

ADDIS ABABA UNIVERSITY
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**Intestinal Parasitic Infections among Patients of Aykel Health
Center, Northwest Ethiopia.**

By

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**A Thesis Submitted to the Department of Microbial, Cellular and
Molecular Biology in Partial Fulfillment of the Requirements for the
Degree of Master of Science in Biology.**

Advisor: Mekuria Lakew (Ph.D)

Addis Ababa, Ethiopia

September, 2017

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List of Acronyms

IHPI	Intestinal helminth parasitic infection
IPPI	Intestinal protozoan parasitic infection
AHC	Aykel Health Center
IPI	Intestinal Parasitic Infection
WHO	World Health Organization
CDC	Center for Disease Control
CSA	Central Statistical Agency
FMOH	Federal Ministry OF Heath
Eh	Entamoeba histolytica
Gi	Giardia lamblia
HW	Hook worm
Al	Ascaris lumbricoides
Ss	Strongyloides stercoralis
Hn	Hymenolepis nana
Sm	Schistosoma mansoni
Ts	Taenia species

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Abstract

Prevalence of Human Intestinal parasitic Infection among Patients who attended At Aykel Health Center from 2014-2016 North West Ethiopia. In developing countries like Ethiopia, intestinal parasites are the next causes of outpatient morbidity and mortality to malaria. Prevalence information on intestinal parasitic infection is important to develop appropriate control strategy. There was no study on prevalence of intestinal parasites in Aykel town and health center, North West Ethiopia. Thus the purpose of this study was to determine the status of intestinal parasitic infections among patient who attended Aykel Health Centre for diagnosis of intestinal parasite infection between 2014-2016. All subjects were considered as the sample/ representative population for Aykel town and the surrounding areas. The data for this retrospective study was collected from Aykel Health Centre record books for the three consecutive years using data collecting forms and analyzed using descriptive statistical method and presented by tables and graphs. Based on the data prevalence of the major protozoa and helminths infections were identified. Accordingly a total of 36,735 patients visited the laboratory for stool examination, 4377(11.9%) were found to have one or more parasitic infections. Males(13.9%) were more infected than females(10.3%).and Prevalence of intestinal parasites in the study area was started with 13.7%, in the first year and dropped the next year to 11.3% and got on to 10.1% on the third year .It was generally on decrease at a noticeable rate. However, the most dominant infections were protozoa parasites (6.9%) followed by helminths (5%). Infection with Giardia was found to be the commonest protozoan infection (5.2%) followed by hook worm (2.5%) and Enamoeba species (1.7%). From the total positive cases (11.9%), 6.7% and 0.3% showed dual and triple parasitic infection respectively. Age group analysis showed that > 15-20 and > 35 age groups were more, 0-5 and 30-35 were les infected than the other age groups. The rural populations (61.9%) have doubled infection that of the urban (38.1%). Most intestinal parasitic infections are among the ten top diseases to cause death. But it is simply transmitted through fecal oral route. To minimize its prevalence the government must give attention to provide education on the area of transmission and prevention before infection especially for rural populations.

Keywords: *Helminth, Intestinal parasitic infection, Prevalence, Protozoa*

1. INTRODUCTION

1.1 Back ground of the study

Parasites are organisms that depend on other organisms for survival at some stage in their life cycle. Some leads as symbiotic or commensals most of their life time and at times become parasitic, while others start their life as parasites and continue to cause acute and chronic illness in different parts of the host body. Such parasites are found distributed all over the world that 3.5 billion people live at risk of infection. Of these risk groups 450 million depending on their part of the body they reside they are named as intestinal hematological mental etc. (WHO, 2003).

Intestinal parasites are those groups of protozoan and helminthes that reside in the digestive system and cause harm to humans. Among the Helminthes, Ascariasis, hook worm and *Trichuris trichiura* are helminths that are recognized to be among the top ten most common infections in the world and each constituting of 1000 million, 900 million and 500 million respectively. They are responsible for considerable morbidity and mortality. That includes stunt growth, physical weakness low cognitive performances of school children. These infections are more treat to the poor segments of the population.ie.people of low economic status, poor personal and environmental sanitation, and overcrowding, limited access to clean water, tropical climate and low altitude (WHO, 2002).

The degree of harm caused by intestinal parasitic infections to the health of individuals and communities depends on the parasite species, the intensity and course of infection, the nature of interactions between the parasite species and concurrent infection, the nutritional and immunological status and numerous socio economic factors of the host.

Thus it is extremely difficult to measure the suffering caused by intestinal parasitic infections because many of them cases are asymptomatic and therefore remain undetected for a long time with the infection subject (WHO,2003).In a study done in children of 17 years of age below from East Africa countries showed 50% prevalence rate and all infected children were asymptomatic at diagnosis(Rice *et al.*,2003).Intestinal helminths in general are more intestinal parasite throughout the tropics, especially among poor communities that are often neglected .In this parts of the world the high prevalent rate of intestinal parasite is attributed largely to the socioeconomic status ,poor sanitation ,inadequate medical care and absence of safe drinking water supplies (WHO,2002).

Regarding the intestinal protozoan infection, Giardiasis is caused by *Giardia lamblia* found in duodenum is the most spread protozoan infection with an estimated prevalence rates up to 7% in developed countries and 20.0-30.0% in most developing countries, affecting approximately 200 million people world-wide (Mineno and Avery, 2003). Amoebiasis due to infections with the intestinal protozoan *Entamoeba histolytica* resulting in 40,000 -100,000 deaths each year (Nematian *et al.*, 2004). Ethiopia like other developing countries, because of the low qualities and lack of availability water supply and latrine coverage in the world people result to using rivers, stream and other sources for routine activities that expose them for higher risk of infection (Tadesse and Tsehaye, 2008). The distribution and prevalence of various species of intestinal parasites differ from region to region because of several environmental, social, geographical and other factors outside the host and the interactions agent interactions.

Even though several studies have been conducted on prevalence of intestinal parasites in different parts Ethiopia, Tadesse *et al.*, (2009), Fayo (2010), Mengstu (2010), Asrat *et al.*, (2011) add Yonas (2011). There are several locations in the country including the study area Aykel Town for which prevalence information about intestinal parasitic infections are not available. Therefore the purpose of this study was to obtain information about the intestinal parasite who attended at Aykel Health Centre from 2014-2016.

1.2 Statement of the Problem

Intestinal parasites are organisms that can infect the gastrointestinal tract of human and other animals. They can live throughout the body, but most prefer the intestinal wall. Means of exposure include, ingestion of under cooked food, drinking of infected water and skin penetration (Loukopoulos *et al.*, 2007). In many of the developing countries like Ethiopia, the most prevalent and important *human* diseases are caused by intestinal parasitic infections commonly resulting from protozoa (*Entamoeba histolytica*, *Giardia lamblia* and helminths (*Ascaris lumbricoides*, *Trichuris trichiura* and hookworms) (WHO, 2002). For instance, it was found that helminthiasis the second most common causes of outpatient morbidity next to malaria in Ethiopia (FMoH, 2004).

Factors such as socio-economic status, poor sanitation, inadequate medical care and absence of safe drinking water supplies, it has also been reported that unsanitary sewage disposal, the habit of eating raw or semi-raw fish and the practice of allowing untreated infected sewage to

drain in fresh water bodies is responsible for the establishment and maintenance of the parasites (Jemaneh, 2000).

The severity of Intestinal parasitic infections is related to a number of factors: in many cases poverty, is the dominant factor for higher rates of prevalence of these diseases. Poor hygiene, ignorance in health related education, non-availability of safe drinking water and in door populations are factors increased by poverty (Stevens, 2004). It significantly reduces people's physical and mental capability (Singh *et al.*, 2008).

Generally the conditions that initiate me to study the prevalence was that intestinal parasites are important health problems, because they cause low educational achievement and stunted growth on children, they migrate through circulatory system to reach their destiny in different parts of the body. For example, *Ascaris lumbricoides* migrate to lungs to get back to heart and intestine).

They live in groups(mixed infection is common), most of them are asymptomatic, this is difficult to treat before they multiply in number, and they get in to the intestine through mouth from un cooked or unwashed food, contaminated water, hands or through the skin penetration with larva infected soils. Some also form cyst that is essential for them to survive outside the host intestine and for the transmission of the parasite among susceptible hosts(Nihar *et al.*,2010).Therefore the knowledge generated in the present study in this area might help to determine the prevalence of human intestinal parasite infection using retrospective data from Aykel Health Center, with the hope that it would help the future formulation of appropriate control strategies and minimize the risk of intestinal parasitic infection by raising the awareness of the people on the prevention, transmission and mode of infection of the disease.

1.3 Significance of the Study

Among the conditions influencing the development of parasitic infections are poor sanitary conditions, malnutrition, poverty, lowering resistance of the host, large family size and poor personal hygiene (Olsen *et al.*, 2001). These diseases can undermine child development, educational achievement, reproductive health and social and economic development (Allen *et al.*, 2002).

Transmission of intestinal parasites to the definitive host is mainly through oral route but also through skin penetration. The epidemiological information on the prevalence of Intestinal parasitic infection is one of the prerequisites for developing appropriate control measures. Despite the public health importance of these infections and the potential consequences, little is known about their prevalence in Aykel Town. In Ethiopia, current experience suggests that intestinal parasitic control are relatively less costly and the changes could be maintained by teaching the community simple hygienic rules like wash hands before eating. People can see the effects of primary health care interventions as they become healthier as a result of the control measures including health education.

Deworming of the under five year children and treatment of drinking water brings immediate changes on the growth of children (Yonas, 2011) .Therefore, the present study was conducted in this area to determine the prevalence of human intestinal parasitic infection attending from Aykel Health Centre which is a prerequisite for formulation of appropriate control strategies like health education and minimize the risk of infection by raising the awareness of the people on the transmission, prevention and mode of infection of the disease.

1.4 Objective of the Study

1.4.1 General Objective:

To determine the prevalence of human intestinal parasitic infections among patients who attended Aykel Health Center between 2014-2016.

1.4.2 Specific Objectives:

To analyses the data and to transform it to results in the form of tables that speak for themselves.

To identify protozoa and Helminthic parasites in Aykel Health Clinic record books.

To determine the prevalence of protozoa and Helminth parasite infections among patients who attended in Aykel Health Center between 2014-2016.

To recommend easy means of controls.

2 LITERATURE REVIEW

2.1 Epidemiology of Intestinal Parasitic Infection

Intestinal parasitic infections are distributed virtually throughout the world. According to the (WHO,2002) estimates, globally about 3.5 billion people are affected by intestinal parasitic infections and cause clinical morbidity in approximately 450 million, majorities of the cases occur among children (WHO,2003). Intestinal parasitic infections such as *Ascariasis* and hookworm infection *are* among the ten most common infections in the world and each constituting of 1000 million, 900 million, and 500 million respectively, being responsible for considerable morbidity and mortality. Beside of causing morbidity and mortality, infections with intestinal parasites have been associated with stunting, physical weakness and low emotional weakness of pre-schoolchildren. These infections are more prevalent among the poor segments of the population and intimately linked with low economic level, poor personal and environmental sanitation, and overcrowding, limited access to clean water, tropical climate and low altitude (WHO, 2002).

The degree of harm caused by intestinal parasitic infections to the health of individuals and communities depends on: the parasite species, the intensity and course of infection, the nature of interactions between the parasite species and concurrent infection, the nutritional and immunological status, and numerous socioeconomic factors of the populations. It is generally extremely difficult to measure the suffering caused by intestinal parasitic infections because so many cases of the diseases are asymptomatic and therefore remain undetected (WHO, 2003).

Another study which was done in children of aged 5 years and below from East African countries showed 50% prevalence rate and all infected children were asymptomatic at diagnosis (Rice *et al.*,2003).

Intestinal helminthes are more prevalent throughout the tropics, especially among poor communities that are often neglected. In these parts of the world the high prevalence rate of intestinal parasites is attributed largely to socioeconomic status, poor sanitation, inadequate medical care and absence of safe drinking water supplies. Records show increasing trends in helminthiasis infections, particularly in developing nations (WHO, 2002).

Regarding to intestinal protozoan infections, Giardiasis caused by *Giardia lamblia*, is the prevalence rates ranging from 2.0 - 7.0% in developed countries and 20.0 - 30.0% in most developing countries. It affects approximately, 200 million people worldwide (Mineno and Avery, 2003). Amoebiasis due to its infections with the intestinal protozoan *Entamoeba histolytica* results in 40,000–100,000 deaths each year (Clark and predominant protozoa infection with an estimated Diamond, 1997). The opportunistic protozoa, *Cryptosporidium sp.* has also emerged as an important cause of diarrheal illnesses worldwide particularly in young children and immuno-compromised patients with a prevalence of 4% in developed countries and three to four times more frequent in developing countries (Mengistu and Berhanu, 2004). Pre-school children carry the heaviest burden of the associated morbidity due to their dirty habits of playing or handling of infested soils, eating with soiled hands, unhygienic toilet practices, drinking and eating of contaminated water and food (Tadesse, 2005). Ethiopia has one of the lowest quality of drinking water supply and latrine coverage in the world (Kurup and Hunjan, 2010). The distribution and prevalence of various species of intestinal parasites differs from region to region because of several environmental, social and geographical and other factors mentioned above.

2.2. Intestinal Protozoan Infections

2.2.1 Amoebiasis

Amoebiasis is one of intestinal protozoan disease which is caused by *Entamoeba histolytica*. It is one of the health issues in many developing countries. It is the most common cause death due to parasitic infection after malaria as estimated by the World Health Organization (WHO, 2002).

Approximately 10% of the world population is infected with *E. histolytica* (Gonin and Trudel, 2003). There are four species of the protozoan genus *Entamoeba* which are commonly found in the human gastrointestinal tract, namely *E. coli*, *E. disarm*, *E. hartmanni* and *E. histolytica*. *E. histolytica* is the causes of invasive amoebiasis and hence the only one with medical importance (Kurup and Hunjan, 2010).

Entamoeba histolytica is a protozoan parasite that causes amoebic colitis and liver abscess. It exists in two forms: the motile and invasive trophozoite and an infective cyst. The trophozoites measure 10-50 micro meter in diameter and contain a single nucleus whereas,

the cyst is 10-15 micro meter in diameter and contains four nuclei when matured *E.histolytica* cysts, which are resistant to acidification, chlorination and desiccation and capable of surviving in a moist environment for several weeks, are spread via the ingestion of facially contaminated food or water (Mineno and Avey, 2003).

Entamoeba histolytica occurs throughout the world in humans, apes, monkeys, dogs, cats and rats. The causative agent of intestinal amoebiasis is the single-celled protozoan parasite *Entamoeba histolytica*. This parasite is endemic in most tropical and subtropical areas of the world, where it causes millions of cases of dysentery and liver abscess each year (Stoker *et al.*, 2009). The trophozoite or feeding stage inhabits the lower small intestine and colon where it multiplies by binary fission and forms characteristic four-nucleated cysts which are passed out and subsequently ingested in contaminated food or water. Sometimes the amoebae invade the mucosa and sub mucosa and may be carried via the portal vein to the liver and other parts of the body. Considerable damage may be caused in the wall of the bowel or in the liver. In most people, there is no tissue invasion and the parasite causes no harm. The symptoms following the invasion of the tissues are variable but usually include diarrhea or dysentery with the loss of blood (amoebic dysentery) (Cox, 2004).

Infection usually occurs by ingestion of water or food contaminated by fecal matter. The cyst wall is dissolved in the upper gastrointestinal tract and the organism excysts within the lumen of the small intestine. During excystation, nuclear division is followed by cytoplasmic division, giving rise to 8 uni-nucleated trophozoites.

Trophozoites of *E. histolytica* are motile forms, which adhere to and invade intestinal epithelial cells which line the gastrointestinal tract. Once penetration of the intestinal mucosa is achieved, dissemination to other organs, extra-intestinal infections, usually the liver, can occur. Trophozoites which dwell in the colon multiply encyst and are passed in the stool from where further spread is possible (Clark *et al.*, 2000).

Symptoms of Amebiasis could be acute (Frequent dysentery with necrotic mucosa and abdominal pain) and chronic: Recurrent episodes of dysentery with blood and mucus in the feces. There are intervening gastrointestinal disturbances and constipation. Cysts are found in

the stool. The organism may invade the liver, lung and brain where it produces abscesses that result in liver dysfunction, pneumonitis, and encephalitis (Gardner and Hill, 2001).

2.2.2. Giardiasis

Giardiasis is one of intestinal protozoan disease which *Giardia intestinalis*, also called *Giardia lamblia* and *Giardia duodenalis*, and is one of the most common intestinal parasites in the world, occurring in both industrialized and developing countries with an estimated 2.8 million new cases annually (Gardner and Hill, 2001). *Giardia lamblia* is a flagellated, binucleated microaerophilic Protozoa that inhabits the upper part of the small intestine of its host and reproduces by binary fission. This is a type of reproduction in which one cell divides into two new cells by mitosis. During a growth cycle, the components of the cell multiply so that each daughter cell is a complete copy of the parent cell. The cells then pinch off from each other, and a complete reproduction cycle occurs. This parasite has a simple direct life cycle consisting of an infective cyst and a vegetative trophozoite (Gillespie and Richard, 2001).

G. lamblia is usually weakly pathogenic for humans. Cysts may be found in large numbers in the stools of entirely asymptomatic persons. In some persons, however, large numbers of parasites attached to the bowel wall may cause irritation and low-grade inflammation of the duodenal or jejunal mucosa, with consequent acute or chronic diarrhea associated with crypt hypertrophy, villous atrophy or flattening, and epithelial cell damage.

The stools may be watery, semisolid, greasy, bulky, and foul-smelling at various times during the course of the infection. Malaise, weakness, weight loss, abdominal cramps, distention, and flatulence can occur. Children are more liable to clinical giardiasis than adults. Immunosuppressed individuals are especially liable to massive infection with severe clinical manifestations. Symptoms may continue for long periods (Butel and Stephen, 2007). *Giardia lamblia* is a cosmopolitan parasite with worldwide distribution and the most common protozoan isolated from gastrointestinal tract (CDC, 2000).

The prevalence of *G. lamblia* infection varies from 2%-7% in industrialized countries to 40% in tropical/subtropical regions with poor sanitation and hygienic conditions (Odoi *et al.*, 2004). Early symptoms include flatulence, abdominal distension, and nausea and foul-

smelling bulky, explosive, and often watery, diarrhea. The stool contains excessive lipids but very rarely any blood or necrotic tissue. The more chronic stage is associated with vitamin B₁₂ malabsorption, disaccharides deficiency and lactose intolerance (Gardner and Hill, 2001). The cyst of *Giardia lamblia* is elliptically shaped, range in size from 6 to 10 microns and contains two to four nuclei (Butel and Stephen, 2007). The structure of the cyst makes the organism very resistant to environmental factors and disinfection and it is the transmittable form that causes the infection. The cysts possess a thin, protective wall that allows them to survive in feces for weeks or in cold water for months (Kurup and Hunjan, 2010). Giardiasis is then contracted via ingestion of contaminated water or foods. The cysts pass through the stomach and enter the small intestine. The protective wall allows the cyst to survive the acidic conditions of the stomach until the cyst reaches the small intestine, where the conditions are alkaline.

The alkaline environment triggers excystation. During excystation, the cyst wall ruptures at the pole opposite to the nuclei, so that flagella and other projections emerge from the rupture point. The cyst wall is then completely shed and the microbe enters the trophozoite stage of its life (Odoi *et al.*, 2004).

The trophozoite stage is approximately 12 - 15 microns by 6 - 8 microns. The organism has a pointed elongated median body with two symmetric nuclei and four pairs of flagella. It resembles a human face on stain stained preparations (Kurup and Hunjan, 2010). The trophozoite is the reproducing and motile form of *Giardia* that attaches to the intestinal wall via its ventral disc and causes the symptoms of giardiasis. In severe cases, the trophozoites can become so numerous along the intestine that they cover it as a "carpet." While the trophozoite is attached, it not only absorbs but blocks nutrients from transporting across the epithelial lining of the intestine. It inhibits the absorption of fats, carbohydrates, vitamin and folic acid. Trophozoites are rarely infective because they are not resistant to gastric acid and die rapidly outside the body. The trophozoite then undergoes encystations.

Encystations take place as trophozoites pass to the posterior regions of the small intestine. Cyst wall formation is completed within approximately 44-70 hour and appears to be initiated by the presence of bile salts in the lower small intestine.

The most visible overall change during encystation is that trophozoites gradually round up and detach, lose mobility, and become retractile. Cyst formation is essential for the survival

of *Giardia* outside the host intestine and for the transmission of the parasite among susceptible hosts (Nihar *et al.*, 2010). The cysts then leave the body and are transmitted from person to person by contact with infected feces directly or picked up by another host via contaminated water or food indirectly (Mengistu *et al.*, 2007).

Although infection after the ingestion of only one *Giardia* cyst is theoretically possible, the minimum number of cysts shown to infect a human under experimental conditions is ten. Generally the cyst stage of *Giardia lamblia* causes the infection while the trophozoite causes the symptoms of giardiasis (Nihar *et al.*, 2010).

2.3 Intestinal Helminthes Infections

Helminthes are parasitic worms, which infect humans and mainly found in two phyla, Platyhelminthes and Nematode. Helminth infections affect over one quarter of the world's population (Bethony *et al.*, 2006). It is quite conceivable that one billion are infected with both ascariasis caused by *Ascaris Lumbricoides* and trichuriasis whose causative agent is *Trichuris trichiura* (Cox, 2004).

2.3.1 Ascariasis

Ascariasis, a soil-transmitted infection is the most common human helminthic infection. Current estimates indicate that more than 1.4 billion people are infected worldwide. In the United States, there are an estimated 4 million people infected, primarily in the southeastern states and among immigrants. The etiologic agent, *Ascaris lumbricoides*, an intestinal roundworm, is the largest nematode to infect humans. The female worms are larger than the males. Important factors associated with an increased prevalence of disease include socio-economic status, defecation practices and cultural differences relating to personal and food hygiene as well as housing and sewage systems. Most infections are subclinical; more severe complications occur in children who tend to suffer from the highest worm burdens (Stoker *et al.*, 2009).

Ascaris lumbricoides is the largest and the most common helminth parasitizing the human intestine and currently infects about 1 billion people worldwide (CDC, 2006). It is estimated that 25% of the world population harbors the parasite. The infection occurs by ingestion of food contaminated with infective eggs which hatch in the upper small intestine. The larvae (250 x 15 micrometers) penetrate the intestinal wall and enter the venules or lymphatics.

The larvae pass through the liver, heart and lung to reach alveoli in 1 to 7 days during which period they grow to 1.5 cm. They migrate up the bronchi, ascend the trachea to the glottis, and pass down the oesophagus to the small intestine where they mature in 2 to 3 months (Brooker *et al.*, 2006).

A female may live in the intestine for 12 to 18 months and has a capacity of producing 25 million eggs at an average daily output of 200,000. The eggs are excreted in faeces, and under suitable conditions (21 to 30 degrees C, moist, aerated environment) infective larvae are formed within the egg. The eggs are resistant to chemical disinfectant and survive for months in sewage, but are killed by heat (40 degrees C for 15 hours).

The infection is man to man. Auto infection can occur (Chen *et al.*, 2003). Symptoms is related to the worm burden. Ten to twenty worms may go unnoticed except in a routine stool examination. The commonest complaint is vague abdominal pain. In more severe cases, the patient may experience listlessness, weight loss, anorexia, distended abdomen, intermittent loose stool and occasional vomiting. During the pulmonary stage, there may be a brief period of cough, wheezing, dyspnoea and sub-sternal discomfort. Most symptoms are due to the physical presence of the worm (Butel and Stephen, 2007).

The adults of *A. lumbricoides* may be expelled through the anus, mouth or nose. It is important to distinguish the adult worms from earthworms which are segmented and are often collected as a contaminant from toilets. The microscopic examination of stool deposits after concentration reveals the characteristic bile stained ova. Eggs may be difficult to identify if an excess of iodine is added to the wet preparation as they retain the stain thus resembling debris. Ova may also become decorticated. In most symptomatic cases identification is easy due to the vast number of eggs, which can be found within a few seconds of starting to scan the slide (CDC, 2006).

2.3.2. Hymenolepiasis

Hymenolepis nana, the dwarf tapeworm, and is the smallest tapeworm to infect humans. This cestode belongs to a large family known as Hymenolepididae. The diagnostic features of this family are: scolex armed with one circlet of five hooks; one to three large testes and sacciform uterus. In addition to the *H. nana*, three other species, *H. diminuta*, *H. microstoma* and *H. citelli* have been used extensively for studies on cestodes.

Hymenolepis nana has a cosmopolitan distribution and is thought to be the most common tapeworm throughout the world. The infection is more frequently seen in children although adults are also infected, causing hymenolepiasis (WHO, 2009).

The life cycle of *H. nana* is the only tapeworm that can be transmitted directly from person to person. Eggs of *H.nana* is immediately infective when passed with the stool and cannot survive more than 10 days in the external environment. When eggs are ingested by an arthropod intermediate host (various species of beetles and fleas may serve as intermediate hosts), they develop into cysticercoids, which can infect humans or rodents upon ingestion and develop into adults in the small intestine. A morphologically identical variant, *H. nana* var. *fraternal*, infects rodents and uses arthropods as intermediate hosts. When eggs are ingested (in contaminated food or water or from hands contaminated with feces), the oncospheres contained in the eggs are released. The oncospheres penetrate the intestinal villus and develop into cysticercoid larvae. Upon rupture of the villus, the cysticercoids return to the intestinal lumen, evaginate their scoleces, attach to the intestinal mucosa and develop into adults that reside in the ileal portion of the small intestine producing gravid proglottids. Eggs are passed in the stool when released from proglottids through its genital atrium or when proglottids disintegrate in the small intestine. There is a high likelihood of internal autoinfection, without passage through the external environment. The life span of adult worms is 4 to 6 weeks, but internal autoinfection allows the infection to persist for years (Thiongo *et al.*, 2011).

2.3.3 Hook Worm Infection

The two major species of hook worm to infect humans are *Ancylostoma duodenale* and *Necator americanus*. Eggs of both species are identical and morphological identification can be done on the basis of the adult morphology (Kurup and Hunjan, 2010).

Hook worms are estimated to infect 151 million people worldwide and cause mortality. No animal reservoirs have been identified for hook worms (Shrestha *et al*, 2012). Mature hook worms typically inhabit the jejunum where they attach to the intestinal mucosa with their ventral teeth (*A.duodenale*) or cutting plates (*N. americanus*). The worms drive their nourishment by feeding on the villous tissue and sucking blood at the point of attachment.

Average blood losses of 0.1 -0.2 ml of blood per day have been reported for *A. duodenale* and 0.02ml per day for *N. americanus*. In their life cycle, adult female passes about 28,000 eggs per day.

Both the eggs and larvae are very sensitive to exposure to the environment and do not survive for more than a month in the soil (Sah *et al.*, 2013).

Human infection is acquired through penetration of the skin by the infective third stage filarial form of larvae (Nihar *et al.*, 2010). Penetration usually occurs in bare feet with skin abrasion, areas on and between the toes, or through a hair follicle. The larvae then enter the circulation and are carried to the lungs. During their fourth stage of development; the larvae break out of the alveoli and migrate up the bronchi and trachea to the pharynx where the larvae are involuntary swallowed and pass down to the small intestine (Nihar *et al.*, 2010; Sah *et al.*, 2013). Clinical signs and symptoms of hook worm include pneumonia in heavily infected children during larval migration and epigastric pain and iron deficient anemia during the intestinal phase of the infection (Stoker *et al.*, 2009).

2.3.4 Strongyloidiasis

Strongyloidiasis is an infection by the nematode *Strongyloides stercoralis*, which is usually embedded in the mucosa and sub mucosa of the small intestine of man (Wichro *et al.*, 2005).

The adult parasite is small in size, the female measuring about 2.2mm in length.

The mature female lies buried in the mucosa and sub mucosa of the intestine where it liberates eggs. The eggs hatch to produce the rhabditiform larvae that are passed in the stool (Ten Hove *et al.*, 2007). The rhabditiform larvae may undergo further development in either of two ways:

- (1) As free living adult under suitable conditions of moisture and temperature or
- (2) As infective filariform larvae under unfavorable conditions (Wichro *et al.*, 2005).

These infective larvae are capable of penetrating the skin of man. After skin penetration the filariform larvae reach the lymphatics or capillaries and are carried to the right side of the heart and pulmonary capillaries. Here they leave the capillary beds and penetrate into the alveoli of the lungs (El-Naggar *et al.*, 2006). Then most of them migrate up the respiratory passages, reach the esophagus and pass down into the stomach and intestines.

The larvae mature to adult female worms in the small intestine and penetrate its mucosa. Finally mature female worms produce eggs that hatch and maintain continuity of the cycle (Wichro *et al.*, 2005). Besides skin penetration by infective larvae, autoinfection is commonly observed in this disease.

The autoinfection cycle involves the change of rhabditiform larvae to filariform larvae within the bowel lumen and their penetration either the perianal skin or the wall of the intestine and maintain the cycle in the absence of re infection.

Strongyloides stercoralis is patchily distributed in tropical areas particularly in Sub-Saharan Africa and South East Asia. Human beings usually acquire the infection by skin penetration of the infective filariform larvae (El-Naggar *et al.*, 2006).

However, due to its “autoinfective” life cycle, stroglyoidiasis can become permanently established in humans without the need to reinfection and a chronic clinical syndrome occurs. In such cases there is a potential for “Hyper infection syndrome” where host immunity is reduced due to steroid or immunosuppressive drug therapy, severe malnutrition, leukemia and lymphoma, DKA, postirradiation treatment and lepromatous leprosy. In Ethiopia stroglyoidiasis was found to be more common in AIDS patients than non-AIDS (Ten Hove *et al.*, 2007). The parasite is not highly prevalent in Ethiopia, but it occurs in the same geographic areas and communities as hookworm infection (Wichro *et al.*, 2005).

2.3.5. Schistosomiasis

Schistosomiasis is a trematode disease caused by different species of *Schistosoma*. Four species of *Schistosoma* namely – *Schistosoma mansoni*, *S. japonicum*, *S. makongi* and *S. intercalatum* are responsible for intestinal schistosomiasis and *S. haematobium* for urinary schistosomiasis (El-Naggar *et al.*, 2006). In Ethiopia, *S. mansoni* causes intestinal disease, while *S. haematobium* causes genitourinary schistosomiasis (Haque *et al.*, 2005).

Infection occurs during body contact with water contaminated with infective Cercariae (Ten Hove *et al.*, 2007). A number of factors govern the disease manifestations. These factors include duration and intensity of infection, host genetics, concurrent infection, and location of egg deposition. Allergic reaction to the schistosomule or eggs is responsible for the acute manifestations, while inflammatory and fibrotic responses to eggs are responsible for chronic manifestations (Mahon and Manuselis 2000). Tissue reaction to retained eggs, which follows

sensitization to egg antigens, is circumoval granuloma. It results from combined humeral and cell mediated attack on the egg, and it is characteristically composed of epitheloid, giant cells, lymphocytes and eosinophils arranged in a concentric circle around the egg. The cellular components of granuloma diminish with time or disappear following chemotherapy (Haque *et al.*, 2005).

There are a number of reservoir hosts capable of carrying schistosoma species, especially in the case of *S. Japonicum*. Snails are intermediate hosts in which the asexual stage (larval stage) develops. Snails are more likely found in stagnant than rapidly flowing water (El-Naggar *et al.*, 2006). The snail species are specific to each Schistosoma species i.e. Biomphalaria for *S. mansoni*, Onchomelania for *S. japonicum* and Bulinus for *S. hematobium*. *S. mansoni* is scattered in Africa, S. America, the Caribbean and parts of Arabia. *S. mansoni* and *S. hematobium* are the species endemic in Ethiopia. *S. mansoni* is reported from all regions with altitude between 1000 and 2000 meters but comparatively more prevalent in the northern areas like Tigray (Adwa), Wollo (Bati, Kemissie, and Dessie), Gojjam (Jiga, Bahir Dar), Jimma and Agaro (Wondwossen, 2008). *S. hematobium* distribution on the other hand is limited to the low lands of Ethiopia with altitudes between 300 and 700 meters above sea level (Girma *et al.*, 2007).

Endemic areas include the swampy flood plains of the Awash and Wabe Shebele valleys and the intermittently flowing stream in Kurmuk, at the Ethio-Sudan border. Areas with irrigation projects have the highest risk of infection (Wondwossen, 2008). Patients with schistosomiasis may have different clinical features based on host factors, site of infection (intestinal, urinary) parasite load and duration of infection. The manifestations occur in 4 stages (Ten Hove *et al.*, 2007; El-Naggar *et al.*, 2006; Haque *et al.*, 2005; Mahon and Manuselis 2000). Stage one (stage of invasion): Patients may have itching sensation at the site of skin penetration by cercariae (called swimmers' itch). It occurs in travelers to endemic areas and is rare in indigenous people. Stage two (acute schistosomiasis): Patients may have diarrhea, abdominal cramp, tenesmus, fever and chills. Stage three and four (Chronic or hepatosplenic schistosomiasis): Patients with *S. mansoni* may present with complications like periportal fibrosis with portal hypertension (causing abdominal swelling (ascites), splenomegaly, and upper GI bleeding from varices) intestinal stricture and polyps.

Chronic manifestations of *S. hematobium* include obstructive uropathy from fleshy masses in the bladder (pseudopapillomas) with the resulting hydro ureter & hydro nephrosis and occasionally followed by uremia. Moreover, *S. hematobium* is known to cause bladder calcification, genital involvement (urethral papillomatosis of men and boys and sterility of women) and cor-pulmonale. It is essential to have a high index of suspicion for patients coming from endemic areas. Confirmation of the diagnosis is by detection of ova using direct microscopic examination of stool or rectal biopsy specimen in the case of *S. mansoni* and urine sediment in *S. hematobium*. The egg of *S. mansoni* is characterized by lateral spine, while that of *S. hematobium* by a terminal spine (Haque *et al.*, 2005; Mahon and Manuselis, 2000).

2.3.6 Taeniasis

A disease caused by *Taenia* species, namely *Taenia saginata* and *T. solium* (El-Naggar *et al.*, 2006). Infestation by *Taenia* species requires one intermediate host where the embryo develops into an infective larval stage. Cattle and pigs are intermediate hosts for *T. saginata* and *T. solium* respectively. Adult worms of *T. saginata* can be 3 -10 meters long and *T. solium* up to 3 m long. Both species reside in the upper jejunum, attached to it with a scolex (Haque *et al.*, 2005). A single *Taenia* may have as many as 1000 proglottids forming a chain structure or strobili. The gravid proglottids (egg-filled segments) migrate out of the anus or are discharged in the feces by detaching from the adult tapeworm (El-Naggar *et al.*, 2006). Cattle (intermediate host for *T. saginata*) and pigs (intermediate host for *T. Solium*) become infected by ingesting eggs at pasture or in the case of pig's direct consumption of feces containing proglottids. The larval stage in cattle or pig muscle is known as a cysticercus (Haque *et al.*, 2005).

Humans become infected after eating uncooked or undercooked beef or pork containing cysticerci. After ingestion, the cysticerci attach to the intestinal mucosa and develop into adult worms (Wondwossen, 2008). *T. saginata* occurs wherever raw or uncooked beef is eaten and there is substandard excreta disposal particularly in Ethiopia, the Eastern Mediterranean and parts of Russia. *T. saginata* infection is highly prevalent in Ethiopia due to the widespread custom of eating raw beef and the habit of defecating in the open grazing fields (Tadesse *et al.*, 2009).

Taenia infections in Ethiopia are underreported missing many infections owing to the tradition of self-treatment using modern or traditional plant medicines such as Kosso (*Hagenia Abyssinia*), enkoko (*Embelia shimperi*) or metere (*Glinus lotoides*) (Mengistu and Berhanu, 2004). *T. saginata* accounted for 3% of the outpatient visits in Zeway Health center, 3.7% of the 246 hospital inpatients in Addis, 2.5% of the residents of a small town in highland Gojjam, 1% of the population near Lake Tana and 28% of elementary school students in a town of Asendabo, in Jimma Zone. *T. solium* on the other hand is endemic in many parts of the world where pork or pork products are eaten, but its existence in Ethiopia is uncertain (Wondwossen, 2008). Taeniasis is highly associated with poor sanitary condition in general and inappropriate human excreta disposal in particular (Tadesse *et al.*, 2009).

There is no direct person to person transmission of the infections, except in *T. solium* where human infection occurs by ingesting viable eggs in infected food or from contaminated fingers. And result in cysticercoids (somatic infection), sometimes with neurologic involvement, and neuro cysticercosis is a common cause of epilepsy (Wondwossen, 2008).

2.4. Mode of Transmission of Intestinal Parasitic Infections

According to Shikur *et al.* (2013), intestinal parasites transmissions are acquired by fecal-oral transmission that includes consumption of contaminated food or water, person-to-person contact, or direct contact with fecal matter. With regard to water-borne-intestinal and diarrhea, transmission patterns occur when in-house water storage facilities or/and water sources are contaminated (corresponding to domestic domain and public domain contamination). Most of transmissions of intestinal parasitic infections and diarrhea occur in the domestic domain (Thiongo *et al.*, 2011).

According to Shikur *et al.* (2013), there are four transmission routes that the major infectious agents use to reach human hosts, namely human-to-human via the environment; human-to-human multiplying in the environment; human-to-animal-to human via the environment; and animal-to-human via the environment.

In situations where faecal contamination of the domestic environment is high, the majority of cases of endemic disease probably occur either by human-to-human transmission, or from the human-to-human transmission of pathogenic agents which have multiplied in the environment (Bogitsh *et al.*, 2005).

2.5. Risk Factors for Intestine Parasitic Infections

Demographic factors: Many studies have established that the intestinal parasitic infections prevalence is higher in younger children (Karim *et al.*, 2001). The prevalence is highest for children 6- 11 months of age, remain at a high level among the one year old children, and decrease in the third and fourth years of life (Bogitsh *et al.*, 2005).

Higher rate of intestinal parasitic infection has been observed in boys than girls (Karim *et al.*, 2001). Other demographic factors, like mothers' younger age Shrestha *et al.*(2012), low level of mother's education Shikur *et al.* (2013), high number of siblings Karim *et al.*(2001) birth order Bogitsh *et al.* (2005), were significantly associated with more diarrhea occurrence in children less than five.

Socio-economic factors: Some studies have shown that the association between socio-economic factors, such as poor housing, crowded conditions Shikur *et al.* (2013) low income Odoi *et al.* (2004); and higher rate of intestinal parasitic infections were statistically significant.

Water-related factors: As intestinal parasitic infections are acquired via contaminated water and foods, water-related factors are very important determinants of intestinal parasitic infections occurrence. Increasing distance from water sources Butel S and Stephen A. (2007), poor storage of drinking water Odoi *et al.*, (2004) (e.g. obtaining water from storage containers by dipping, no drinking water storage facility), use of unsafe water sources (such as rivers, pools, dams, lakes, streams, wells and other surface water sources) Thiongo *et al.*,(2011), water storage in wide mouthed containers Kurup and Hunjan, (2010), low per capita water used Odoi *et al.* (2004), have been found to be risk factors for more diarrhea occurrence among children less than five.

Sanitation factors: Sanitation obviously plays a key role in reducing intestinal parasitic infections morbidity. Some sanitation factors, like indiscriminate or improper disposal of children's stool and household garbage Thiongo *et al.*(2011), no existence of latrine Odoi *et al.* (2004) or unhygienic toilet Sah *et al.*(2013). Sharing latrine Bogitsh *et al.* (2005), house without sewage system, increased the risk for diarrhea in children (Shrestha *et al.*, 2012).

Hygiene practices: Some studies have revealed that children not washing hand before meals or after defecation, mothers not washing hands before feeding children or preparing foods,

children eating with their hands rather than with spoons, eating of cold leftovers, dirty feeding bottles and utensils Thiongo *et al.* (2011), unhygienic domestic places (kitchen, living room, yard) Odoi *et al.* (2004), unsafe food storage, presence of animals inside the house (Sah *et al.*, 2013).

Presence of flies inside the house, were associated with risk of intestinal parasitic infections morbidity in children (Bogitsh *et al.*, 2005).

Breastfeeding: The literature on feeding practices and risk of intestinal parasitic infection is extensive. In general, the morbidity of intestinal parasitic infection is lowest in exclusively breast-fed children; it is higher in partially breast-fed children, and highest in fully-weaned-children (Thiongo *et al.*, 2011). In addition, a particular risk of intestinal parasitic infection is associated with bottle-feeding (Bdir and Adwan, 2010).

Many studies have shown the strong protective effect of breast feeding. A high concentration of specific antibodies, cells, and other mediators in breast milk reduces the risk of intestinal parasitic infections following colonization with entero pathogens (Sah *et al.*, 2013).

Seasonal distribution: Seasonal patterns to childhood intestinal parasitic infections have been noted in many tropical locations, where there are two definite seasonal peaks: the summer one, associated with bacterial infections, and the winter one, related to viruses (Thiongo *et al.*, 2011). In some studies intestinal parasitic infections prevalence was found to be higher in the rainy season than in the dry season (Sah *et al.*, 2013). During the dry seasons when rainwater and borehole water are less available, disinfecting drinking water from available surface sources may substantially reduce illness. In some studies contamination was more prominent during the rainy season (Bogitsh *et al.*, 2005).

According to Odoi *et al.* (2004), the number of intestinal parasitic infection patients in the first peak in April is sensitively correlated to climate elements in pre-monsoon.

Climate in pre monsoon influences the total number of intestinal parasitic infection patients through the spring peak (April-May) and the climate in August through October influences the autumn peak of patients. Meteorological elements play reverse role on the peak of spring and autumn diarrhea patient. There are also some researches reporting that a distinct increase of intestinal parasitic infection takes place in the years of El Nino (Thiongo *et al.*, 2011).

Consumption of food sold by street vendors: This is also a significant risk factor (Sah *et al.*, 2013). Tourists visiting foreign countries with warm climates and poor sanitation can acquire intestinal parasitic infections by eating contaminated foods such as fruits, vegetables, seafood, raw meat, water, and ice cubes (Odoi *et al.*, 2004).

Eating habits: Eating with the hands; eating raw foods; or drinking unboiled water, may increase the risk of intestinal parasitic infections.

2.6. Implications of intestinal parasite infections

Intestinal parasite infestation as a cause of malnutrition/ growth stunting is well documented and is caused by a decline in food intake and/or an increase in nutrient wastage (Shrestha *et al.*, 2012). Infestation with intestinal parasites is significantly correlated with low levels of hemoglobin and the packed cell volume in blood. Parasitic infections can cause deficiencies in vitamins (A, B6, B12) and minerals (iron, calcium, and magnesium), block nutrient absorption, and diminish immunity, predisposing subjects to serious diseases. Intestinal parasite infections often go undetected for years due to delayed onset of symptoms, which can exacerbate the effects of malnutrition. Parasitic infections are more common in children than adults and are a major cause of malnutrition. It is a point of concern, because malnutrition in children can compromise their learning capabilities in their formative years.

Venkatachalam and Patwardhan studied the effect of ascariasis on the digestion of protein in school children in India (Shrestha *et al.*, 2012). They reported that *Ascaris* in the small intestine interfered with the digestion and absorption of dietary protein. They further suggested that incomplete digestion, resulting from inefficient absorption, may be one of the etiological factors in nutritional edema syndrome in young children.

Sah *et al.* (2013) investigated the effects of *Ascaris* infection on the nutritional status and the intellectual level of primary school children in Giza, Egypt. They reported that infected children had significantly lower body weight, height, arm circumference, hemoglobin concentration, and IQ than the controls. Tarleton and colleagues compared verbal and nonverbal test scores with a health surveillance database (which tracks incidence of diarrhea and *E. histolytica* infection and nutritional status) for a group of Bangladeshi children. Cognitive scores were negatively associated with stunted growth in school age children (Shrestha *et al.*, 2012).

2.7. Intervention/Prevention/Control Intestinal Helminthic and Protozoan Disease

Impose a great burden on poor populations in the developing world. This segment of the population does not have purchasing power, political voice, or any clout in decision-making processes. Therefore, the public health and economic impact of these diseases have traditionally been given low priority in public health planning (Shrestha *et al.*, 2012). This deaf ear attitude has resulted in the plight of people in endemic areas, left without any comprehensive effort to combat these diseases.

The history of infectious diseases has shown that changes in this attitude are provoked by highly visible phenomena (incidence/ outbreak). For example, *Cryptosporidium* had been a significant public health threat even before 1987; however, the Milwaukee outbreak was the impetus for all the regulatory/scientific focus on *Cryptosporidium* in the USA. A variety of strategies has been used to combat these diseases. The most commonly reported strategies include hand-washing/personal hygiene/family hygiene and chemotherapeutic control (Shrestha *et al.*, 2012).

Hand-washing is one of the most important interventions that have proven to effectively intervene with fecal–oral transmission of diseases. Hand-washing can interrupt parasite transmission by acting as a primary barrier (to remove fecal matter after contact with stools) or as a secondary barrier (before preparing food, handling fluids, feeding, eating). The use of water and soap or similar agents is critical for effective removal of parasitic ova/ oocytes from contaminated hands.

The use of soap is determined by economic and logistic factors, and also by the perception of what is dirty and what is not. Therefore, hygiene plans must clearly indicate when hand-washing with soap is most needed for health protection. It has been shown that hands readily become contaminated after defecation even with the use of toilet paper (Kurup and Hunjan, 2010). Hand-washing after defecation or stool contact is far from universal. Huntley and others reported that in Peru only 11% of people wash their hands after defecation (Shrestha *et al.*, 2012).

This habit is a high risk factor for parasite transmission. For example, dirty nails in school children have been associated with high parasite infestation. The ability of parasite ova/cysts

to survive on environmental surfaces vary greatly among different groups of parasites. While *Ascaris* eggs are known to survive for a long time in the environment, eggs of other parasites (such as *Enterobius*) are relatively less resistant to environmental stresses. *E. histolytica* cysts contaminating fingers rarely survive air drying of more than five minutes (Shrestha *et al.*, 2012). A number of epidemiological studies have shown substantial reductions in gastrointestinal diseases by more introduction of hand-washing; however, few make the distinction between hand-washing as a primary or secondary barrier. The effectiveness of hand hygiene in controlling infectious diseases has been widely shown. One month after hygiene education, a 63.6% to 78% reduction in load of intestinal parasites was reported among children practicing hand-washing with soap after defecation, that is without chemotherapy (Kurup and Hunjan, 2010).

In Indonesia, an 89% reduction in the incidence of gastrointestinal diseases was reported through the promotion of hand-washing in four different circumstances, including after defecation (Shrestha *et al.*, 2012). In Burma, a 30% reduction in diarrheal morbidity was reported by regular hand-washing with soap. Variation in hand-washing practices can also impact the risk of disease transmission, and rigorous hand washing habits are effective in reducing the risk of contracting disease (Shrestha *et al.*, 2012).

3 MATERIALS AND METHODS

3.1 Study Area and Design

Recorded data extracted from a health center at Aykel town and its surrounding areas, in North Gondar Administrative Zone of Amhara National Regional State. It is geographically located in the North Western Ethiopia between 12°27'37" - 12°38'27" North latitude and 36°57'30" - 37°10'06" East longitude. Aykel town is located 810 km from Addis Ababa and 60 km from Gondar town. It, being at elevation range between 1860 - 2240m above sea level, experiences a Mid Altitude Climate.

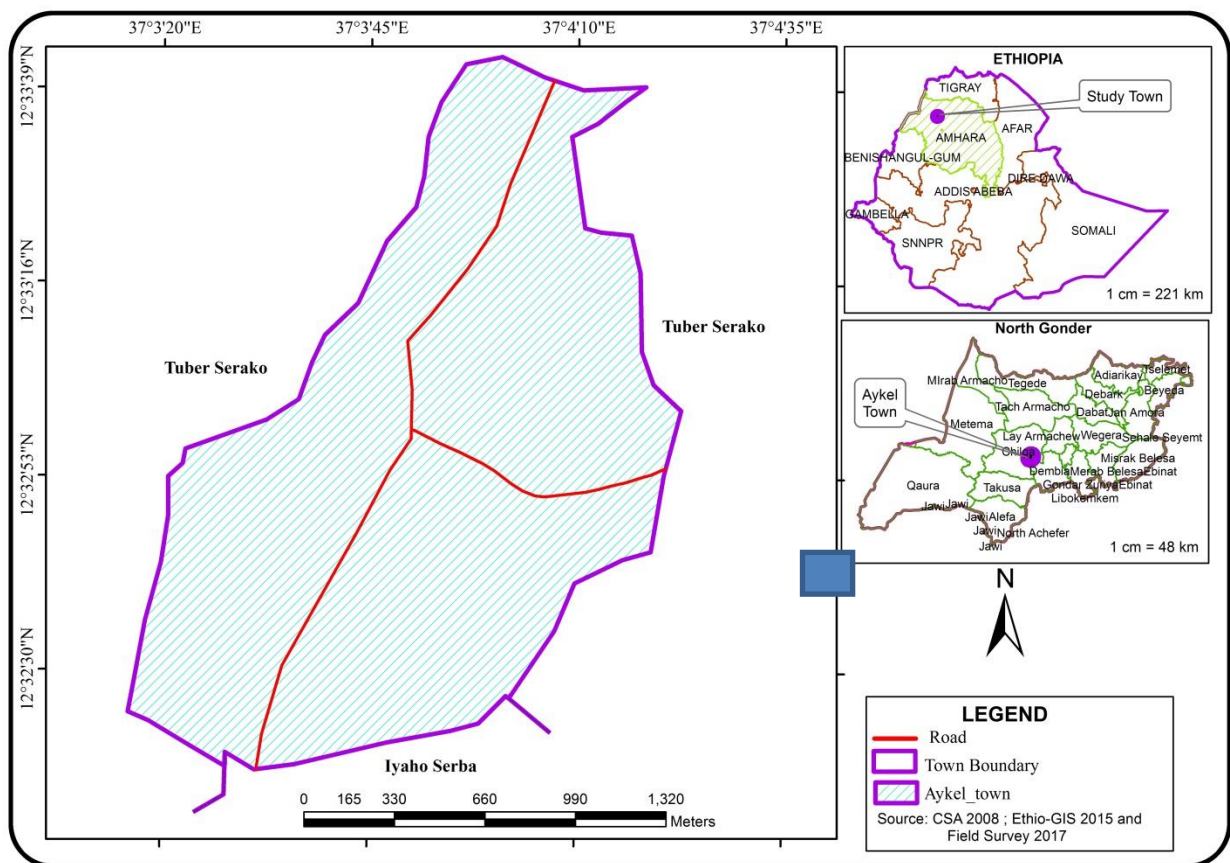


Figure 1 location map of the study area Aykel town, North Gondar, Ethiopia

Aykel town consists of urban and rural kebeles, 21,113 and 19,611, respectively (CSA, 2007). That share one governmental clinic and a recently established hospital. Besides these health services, there are private clinics which are staffed by few health officers, nurses and laboratory technicians. The study design was a retrospective study using secondary data on

prevalence of intestinal parasitic infection of patients who visited Aykel Health Center and had stool examination for protozoa and helminth infection, between 2014-2016.

3.2 Variables:

Dependent variable including: Intestinal parasite and Independent variables including: sex, age and area.

3.3 Methods of Data Collection

Results of stool specimens in AHC diagnostic laboratory were routinely wet mounted in saline preparation for microscopic examination by biomedical technicians or technologists. The results were then recorded in the laboratory register books by using data collecting forms (Appendix 1). For the purpose of this study, all such records showing positivity for helminthes and protozoan infections were recorded.

Retrospective study, involving data processing and analysis of the collected data on sheet/form (as shown from Appendix 1), were copied from the registration/record books and were transformed to results that show the outputs of the research.

3.4 Data Analysis

The data were analyzed using descriptive statistical tools like percentages were operated and which were represented by tables, graphs. To make calculation, to determine proportions and to draw bar graphs MS Excel spread sheet was utilized.

3.5 Data Quality Control

To get the correct results of the study and to control data quality the researcher prepared data collection forms that handle the patients record and then arrange based on their sex, age, living area and the year they examined. After that the data were double entered in Microsoft Excel and cleaned.

3.6 Ethical Considerations

Support letter was obtained from biology department, Addis Ababa University. Prior to the commencement of the study, the head of Chilga Woreda health office and the head of AHC both gave their written consent for the study. A letter of permission was given to department of laboratory at AHC. Permission was obtained from department of laboratory for study after explaining the purpose of the study.

4. RESULTS

1 4 Prevalence of Human IPI among Patients who attended in AHC

As shown from Table 1 below number of examined patients who attended AHC was decreased from (38.4%) in 2014 to (35.1%) in 2015 to(26.5%)in 2016,because p value =0.011 and the number of prevalence of positive cases were also decrease from (13.7%) to(11.3%) to(10.1%) from year to year(p=0.033).Therefore the difference was statistically significant.

Table 1The prevalence of Human IPI in AHC stratified by Year

	Year	M	F	P value
No of examined	2014	6757(40.2 %)	7348(36.9%)	0.01113
	2015	5843(34.8%)	7053(35.4%)	
	2016	4213(25%)	5521(27.7)	
	Total	16813(45.8%)	19922(54.2%)	
No of positive cases	2014	988(14.6%)	945(12.9%)	0.033295
	2015	803(13.7%)	654(9.3%)	
	2016	538(12.8)	449(8.1%)	
	Total	2329(13.9)	2048(10.3%)	

Key: IPI intestinal parasite infection, AHC Aykel health center

4.1.1 Mixed infection and types of parasite combinations in AHC

In this study of 4377 positive cases, more than one parasite were recorded in 306 (7%) of the stool samples, The majority of multi-parasitic infections 293(6.7%) were a double infections and the other were triple infections 13 (0.3%).

Table 2 prevalence of mixed infection

	Male positive= 2329(13.9%)	Female positive =2048(10.3%)	Total positive case=4377(11.9%)
Double infection			
Eh, Gl	35(1.5)	44 (2.1)	79 (1.8)
Gl, Hn	9(0.4)	5(0.2)	14(0.3)
Gl, Sm	17(0.7)	2(0.09)	19(0.4)
Al, Hw	10(0.4)	14(0.7)	24(0.5)
Eh, Hn	5(0.2)	1(0.05)	6(0.1)
Gl, Hw	33(1.4)	41(2.0)	74(1.7)
Hw, Sm	6(0.3)	2(0.09)	8(0.2)
Al, Sm	6(0.3)	2(0.09)	8(0.2)
Gl, Al	17(0.7)	14(0.7)	31(0.7)
Eh, Sm	1(0.04)	-	1(0.02)
Hw, Ts	1(0.04)	-	1(0.02)
Eh, Hw	8(0.3)	3(0.1%)	11(0.3)
Gl, Ss	2(0.08)	-	2(0.05)
Hw, Ss	1(0.04)	-	1(0.02)
Eh, Al	2(0.08)	6(0.3)	8(0.2)
Hw, Hn	1(0.04)	2(0.09)	3(0.07)
Hn, Sm	1(0.04)	-	1(0.02)
Gl, Ts	-	1(0.05)	1(0.02)
Al, Hn	-	1(0.05)	1(0.02)
Prevalence of dual infections	155(6.7)	138(6.7)	293(6.7)
Triple infection			
Eh, Al, Hw	1(0.04)	-	1(0.0)
Gl, Al, Sm	1(0.04)	-	1(0.02)
Gl, Al, Hw	1(0.04)	-	1(0.02)
Eh, Hw, Ss	1(0.04)	-	1(0.02)
Eh, Gl, Hw	1(0.04)	2(0.09)	3(0.07)
Gl, Hw, Hn	1(0.04%)	-	1(0.02)
Eh, Hw, Sm	1(0.04%)	-	1(0.02)
Gl, Hw, Sm	-	1(0.05)	1(0.02)
Al, Hw, Sm	-	1(0.05)	1(0.02)
Gl, Hw, Sm	-	1(0.05)	1(0.02)
Eh, Gl, Al	-	1(0.05)	1(0.02)
Prevalence of triple infections	7(0.3%)	6(0.3)	13 (0.3)
Over all prevalence	162(7.0%)	144(7.0)	306(7.0)

Keys: Eh: *Entamoeba histolytica*, Gl: *Giardia lamblia*, Hw: Hookworm, Al: *Ascaris lumbricoides*, Ss: *Strongyloides stercoralis*, Hn: *Hymenolepis nana*, Sm: *Schistosomamansonii*, Ts: *Taenia* species

4.1.2 The distribution of Protozoan and Helminthic parasites in Aykel Health Center

In this study as shown in table 2, eight (8) species of parasites were identified. The overall intestinal parasite prevalence for at least one parasite was 4377/36735 (11.9%), from these, 6.9% (2538/36735) were positive for intestinal protozoa and 5% (1839/36735) for intestinal helminthes.

Infection with *Giardia* species was found to be the commonest protozoan infection (5.2%), and among helminths, hookworm was the most prevalent etiology of parasitic infections, with a prevalence of 2.5% followed by *Ascaris lumbricoides* (1%). *S. stercoralis* was identified only in 0.06%, thus the least common cause of helminths infections, as shown in Table 3.

Table 3 Prevalence of protozoan and Helminthic parasites in AHC.

Total sample	Types of parasites	Positive cases	Rate of infection (%)
36735	protozoan infections		
	<i>E. h/dispar</i>	613	1.7
	<i>G. l</i>	1925	5.2
	Over all prevalence of protozoans	2538	6.9
	Helminthic infections		
	H.w	927	2.52
	<i>A .l</i>	371	1.0
	<i>S.m</i>	229	0.62
	T.s	26	0.07
	<i>H.n</i>	265	0.7
	<i>S.s</i>	21	0.06
	Overall prevalence of Helminthic infection	1839	5.0
	Over all prevalence IPI	4377	11.9

Key: AHC: Aykel Health Center: *Eh:* *Entamoeba histolytica/dispar* , *Gl:* *Giardia lamblia*, *Hw:* Hookworm, *Al:* *Ascaris lumbricoides*, *Ss:* *Strongyloides stercoralis*, *Hn:* *Hymenolepis nana*, *Sm:* *Schistosoma mansoni*, *Ts:* *Taenia* species, IPI; Intestinal parasitic infection

4.2 Sex variation on the prevalence of intestinal infection

As shown from table 2 below a total of 36735 patients visiting for stool examination for intestinal parasitic infection in AHC, 4377 (11.9) patients showed positive result over the 3 years period from 2014 – 2016. of these positive cases 2329(13.9%) and 10.3%) were among males and females respectively. more female visitors than males, but more infected males than females. The difference is statistically significant and Sex variation has effect on the prevalence of IPI, because p value=0.04.

Table 4 Prevalence of IPI in AHC stratified by sex

Sex	Total sample (%)	Positive cases	Rate of infection (%)	P value
M	16813 (45.8)	2329	13.9	0.041
F	19922(54.2)	2048	10.3	
Total	36735(100)	4377	11.9	

Key: AHC: Aykel Health Center IPI; intestinal parasitic infection

4.3 Age variation on the prevalence of Intestinal parasitic infection

IPI were most prevalent in patients between 15-20 and >35 age group lowest in 0-5 age When IPPI(6.9%) distribution compared to IHPI(5.0%) ,IPPI were more prevalent.

Table 5 Prevalence of Protozoa and Helminth parasites stratified by age

	Age group	No of positive cases for IPPI	No of positive cases IHPI	P value
0-5	4709	300	97	
5-10	4618	213	195	
10-15	4599	263	173	
15-20	4488	411	418	
20-25	4528	346	251	
25-30	4600	314	226	
30-35	4588	228	162	
>35	4605	463	317	
Total	36735	2538(6.9%)	1839(5.0%)	2.076

4.4 Living site variation on the prevalence of intestinal parasitic infection

As shown from Table 5.or Figure 2, Rural populations 2710(61.9%) were twice infected than urban population 1667 (38.1%). But the difference is not statistically significant because P value =0.148

Table 6 prevalence of IPI stratified by Area

Area	Total positive cases	Percentage of infection	P value
Urban	1667	38.1	0.148
Rural	2710	61.9	
Total	4377	100	

KEY: IPI intestinal parasite infection

5. DISCUSSION

In the present retrospective study, it has been observed that a total of 36,735 patients who visited for stool examination of IPI at AHC over the 3 years period from 2014 – 2016, 4377(11.9%) were found to be positive for protozoa and /or Helminthes infection. The prevalence of intestinal parasites 11.9% (Table 1) observed in the present study, compared to those reported in other areas within and outside the country was relatively low. 34.5% in Tikure Anbessa Hospital over the five years study period, 2006-2010, Alemnesh (2011), 35% in Northern Palestine over a period of ten years 2000-2009(Bdir and Adwan,2010). The reason most likely is that this study is based on diagnostic laboratory record which is secondary data only showing the cases that had experienced symptoms and seeking treatment gone to health service, whereas the reports on other areas are primary data generated from a sample population of the respective communities to show more or less the exact prevalence of the parasites, that is why it is called a community diagnosis. It is thus the 11.9% is representatives of the acute cases and no doubt that there are double or triple times more asymptomatic and symptomatic cases who had lighter infection were able to stand harmful effect, And others who tolerated the parasite infection because of the in convenience including the cost, living in the remote area etc., they cannot see the face of the hospital services.

The other observation of this thesis work is that there was a decrease number of people who visited the clinic over the years. That could be a decrease in the number of a new infection because of the treatment of patients that had intense infection and were the source of infection improved sanitation, personal hygiene etc. And also some times when I saw the activity of the nurse and others in the study area they gave anti parasite drugs (Deworming) two times per a year for children, and they gave education on the role of hand washing at critical times, home management, and narrow mouthed water container.

Another reason might be using the low sensitivity of direct saline method and the present of incompleteness on record books could also be responsible for the low prevalence in this study area. However, lower results of the present study was found from Saudi Arabia, where an overall parasite prevalence rate among Hospital recording patients, from 1996 to 2003, was 2.3%; the Stool examinations were carried out using direct and concentration techniques

(Ibrahim, 2006), A 6-year (2005-2010) Retrospective Study average prevalence of intestinal parasites in Mojo Health Center was 9.3% Chala (2013) and Prevalence of Intestinal Parasitic Infections in a Tertiary Care Hospital in Northern India From 2008 – 2012 was 6.68% (Sah *et al.*, 2013). The reason for this difference in prevalence could be due to the socioeconomic status and living standard of study subjects and the difference in civilization between the two countries. For example, as Ethiopia is less developed than Saudi Arabia.

The prevalence of intestinal parasites in this study showed a decrease from 1933 (13.7%) in 2014 to 1456 (11.3%) in 2015 and then declined to 987 (10.1%) in 2016. The difference is statistically significant and an indication of better awareness of personal hygiene and better sanitation. Because p value =0.033

In the present retrospective study, the highest prevalent rate was observed on males (13.9% than females (10.3%). Therefore, the prevalence rate in males was greater than females which were in accordance with the studies by Shrihari *et al.* (2011), Kahumburu (2008), Hailu (2014) have reported significance different in infection rates the males being more infected than females. In other studies females were more infected than males (Feleke *et al.*, 2017). While other studies Chala (2013) no significance difference showed between the sexes among the distribution of parasites. The differences in this area is might be due to farming is common in the study area and males are more engaged in these activates where they depend on ponds and rivers as a source of drinking and swimming.

Males are mainly infected when working and walking bare footed when compared to females the difference was statistically significant because p value=0.04.

In this retrospective study eight (8) parasites (*E. histolytica/ dispar*, *G. lamblia*, h.worm, *A. lumbricoides*, *H. nana*, *S. stercoralis*, *T. saginata* and *s. mansoni*) were detected. Protozoa is the most dominant (6.9%) followed by helminthes (5%). Intestinal parasites *G. lamblia* and *E.histolytica* were the predominant protozoan parasites while, h.worm (2.5%) was the commonest helminthes parasite followed by *A. lumbricoides* (1.0%).

In other studies also *G. lamblia* and *E. histolytica* were the commonly detected protozoan parasites (Haftu *et al.*, 2014). With regard to helminth parasites, the same result was found by Feleke *et al.* (2017). But hookworm was to the most prevalent parasite suggesting the fact

people do not wear shoes. While other studies showed that *A. lumbricoides* Haftu *et al.* (2014) was the commonest parasite. In some other studies *H. nana* Tadesse (2005) was the commonly detected intestinal helminthes. Generally *G. lamblia*, *E. histolytica*, *A. lumbricoides* and hookworm infections are the common intestinal parasites worldwide. The presence of high prevalence of hook worm in the study area indicates there is infected soil and bar footed population.

These parasitic agents are also very common in Ethiopia (Feleke *et al.*, 2017).The high prevalence of *G. lamblia*. *E. histolytica* in the study area was due to lack of clean water supply. Giardiasis and amoebiasis are parasitic diseases mainly caused by drinking contaminated water. In study area there is shortage of clean or filters drinking water. As a result, the community might drink water from unsafe sources, and also lack of awareness about the transmission and prevention of parasitic diseases caused by drinking contaminated water especially in rural populations. These factors can contribute for the high prevalence of giardiasis and amoebiasis in the study area.

In this study of 4377 positive cases, more than one parasite were recorded in 306 (7%) of the stool samples, The majority of multi-parasitic infections 293(6.7%) were a double infections and the other were triple infections 13 (0.3%).

The most common dual infection was *E. histolytica* and *G. lamblia* 79 (1.8%) followed by *G. lamblia* and Hookworm 74(1.7%). *E. histolytica*, *G. lamblia* and hookworm were the common triple infections 3(0.07%), the reason of mixed infection of these parasites was due to the present of the same mode of transmission that was favorable for parasites live together and they are not antagonistic.

Parasite infection among age; the highest protozoa and Helminth infection was observed in age groups between 15-20 and >35 and The lowest result observed in age groups 0-5 and 30-35.

This situation of more infection rate among adults than children is in agreement with study results in Nigeria (Olusegun *et al.*, 2011).

.This was due to 15-20 age groups spend a lot of time and eat food outside the home. The lowest result in age groups 30-35 might be improvement of their feeding habits and sanitation.

The lowest result in 0-5 age groups might be most of them are breast feeder's .Because breast milk according to Sah et al.,2013 contain Antibody(IgA)that reduce the risk of intestinal parasite infection.

Both protozoa and helminths have the same patterns of transmission but in this study Children (age groups 0-5) were more infected by protozoans when compared to Helminths. This was due to protozoans transmitted in home but helminths are field transmitters.

In this study of 4377 total patients, rural populations 2710(61.9%) were more infected than urban population 1667 (38.1%). This difference in rate of infection in rural and urban area could be attributed to poor sanitation, illiteracy and lack of personal hygiene along with poverty in rural area (Shrihari *et. al.*, 2011).But the different is not statistically significant because p value =0.148.

The limitations of the study were there was no internet service in the study area, the lab technicians use only low sensitivity of direct saline method to diagnose the parasite, incompleteness of patients record books, the researcher do not use multiple sample, there was no seasonal data and number of cyst, trophozoite, egg and larva lists.

6 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

This retrospective study showed a variable prevalence of intestinal parasites from year to year with significant reduction. The overall outcome of this study has shown prevalence of intestinal parasitic infections among patients who attended AHC between 2014 to 2016 was 11.9% and found to be positive for at least one intestinal parasite. Out of 36735 stool examined, 2538 were positive for intestinal protozoa and 1839 for intestinal helminthes. *G. lamblia* was the most commonly reported parasite of the patients. Age group specific prevalence of helminths and protozoan infections were highest on 15-20 years age groups. Males were also more infected than females. This means that there is the need for health education, good sanitation, and personal hygiene, proper cooking of food, safe drinking and use of foot wears especially by the rural population and a community diagnosing program followed by treatment.

6.2 Recommendations

This was a retrospective study and as noted it was necessary to improve laboratory patients record, because some of the physicians'(Laboratory Technician) notes in AHC were incomplete Therefore it would be important to do a retrospective study and follow up the patient in order to get the prevalence and distribution of intestinal parasites in the patients visiting AHC. Therefore, training should be given for staff on the importance of having complete Parasitology laboratory documentation.

Even though the result of intestinal parasitic infection prevalence in the study area showed that it was decreasing but the disease is infectious and spread in a short period of time. Therefore, efforts must be made to further decrease its prevalence through health education about the transmission, prevention and control of the disease to patients who attend at Aykel health center to make them aware about personal hygiene, sanitation, consumption of safe drinking water, avoidance of bare foot walking on soil and proper cooking of food.

National control programs should be developed and linked to existing programs on primary health care (e.g. nutrition, water supply and sanitation, maternal and child health, control of diarrheal diseases, school health programs, family planning).

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APPENDICES

Appendices 1 Data collection form

serial no	of date	Sex	age	Laboratory Results								
				Type of Parasite								
				protozoan parasites	Helminthes Parasites							
				<i>E. h/ dispar</i>	<i>Lambliia</i>	<i>H nana</i>	<i>T .saginata</i>	<i>A.lumbricoides</i>	<i>S.m ans oni</i>	Hook worms	<i>Strogyl oides</i>	others

Declaration

I, the undersigned, declare that this thesis is my original work and has not been presented to any other university and all sources of information used for the thesis have been fully acknowledged.

Name_____

Signature_____

Date_____

This MSc thesis has been submitted for examination with my approval as an advisor.

Name Mekuria Lakew (PhD)

Signature_____

Date _____