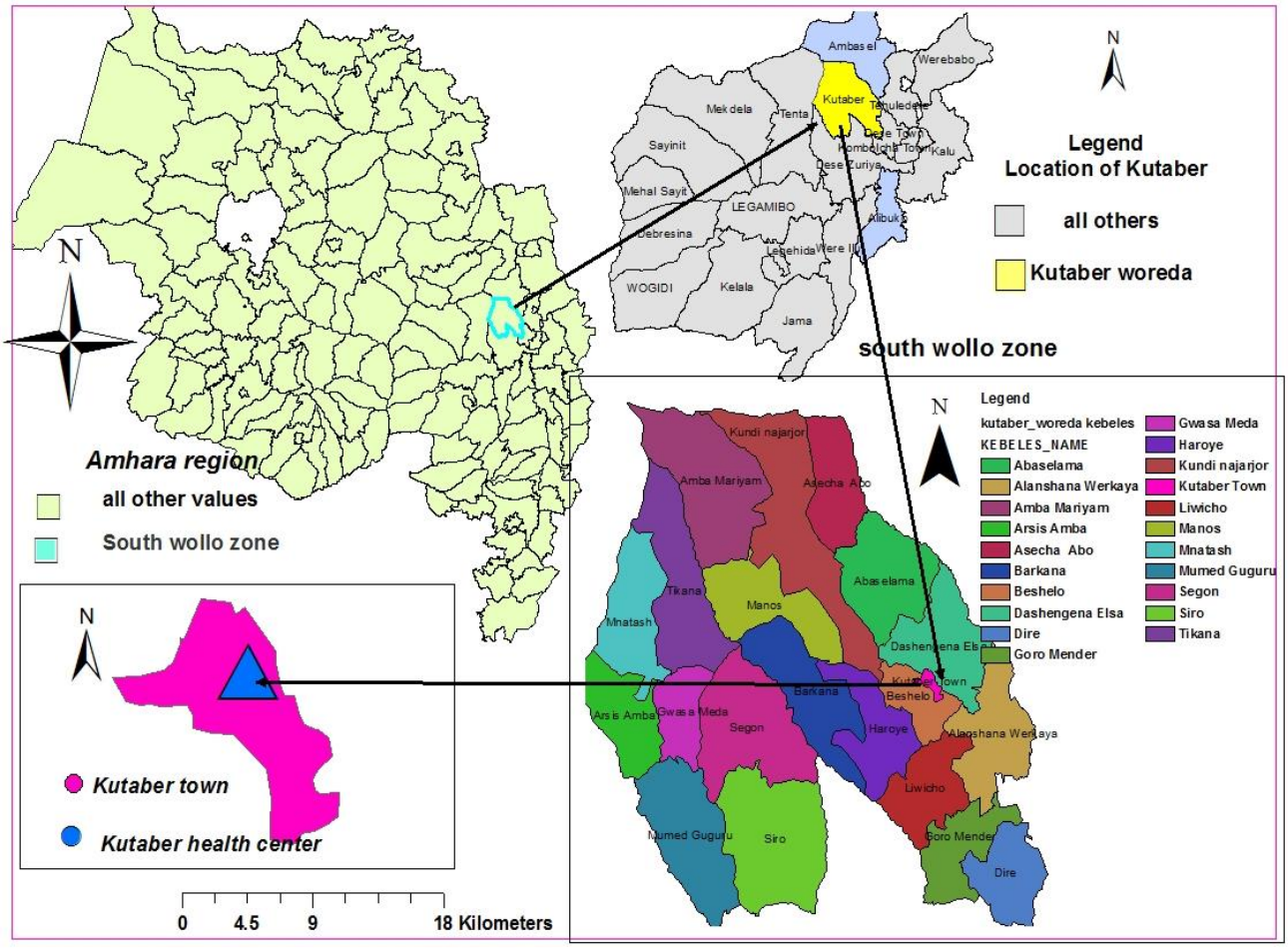

Figure 1: Map of the study sites

(Source: Arc giographic information system 10.1)

3.2: The Study design

It was a cross-sectional survey study based on patients visiting KHC and it was conducted from October 2017- March 2018. To collect data and know the different source of IPIs based on socio demographic characters, environmental related factors, sanitary indicators, water treatment, latrine facility, resident areas and other information from the study participants, a structured questionnaire was constructed.

3.3: Study population and sampling size

The target populations for the study participants were coming from Kutaber Town and different Kebeles that were suspected to have IPIs and examined at KHC. A total of 450 patients were included in this study using convenient sampling technique. Participants who could not answer the questionnaires properly and under five age group infants were excluded from the final analysis.

3.4. Stool collection and processing

Wet mounting is the simplest and easiest technique for the examination of faeces. After proper instruction each participant was requested to provide approximately 2-3 g of fresh stool samples on small pieces of paper using applicator stick. Using a direct smear method with normal saline (0.85% NaCl solution) was prepared on the slide by the study site laboratory technicians and examined under low objective power of microscope at 10X and 40X magnification for the presence of motile intestinal protozoan parasites and worms like trophozoites, cyst and eggs. Contamination was controlled by giving awareness to the patients about how they transport the stool sample and wash their hands.

3.5. Process of data collections

To achieve the objectives of the study, the following data collection methods were used. First the study participants were asked to give fresh stool samples to the laboratory technicians and then, I have been communicated with them to reached an agreement with written consent. After they have agreed, they were invited to complete a questionnaire in Amharic language. This practice was done to all the target participants who were included in the final data analysis. The prepared questionnaire contains the main determinant factors for IPIs and demographic characters.

3.6. Data quality control

Before starting the actual work, quality of reagents and instruments were checked by experienced laboratory technicians who are Alemitu Hussien and Gebrie Abera. The specimens were labeling with code number by following the procedures of collection and diagnosis. To eliminate observer bias, each stool sample was examined by two laboratory technicians and recorded the results for each patient.

3.7. Data analysis techniques

SPSS (statistical package for social sciences) version 21.0 software was used for statistical data analysis. Descriptive statistics were done to assess the prevalence and types of intestinal parasites. Logistic regression analysis was performed to determine the effect of independent variables with dependent variable by calculating the strength of the association between IPIs and determinant factors using odds ratio. Both crud odd ratio and adjusted odd ratio were calculated by univariate and multivariate logistic regression analysis with respective 95% CIs respectively. P value <0.05 was considered as statistically significant.

3.8. Ethical Clearance

The first letter was obtained from Addis Ababa University Zoological Science Department to get permission from concerned bodies based on this letter additional permission was obtained from the administrative of KHC administrative to conduct this study. All the study participants were clearly informed about the purpose of the study and kindly asked to participate and reached agreement to written consent before starting the study. They were insured that any information concerning them will never be used by anybody or institution by names. The result was collected with their code numbers. Positive individuals were treated by giving related drugs that were prescribed by health officers who are Mohammed Zeki and Getu Alemseged.

4. Results

4.1. Study population

In this study 450 patients participated in the study, of these, 216(48%) were males and 234(52%) were females. Majority of study participants 264(58.7%) live in surrounding rural place of the study area, while the rest 186(41.3%) live in the urban area. The participants were divided in to three age groups, 5-14 years old 164(36.4%), 15 -24 years old 85(18.9%) and the majority of the study participants 201(44.7%) were ≥ 25 years old. With regard to educational level, 188(41.8%), 133(29.6%), and 129(28.7%) said that they have primary education and above, read and write and illiterate respectively. Most of the participants 141(31.3%) were farmers. There were 129(28.7%) students, 76(16.9%) others, 65(14.4%) merchants and 39(8.7%) civil servants.

4.2. Prevalence of IPIs in the study population

Among the study participants 179(39.8%) had IPIs. From these 176 individuals were infected with single intestinal parasites and three were infected with double parasites. Out of 216 males and 234 females examined, 94(43.5%) and 85(36.3%) were positive respectively. Six different types of intestinal parasites were identified. These are *Entamoeba histolytica/dispar/moshkoviskii* was predominant 99(22.0%) parasite followed by *Gardia lamblia* 46(10.2%). The other intestinal parasites were *Hymenolepis nana* 12(2.7%), *Entrobius vermicularis* 10(2.2%), *Ascariasis lumbricoides* 7(1.6%), *Trichuris trichiura* 2(0.4%), and mixed/double intestinal parasites were *Entamoeba histolytica/dispar/moshkoviskii* and *Gardia lamblia* 2(0.4%), *Hymenolepis nana* and *Gardia lamblia* 1(0.2%) were identified. Protozoan infection was 145(32.2%) and intestinal parasitic helminths infection was 31(6.9%), mixed infection was 0.7% (Table 1). In terms of age, children between 5-14 years old were more infected compared to other age groups (Table 2)

Table 1: Type and prevalence of intestinal parasites isolated from stool specimen in relation to gender from October 2017- March 2018

Intestinal parasites identified	**Male (n=216)**	**Female (n=234)**	**Total (n=450)**
	Positive, n (%)	Positive, n (%)	Total, n (%)
Protozoa	76(35.2)	69(29.5)	145(32.2)
Entamoeba histolytica/dispar/moshkoviskii	56(25.9)	43(18.4)	99(22.0)
Gardia lamblia	20(9.3)	26(11.1)	46(10.2)
Helminths	16(7.4)	15(6.4)	31(6.9)
Hymenolepis nana	7(3.2)	5(2.1)	12(2.7)
Entrobius vermicularis	7(3.2)	3(1.3)	10(2.2)
Ascariasis lumbricoides	1(0.5)	6(2.6)	7(1.6)
Trichuris trichiura	1(0.5)	1(0.4)	2(0.4)
Double infections	2(0.9)	1(0.4)	3(0.7)
Entamoeba histolytica/dispar/moshkovskii + Gardia lamblia	2(0.9)	0(0.0)	2(0.4)
Hymenolepis nana + Gardia lamblia	0(0.0)	1(0.4)	1(0.2)
Total	**94(43.5)**	**85(36.3)**	**179(39.8)**

Table 2: Type and prevalence of intestinal parasites in relation to age groups (October 2017-March 2018)

Intestinal parasites	**Age groups in years**			
	5-14 (n=164)	15-24 (n=85)	≥25 (n=201)	Total(n=450)
	Positive, n (%)	Positive, n (%)	Positive, n (%)	Positive, n (%)
Intestinal protozoa	**75(45.7)**	**17(20.0)**	**53(26.4)**	**145(32.2)**
Entamoeba histolytica/dispar/moshkovskii	51(31.1)	11(12.9)	37(18.4)	99(22.0)
Gardia lamblia	24(14.6)	6(7.1)	16(7.96)	46(10.2)
Intestinal helminths	**18(10.9)**	**3(3.5)**	**10(4.9)**	**31(6.9)**
Hymenolepis nana	7(4.3)	3(3.5)	2(0.99)	12(2.7)
Entrobius vermicularis	5(3.0)	0(0)	5(2.5)	10(2.2)
Ascariasis lumbricoides	6(3.7)	0(0)	1(0.5)	7(1.6)
Trichuris trichiura	0(0)	0(0)	2(0.99)	2(0.4)
Double parasites	**0(0.0)**	**1(1.2)**	**2(0.99)**	**3(0.7)**
Entamoeba histolytica/dispar/moshkovskii + Gardia lamblia	0(0.0)	0(0.0)	2(0.99)	2(0.4)
Hymenolepis nana + Gardia lamblia	0(0.0)	1(1.2)	0(0.0)	1(0.2)
Total	**93(56.7)**	**21(24.7)**	**65(32.3)**	**179(39.8)**

n=number

4.3. Association of determinant factors with intestinal parasitic infection

Sociodemographic and sanitary determinants were analyzed to identify their possible association with IPIs in the univariate model (Table 3) and significantly associated variables were identified and entered into multivariate model to test their independent association with IPIs (Table 4).

Significant relationships were observed between IPIs (dependent variable) and some of socio-demographic, environmental and other related determinant factors. The prevalence of IPIs in the age group 5-14 was statistically significantly higher than that in others groups (Adjusted odds ratio (AOR) 3.099; 95% CI, 1.777-5.406, p<0.001). Concerning the residence of the participants, rural dwellers were more infected with IPIs than urban ones and the difference was statistically significant (AOR 2.192, 95% CI, 1.269-3.786, p=0.005). Participants who had no awareness to about transmission and prevention of IPIs had significantly higher risk of IPIs (AOR 2.086, 95% CI, 1.219-3.568, p=0.007). Individuals who washed their hands occasionally before meal had significantly higher risk of infection than those do the practice always (AOR 4.145, 95% CI, 1.910-8.998, p<0.001).

Participants who responded as using unprotected water were at significantly increased risk of IPIs than those who used chlorinated tap water (AOR 2.556, 95% CI, 1.442-4.529, p=0.001). In addition, individuals who practice home garbage disposal around river were at significantly greater risk of acquiring IPIs than those who used other method (AOR; 2.257, 95% CI, 1.277-3.991, p=0.005). Individuals who had no habit of post-toilet hand-washing with soap are significantly more likely to be exposed to IPIs than those who had hand washing with soap regularly (AOR 5.046, 95% CI, 2.692-9.456, p<0.001).

On the other hand, although patients who responded ‘no’ about the availability of water near latrine were more vulnerable to IPIs in comparison with those who had, the difference was not statistically significant (AOR 1.244, 95% CI, 0.730-2.118, p=0.422). Similarly, those participants who reported that they do not clean their latrines at all were more infected with IPIs than those who clean everyday but the difference was not significant (AOR 1.898, 95% CI, 0.959-3.755, p=0.066). Surprisingly, individual who had reported no attendance of health education had twice higher risk of getting IPIs than who spoke the opposite but without statistically significant variation (AOR 1.559, 95% CI, 0.923-2.634, p=0.097).

Table 3: Univariate logistic regression analysis of sociodemographic and sanitary factors in relation to IPIs in KHC (October 2017- March 2018) (n=450)

Variables	Alternatives	n	Number of Pos (%)	COR	95% CI	P-value
Sex	Male	216	94(43.5)	1.351	0.925-1.972	0.120
	Female	234	85(36.3)	-	-	-
Age group	5-14	164	93(56.7)	2.741	1.787-4.203	0.000*
	15-24	85	21(24.7)	0.687	0.386-1.220	0.200
	≥25	201	65(32.3)	-	-	-
Residence	Urban	186	39(20.9)	-	-	-
	Rural	264	140(53.0)	4.256	2.774-6.528	0.000*
Educational level	Illiterate	129	61(47.3)	1.547	0.981-2.440	0.060
	Read & write	133	49(36.8)	1.006	0.635-1.594	0.980
	Primary education and above	188	69(36.7)	-	-	-
Occupation	Civil servant	39	10(25.6)	-	-	-
	Merchant	65	23(35.4)	1.588	0.658-3.830	0.303
	Farmer	141	59(41.8)	2.087	0.944-4.611	0.069
	Student	129	56(43.4)	2.225	1.001-4.944	0.050
	Others	76	31(40.7)	1.998	0.582-4.683	0.111
Past -treatment for IPIs	Yes	149	64(42.9)	1.218	0.817-1.815	0.333
	No	301	115(38.2)	-	-	-
Awareness to IPIs	Yes	180	44(24.4)	-	-	-
	No	270	135(50)	3.091	2.040-4.682	0.000*
Abdominal discomfort	Yes	160	73(45.6)	1.457	0.984-2.156	0.060
	No	290	106(36.6)	-	-	-
Pre-meal hand-washing	Always	223	70(31.4)	-	-	-
	Usually	157	64(40.8)	1.504	0.983-2.303	0.060
	Occasionally	65	43(66.2)	4.277	2.377-7.680	0.000*
	Never	5	2(40.0)	1.457	0.238-8.916	0.684
Water treatment	Chlorinated tap water	208	45(21.6)	-	-	-
	Boiling	17	6(35.3)	1.976	0.693-5.635	0.203
	Unprotected water	225	128(56.9)	4.780	3.133-7.293	0.000*
Latrine type	Building well	60	17(28.3)	-	-	-
	Pit latrine (uncovered)	298	122(40.9)	1.753	0.955-3.218	0.070
	On the field	92	40(43.5)	1.946	0.970-3.905	0.061
Disposal of garbage	Burn	170	47(27.6)	-	-	-
	Open ground	98	38(38.8)	1.657	0.978-2.808	0.060
	Around the river	182	94(51.6)	2.795	1.792-4.360	0.000*
Post-toilet hand-washing	Always	127	34(26.8)	-	-	-
	Occasionally	185	48(25.9)	0.958	0.574-1.599	0.871
	Never	138	97(70.3)	6.471	3.785-11.063	0.000*
Availability of water near the latrine	Yes	223	64(28.7)	-	-	-
	No	227	115(50.7)	2.551	1.728-3.767	0.000*
Cleaning latrine	Everyday	140	46(32.9)	-	-	
	Once per week	196	78(39.8)	1.351	0.858-2.127	0.194
	Not at all	113	55(48.7)	1.938	1.163-3.228	0.011*
Eating raw meat and unwashed vegetables	Yes	153	62((40.5)	1.048	0.704-1.560	0.817
	No	297	117(39.4)	-	-	-
Health education	Yes	211	55(26.1)	-	-	-
	No	239	124(51.9)	3.058	2.053-4.556	0.000*

CI: confidence interval; COR: crude odds ratio; n: number examined; %: percent; pos: positive (number infected); *statistically significant ($p<0.05$); IPIs: intestinal parasitic infections; KHC: Kutaber Health Center

Table 4: Multivariate logistic regression analysis for risk factors which are associated with IPIs from October 2017- March 2018 (n=450)

Variables	Alternatives	n	Pos (%)	AOR	95% CI	P-value
Age (year)	5-14	164	93(56.7)	3.099	1.777-5.406	0.000*
	15-24	85	21(24.7)	1.067	0.523-2.177	0.858
	≥25	201	65(32.3)	-	-	-
Residence	Urban	186	39(20.9)	-	-	-
	Rural	264	140(53.0)	2.192	1.269-3.786	0.005*
Awareness to IPIs	Yes	180	44(24.4)	-	-	-
	No	270	135(50)	2.086	1.219-3.568	0.007*
Pre-meal-hand washing	Always	223	70(31.4)	-	-	-
	Usually	157	64(40.8)	0.760	0.433-1.333	0.338
	Occasionally	65	43(66.2)	4.145	1.910-8.998	0.000*
	Never	5	2(40.0)	0.766	0.110-5.323	0.787
Water treatment	Chlorinated tape water	208	45(21.6)	-	-	-
	By Boiling	17	6(35.3)	2.561	0.657-9.986	0.176
	Unprotected	225	128(56.9)	2.556	1.442-4.529	0.001*
Disposal of garbage	Burn	170	47(27.6)	-	-	-
	Open ground	98	38(38.8)	1.200	0.609-2.363	0.598
	Around the river	182	94(51.6)	2.257	1.277-3.991	0.005*
Post-toilet-hand-washing	Always	127	34(26.8)	-	-	-
	Occasionally	185	48(25.9)	1.378	0.737-2.576	0.315
	Never	138	97(70.3)	5.046	2.692-9.456	0.000*
Water availability near Toilet	Yes	223	64(28.7)	-	-	-
	No	227	115(50.7)	1.244	0.730-2.118	0.422
Cleaning latrine	Everyday	140	46(32.9)	-	-	-
	Once per week	196	78(39.8)	1.678	0.917-3.068	0.093
	Not at all	113	55(48.7)	1.898	0.959-3.755	0.066
Health education	Yes	211	55(26.1)	-	-	-
	No	239	124(51.9)	1.559	0.923-2.634	0.097

AOR: Adjusted odds ratio; CI: confidence interval; COR: crude odds ratio; n: number; %: percent; pos: positive, * statistically significant ($p<0.05$); IPIs: intestinal parasitic infections; KHC: Kutaber Health Center

5. Discussion

In the current study, the overall prevalence of IPIs was 39. 8%. The finding is similar to the study, in Gamo area, South Ethiopia found that overall prevalence of IPIs was 39.9% in a community-based study (Wegayehu *et al*., 2013). But the prevalence in this study was higher than that of some studies in Arba Minch Town, Haftu *et al*., (2014), South Ethiopia (27.7%), Amare *et al*., (2013), Northwest Ethiopia (22.7%), Amer *et al*., (2017) in Riyadh Region, Saudi Arabia (6.9%). In contrast, it was lower than the prevalence rate reported by Gabbad and Elawad, (2014, in Elengaz area, Khartoum, Sudan (64.4%), Ayalew and coworkers reported, (2011) among Delgi schoolchildren, north Gondar, Ethiopia a prevalence of (79.8%). High prevalence was found in people with low socio-economic status, poor living condition in overcrowded areas, poor environmental sanitation, improper garage disposal, unsafe water supply and unhygienic personal habits.

In this study, *Entamoeba histolytica/dispar/moshkovskii* was the predominant infection followed by *Gardia lamblia* and both were the predominant infections from other previous studies conducted by other workers (Dash et al., 2010; Shrestha *et al*., 2012). In our study, the prevalence rate of *Entamoeba histolytica/dispar/moshkoviskii* observed 22% which agrees with Alamir *et al*., (2013), (21.6%) and higher than studies carried out by Gabbad and Elawad, (2014), in Khartoum, Sudan (3.6%); but it was lower than the findings of Tefera, (2015) at Wonago Health Center, southern Ethiopia (53.8%), Padmaja et al., 2014 from Amalapuram, India (63.3%). This variation between the present and past research findings might be environmental hygiene differences of the study subjects and climatic conditions.

The prevalence rate of *Gardia lamblia* in the current study (10.2%) was higher than the findings of Maru, (2017) from Adigrat town, Northern Ethiopia (2.3%). Although, which was lower than the prevalence rate of Jad *et al*., (2015) among Patients Seeking Treatment in a Tertiary Care Hospital in Jammu, India (73.5%). The water supply is really an important risk factor for the *Giardiasis*, and several large outbreaks of *Giardiasis* have resulted from the contamination of drinking water supply with the human waste (Kotian *et al*., 2014).

The prevalence of *Hymenolepis nana* in my study (2.7%) was lower than the previous findings carried out by Ayalew *et al*., (2011) from North Gonder 6.8%, Gabbad and Elawad, (2014), in Khartoum, Sudan (26.4%) but higher than the findings of Amer *et al*., (2017), Saudi Arabia (0.5%). The prevalence of *Entrobius vermicularis* (2.2%) was slightly higher than the research findings presented by Imam *et al*., (2012), in Qassim region, Saudi Arabia (0.2%). However, it was lower than Alamir *et al*., (2013), in Dagi primary school, Amhara National Regional State, Ethiopia (7%).The rate of *Ascariasis lumbricoides* prevalence in this study (1.6%) was nearly equal to Kotian *et al*., (2014), from India (1.5%), and which was lower than the findings reported by Ayalew *et al*., (2011), North Gondar (48.0%), but it was higher than the prevalence rate carried out by Feleke *et al*., (2017), from Axum, Northern Ethiopia (0.4%).

In my research findings the rate of *Trichuris trichiura* prevalence (0.4%) was relatively similar with Jad *et al.,* (2015) in Jammu, India (0.8%). In contrast, it was lower as compared to the previous outcomes expressed by Emile *et al*., (2013), in Kigali, Rwanda, (20.0%). Differences in reported prevalence of IPIs might be indicative of differences in geographical distributions of parasites and other risk factors associated with poor hygiene and the other environmental factors (Nguyen *et al.,*2012). In this study hookworm and *Taenia spp* were not detected. It might be due to having habits of wearing shoes regularly and avoiding eating raw meat.

Among 179 positive individuals the majority, 176(39.1%) had single IPIs in agreement with Opara *et al.*, (2012) from rural and urban school-aged children in Nigeria, average rate of 40.8% was identified. However, individuals co-infected with two species of parasites 3(0.7%) were lower than Opara *et al.*, (2012), in Nigeria (19.1%). In the current study the prevalent double IPIs were observed *Entamoeba histolytica* and *Gardia lamblia* (0.4%), and *Hymenolepis nana* and *Gardia lamblia* (0.2%). This finding was consistent with Kosar *et al.*, (2017) from Punjab, Pakistan, found that Entamoeba histolytica and Gardia lamblia (0.3%), Hymenolepis nana and Gardia lamblia (0.2%).

The majority of the study participants were in the age group 5-14 years old. The highest prevalence rate of IPIs was in this age group. Except *Trichuris trichiura*, all single species of intestinal parasites identified in the study area predominantly parasitized younger aged groups from 5-14 years. IPIs are more prevalent among children as compared with the general population. About 12.0% of the global disease burdens caused by intestinal parasites were observed among children with age ranges from 5-14 years in developing

countries Hailegebriel, (2017). The main factors could be low level of awareness about the mode of transmission and prevention of IPIs, poor personal and environmental hygiene among other factors.

Concerning the residence of participants, 53.0% of rural dwellers was more infected with IPIs than urban ones and had statistically significant differences. It was supported by the previous research findings conducted in Nigeria by (Opara *et al*., 2012). They expressed that the prevalence of intestinal parasites and under nutrition was significantly higher in rural than in urban children. Schoolchildren from the rural areas (80.9%) were significantly more infected than children from the urban areas (51.4%). The difference might be due to communities from rural areas had low awareness about transmission and prevention of IPIs, usually rural communities use wells/spring water which are not properly treated and having poor sanitary practices. About 60.0% of the participants in this study had no awareness about the transmission and prevention of IPIs and as a result had high IPIs. Other study from Abaye Deneba area, Ethiopia, showed that a high prevalence of IPIs in a community whose knowledge about the parasite was low (Nyantekyi *et al.,* 2014).

Regarding improper hand wash after a toilet and pre- meal increases prevalence of IPIs and both were statistically significant in this study. About (30.7%) of participants were not washing their hands after toileting. Previous findings also found that in developing countries poor hand washing practices pre-meal and after defecation is a leading cause for faecal-oral transmission of parasitic infection (Kosar *et al*., 2017). According to the findings of Azam *et al*., (2007), washing of hand with soap before meal and after defecation showed a marked reduction in overall distribution of intestinal parasites. About ways of water treatment (50%) of individuals were used unprotected water and had a significant role for IPIs and supported by Kosar *et al*., (2017), who proposed (70%) of the children used untreated water which posed a significant health risk.

There was a statistically significant association between garbage disposal and IPIs. It was supported by the research conducted by Gabbad and Elawad, 2014 in Sudan. They stated that unsanitary solid waste disposal was statistically significant with IPIs among primary school children. To latrine cleaning (25.1%) of participants did not clean their latrine at all and from them (48.7%) were infected with intestinal parasites, but not significant. This was supported by the study of Azam *et al*., 2007 where non- sanitary latrine users harbor parasite 29.3%. Individual who had not getting health education had twice higher risk of getting

IPIs than who had but without statistically significant variation. Health education programs create awareness of the risk factors associated with exposure of individuals to IPIs. The study of Kanoa *et al*., (2006), from Palestine, revealed that there was a significant relationship between health education and the improvement of hygiene and low parasitic infestation among target population.

At the end, in this study no attempt was made to investigate seasonality as potential factor, so seasonal fluctuations might have affected the actual prevalence rate of IPIs and the method applied in stool diagnosis. In addition to that, under five age group were not included due to the absence of stool samples diagnosed by laboratory technicians. This is because the health officers did not order them to give the stool samples. They only observe the general symptoms of those infants and gave treatment. This might also have its own impact on prevalence rates. Concerning this, it should be carried out further studies in the study area.

6. Conclusions and recommendation

Intestinal parasitic infection remains a major health problem in the study area. The result of this study showed that the most vulnerable individuals were the youngest ones and those living in the rural areas. The most frequent IPIs were protozoan parasite than helminths showing waterborne transmission due to shortage of safe drinking water. In addition, poor personal and environmental sanitary practices like pre-meal and post-toilet hand washing as well as poor garbage disposal, and inadequate awareness about predictors of IPIs was noticed among the study population. Therefore, scaled-up health education and practical measures on personal and environmental sanitation are important for effective control of IPIs in the study area.

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8. Annexes

Annex 1. Written consent form

Cod No _____Age_____ Sex___

Study site/center/ Kutaber health center

I am a post graduate student from Addis Ababa University Zoological Science department. I have investigated on "Intestinal parasitic infections and associated determinant factors among Patients Visiting Kutaber health center, Northeast Ethiopia." The main purpose of this study is to assess the prevalence of IPIs and their determinant factors among patients visiting Kutaber health center in relation with knowledge, attitude and practice of the study participants. It is very important to create awareness on its prevalence and controlling measure among all concerned bodies. You are kindly invited to take part in this research. Participation into the study is on your voluntary basis. For this study, I am requesting to give stool sample for intestinal parasites identification and to fill the given questioners. If you are willing to participate in my study, you need to understand and agree on the consent. All the responses given by the participant and the results obtained will be kept confidential. If you have understood the explanation well enough, I am requesting you to put your signature as illustrated below.

Name (participant) _____Signature_____ Date_____

Name (Investigator) _____Signature_____ Date_____

Name (Physician) _____ Signature _____ Date_____

Annex 2: Written consent form (Amharic version)

የውል ስምምነት መጠየቂያ ቅጽ

የሚስጥር ቁጥር---------- እድሜ----------ጸታ----------

የጤና ጣቢያው ስም----------

እኔ በአድስ አበባ ዩኒቨርስቲይ የዞሎጅካል ሳይንስ ትምህርት ክፍል የድህረ-ምረቃ የክረምት ተማሪ ስሆን ወደ ኩታብር ጤና አጠባበቅ ማዕከል ከሚመጡ ታካሚዎች መካከል የአንጀት ውስጥ ጥገኛ ተህዋሲያን በሽታ ስርጭትና አጋላጭ ምክንያቶችን ለመዳሰስ የመስክ ጥናት በማድረግ ላይ እገኛለሁ፡፡ የዚህ ጥናት ዋና አላማ የአንጀት ውስጥ ጥገኛ ተህዋሲያን በሽታ ስርጭትና የጥናቱ ተሳታፊዎች ለበሽታው ተጋላጭ የሆኑበትን ምክንያቶች ለማወቅና የጽዳት ልማዳቸውን ለመዳሰስ ነው፡፡ ይህ ጥናት ለሚመለከታቸው አካላት በሙሉ ስለበሽታው ስርጭትና በሽታውን ለመቆጣጠር መወሰድ ስለሚገባቸው ርምጃዎች ግንዛቤ ለመፍጠር በጣም ጠቃሚ ነው፡ የዚህ ጥናት ተሳታፊ እንድሆኑ በአክብሮት እጋብዛለሁ፡፡ የሚያደርጉትም ተሳትፎ በፈቃደኝነት ላይ የተመሰረት ነው፡፡ ለዚህ ጥናት የሚሆን የአንጀት ውስጥ ጥገኛ ተህዋሲያንን ለመለየት የሰገራ ናሙና እንድሰጡና የጽሁፍ መጠየቆችን እንድሞሉልኝ እጠይቃለሁ፡፡ በጥናቱ ውስጥ ለመሳተፍ ፈቃደኛ ከሆኑ ስምምነቱን መረዳትና መስማማት ይጠበቅበዎታል፡፡ የሚሰጡት ማንኛውም ምላሽና የሚገኘው የምርመራ ውጤት በሚስጥር ይያዛል፡፡ የተሰጠውን ማብራሪያ ከተረዱና በቂ ከሆነ ከዚህ በታች በተገለጸው ላይ ፊርማዎትን እንዳስቀምጡ እጋብዛለሁ፡፡

የተሳታፊው ስም----------ፊርማ----------ቀን----------

የአጥኒው ስም----------ፊርማ----------ቀን----------

የቤተሙከራ ባለሙያው ስም----------ፊርማ----------ቀን----------

Annex 3. Questionnaire

Introduction

The main purpose of this questionnaire is to gather data on intestinal parasitic infections among patients visiting KHC. It will help the investigator to find out the study participants knowledge, attitude and practices towards the parasites. It is also very important to create awareness on its prevalence and controlling measure among all concerned bodies. Therefore, I kindly request you to give your genuine response for each question.

Thank you!

Part1. Participant's identification:

Code no____ Sex; Male___ Female____ Age____ Kebele _____Residence: urban_____ rural____

Educational level: Illiterate _____Read and write _____Primary education _____

Secondary education and above_____

Status of occupation: Civil servant _____ Merchant____ Farmer _____ Student_____ House wife_____ Other_____

Part 2: Gathering information about knowledge, attitude and sanitary practices towards intestinal parasites.

1. Have you ever been treatment for IPIs? A. Yes B. No
2. Do you know the transmission and prevention of intestinal parasitic diseases? A. Yes B. No
3. Do you have generalized abdominal discomfort or pain? A. Yes B. No
4. Do you wash your hands before meal? A. always B. usually C. occasionally D. never
5. How do you use drinking water? A. Chlorinated tap water B. by boiling C. Unprotected
6. Which latrine type do you use? A. building well B. pit- latrine (uncovered) C. on the field
7. How do you dispose your home garbage? A. burn B. open ground C. around the river
8. Do you wash your hands with a soup after using a toilet? A. always B. occasionally C. never
9. Is there any water source available near the latrine? A. Yes B. No
10. How often clean the latrine? A. everyday B. once per week C. not at all
11. Do you eat undercooked meat and unwashed vegetables? A. Yes B. No
12. Did you get health education before? A. Yes B. N

Annex 4: Questioners Amharic version

የጽሑፍ መጠየቅ

መግቢያ: የዚህ መጠይቅ ዋና አላማ ወደ ኩታበር ጤና ጣቢያ ከሚመጡ ታካሚዎች ስለ አንጀት ጥገኛ ተህዋሲያን በሽታ መርጃ ለመሰብሰብ ነው።ይህ መጠይቅ ለጥናቱ አጥኒ የተሳታፊዎችን ስለበሽታው ያላቸዉን እዉቀት አመለካከትና የጽዳት ልማድ ለመዳሰስ ይረዳል። በተጨማሪም ይህ የፅሁፍ መጠዬቅ ለሚመለከታቸው አካላት ስለበሽታው ስርጭትና ስለሚወሰዱ እርምጃዎች ግንዛቤ ለመፍጠር በጣም ጠቃሚ: ስለሆነ ለእያንዳንዱ ጥያቄ ተገቢ ምላሽ እንድሰጡ ባክብሮት እጠይቃለሁ።የሚሰጡት ምላሽ ሚስጥራዊነቱ የተጠበቀ ነው።

ስለትብብረወ አመሰግናለሁ።

<u>ክፍል አንድ፡- የተሳታፊዎች መለያ</u>

የመዝገብ ቁጥር_____ ጾታ፡- ወንድ -------ሴት-------ዕድሜ-------- ቀበሌ--------

መኖሪያ፡- ገጠር------ ከተማ-----

የትምርት ደረጃ፡- ያልተማረ------ማንበብና መጻፍ የሚችል-----የመጀመሪያ ደርጃ----ሁለተኛ ደረጃና በላይ---

የስራ ሁኔታ፡- የመንግስት ስራተኛ---------ነጋዴ---------ገበሬ------ተማሪ------የቤት እመቤት---------ሌላ----

<u>ክፍል ሁለት፡-ስለአንጀት ጥገኛ የተሳታፊውን እውቀት አመለካከትና የጽዳት ልማድ መረጃ መሰብሰቢያ</u>

1. ከዚህ በፊት የአንጀት ውስጥ ጥገኛ ተሲህዎሲያን ህክምና ወስደው ያውቃሉ?

ሀ. አዎ ለ. አላውቅም

2. የአንጀት ጥገኛ በሽታ መተላለፊያና መከላከያ መንገድ ያውቃሉ?

ሀ. አዎ ለ. አላውቅም

3. አጠቃላይ የሆድ እቃ ህመምና ስቃይ አለበዎት? ሀ. አዎ ለ. የለብኝም

4. ከምግብ በፊት እጆትን ለምንያህል ጊዜ ይታጠባሉ?

ሀ. ሁልጊዜ ለ. በአብዛሀኛው ሐ. አልፎ አለፎ መ. አልታጠብም

5. የመጠጥ ዉሃን ዕንደት በማከም ይጠቀማሉ?

ሀ. ክሎሪን (ውሀ አጋር) በመጨመር ለ. በማፍላት ሐ. ያለታከመ ውሀ

6. በአብዘሀኛው ምን አይነት ሽንት ቤት ይጠቀማሉ?

ሀ. በግንብ በተስራ ጉድጓድ ለ. ክፍትና በግንብ ባልተሰራ ጉድጓድ ሐ. ሜደላይ

7. የቤት ውስጥ ቆሻሻን እንዴት ያስወግዳሉ?

ሀ. በማቃጠል ለ. ሜዳ ላይ በመጣል ሐ. ወንዝ ዳር በመጣል

8. መጸዳጃ ቤት ከተጠቀሙ በኃላ እጆትን በውሃና በሳሙና ለምንያህል ጊዜ ይታጠባሉ?

ሀ. ሁልጊዜ ለ. አልፎ- አልፎ መ. አልታጠብም

9. በሚጸዳዱበት አካባቢ የውሃ አቅርቦት አለ? ሀ. አዎ ለ. የለም

10. መጸዳጃ ቤተ ለምንያህል ጊዜ ይጸዳል?

ሀ. በየቀኑ ለ. በሳምንት አንድ ቀን ሐ. ጭራሽ አይጸዳም

11. በደንብ ያልበሰለ ስጋና ያልታጠበ አትክልትና ፍራፍሬ ይመገባሉ?

ሀ. አዎ ለ. አልመገብም

12. ከዚህ በፊት ስለግል ንጽህና እና አካባቢ ጽዳት ትምህርትና ስልጠና አግኝተው ያውቃሉ?

ሀ. አዎ ለ. አላውቅም

Annex 5. Data collecting format in the study site

Table1. Study patients by sex, age and resident in relation to types of intestinal parasites identified

No	Code NO	Sex	Age	Resident	Types of intestinal parasites

9. Declaration

I, the undersigned, declare that this Thesis is my original work and all source materials used are duly acknowledged.

Name Ahmed Mohammed Hassen

Signature _____

Date _____

10. Statement of supervisor

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

Name Hassen Mamo (PhD)

Signature_____ Date_____