



**Infection Rate of Intestinal Parasites among Children under  
Five years of age in Addis Ketema Sub-City Health Center,  
Addis Ababa, Ethiopia**

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## **LIST OF ACRONYMS**

|       |  |
|-------|--|
| CDC   | Center for Disease Control                         |
| CI    | Confidence Interval                                |
| CLSI  | Clinical and Laboratory Standards Institute        |
| CSA   | Central Statistical Authority                      |
| DQC   | Data Quality Control                               |
| IHPI  | Intestinal Helminthes Parasitic Infection          |
| IPI   | Intestinal Protozoan Parasitic Infection           |
| IPPI  | Intestinal Parasitic Infection                     |
| NCCLS | National Committee on Clinical Laboratory Standard |
| RPM   | Revolutions Per Minute.                            |
| SPSS  | Statistical Package for Social Science             |
| STH   | Soil Transmitted Helminthes                        |
| MOH   | Ministry of Health                                 |
| WHO   | World Health Organization                          |

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## **ABSTRACT**

**Background:** *Intestinal Parasites which consist of protozoa and helminths mostly infect gastro-intestinal tract of humans. Infections are widely distributed in tropical and sub-tropical area with greatest number of occurrence in sub-sahara Africa, China and Asia. In Ethiopia high infection rate of intestinal parasites is attributing to factors associated with low socio-economic status such as, poor personal hygiene, environmental sanitation, and low household income, poor access to health services, overcrowding and lack of clean water supplies.*

**Objective:** *to assess the major intestinal parasite species and determine their Infection rate in children less than five years of age in Addis Ketema Sub-City Health Canter, Addis Ababa during Sept. 2017-May. 2018.*

**Method:** *A cross sectional study was conducted on major intestinal parasite species in children under-five years of age in Addis Ketema Sub-City Health Canter during Sept. 2017- May 2018. Stool samples (n=384) were collected, 45.8% from males and 54.2% from females and examined for intestinal parasites using wet mount and formol-ether concentration methods. In addition, a total of 384 parents and caregiver of under-five children were interviewed regarding their Knowledge, attitude and practice about intestinal parasitic infections. Data were analyzed using SPSS version 20.0 statistical software and P values were used to check the presence of association between dependent and independent variables.  $P < 0.05$  was considered as statistically significant association.*

**Results:** *It was found that 39.2% male and 36.1% female children were infected with intestinal parasites. Thus, the overall prevalence of infections with different types of intestinal parasites was 37.5%. The rate of protozoan parasite includes Entamoeba histolytica, 13.5%, and Giardia lamblia, 10.2%., Similarly, the rate of helminthic parasite infections includes Ascaris lumbricoides, 7%, Trichuris trichuira, 4.7%, and Hymenolepis nana, 2.1. The Infection rate of intestinal parasitic infections was significantly associated with some of risk factors such as hand washing habits, eat properly washed fruit and cooked vegetables (  $p=0.001$ ,  $P=0.013$  respectively).*

**Conclusion and recommendations:** *intestinal parasitic infections represent a public health problem in children less than five years in Addis ketema sub city. The main factors that were associated with intestinal parasitic infections were poor hand washing practice, consumption of unwashed fruits and raw vegetables and finger nail cleanness ( $p < 0.05$ ). This suggested that personal hygiene, environmental sanitation and health education are needed to reduce the infection rate of human intestinal parasitic infections among children in the study area.*

**Key Words:** *Infection rate, Intestinal parasites, Maternal knowledge, Risk factor*

# 1. INTRODUCTION

## 1.1. Background of the study

Intestinal parasites are cause of gastro-intestinal tract infections on humans, other animals and have adverse consequence in health of human beings. The majority of these intestinal parasitic infections are concentrated in developing countries. The problems are more serious in Sub-Saharan Africa, Asia and Latin America associated with inadequate water supply, environmental sanitation, fast population growth, and other economic and social problems (WHO, 2015).

Intestinal parasites have their own characteristics; have different morphological and biochemical mechanisms to infect humans and animals. They are usually classified as protozoa and helminths. The most important intestinal protozoan pathogens are *Entamoeba histolytica* and *Giardia intestinalis (lamblia)*. The predominant intestinal helminths are *Ascaris lumbricoides*, *Trichuris trichiura*, *Schistosoma mansoni*, *Hymenolepis nana* and *Enterobius vermicularis* and *Strongyloides stercoralis* (WHO, 2015).

Human intestinal parasites are identified as causes of morbidity and mortality throughout the world particularly in developing countries including Ethiopia. Infection rate of intestinal parasites are very high throughout the tropics, especially among poor communities. Records show increasing trends of intestinal protozoan and helminth infections, occur particularly in developing nations (Thiongo *et al.*, 2011). High Infection rates of intestinal parasitic infections in human are positively correlated with poverty and poor personal hygiene, lack of safe water supply and contamination of the environment by human excreta and animal wastes. Intestinal parasitic infections increase host's susceptibility to other infections and diminish learning ability and growth in children (King *et al.*, 2013).

Both protozoan and helminths affect children under five-age globally. Intestinal parasites are present throughout the world in varying degrees of prevalence. The burden of the infection remains one of the greatest health problems in children developing world, with over one billion people estimated to be infected (WHO, 2015). While most infections remain asymptomatic, the clinical spectrum of disease widespread, ranging from mild gastrointestinal symptoms to death from disseminated infection. More than 1.5 billion people or 24% of the world population are infected with soil transmitted helminth infections worldwide. Infections are widely distributed in tropical and sub-tropical area with greatest number of occurrence in sub-Sahara Africa, china and Asia (WHO, 2018). Over 267 million children under five age infected with soil transmitted helminths (*Ascaris lumbricoides*, *Trichuris trichura* and hookworm; *Necator americanus* and *Ancylostoma duodenale*) in sub-Sahara Africa, Asia and Latin America (WHO, 2018).

The role of intestinal parasitic protozoan and helminthes in causing morbidity and mortality and their pathogenesis differ from species to species. Similarly, the distribution and infection rate of various species of intestinal parasites also differ from region to region because of several environmental, social and geographical factors. Hence, study on the infection rate of various intestinal parasitic infections is a prerequisite not only for formulation of appropriate control strategies but also to predict risks for communities under consideration (Nyantekyi *et al.*, 2010).

In Ethiopia high infection rate of intestinal parasites is attributing to factors associated with low socio-economic status. Such factors include poor personal hygiene, environmental sanitation, low household income, overcrowding and lack of clean water supplies. For instance, Ethiopia has one of the lowest quality drinking water supply and latrine coverage (Mengistu *et al.*, 2007).

Intestinal parasite infections are common among children under-fives years old. There are different factor that favors the infection rate such as playing with soil, sucking fingers and defecation in open field. Maternal awareness for the prevention and control of intestinal parasite has its own impact on the rate.

Child hands washing before and after using toilet were associated with intestinal parasitic infections (Abate *et al.*, 2013). Children who did not wash their hands before eating were more likely to acquire intestinal parasites infection than children who wash their hands before meal regularly (Haftu *et al.*, 2014). Intestinal parasite cysts, eggs or infective stage of larvae are excreted through faces. Those stages survive in external environments for several days or weeks and can infect child through contaminated food and water. As a result of that absence of toilet (Abate *et al.*, 2013) or types of toilet facility were significantly associated with intestinal parasitic infections (Kandala *et al.*, 2013). To reduce the impact of intestinal parasites increasing access to safe water, sanitation and health education are necessary (Canete *et al.*, 2012).

Several studies indicate the problem and severity of intestinal parasitic infection in Ethiopia. In line with this, continuous monitoring of intestinal parasitic infection and their associated factors are essential among children under five years in the country. There is no recent information about the infection rate of intestinal parasites and correlated factors in the study area. Therefore, the present study was aimed to determine the infection rate of intestinal parasites among children under five aged who have visiting the Addis Ketema Sub-City Health Canter.

In Ethiopia, intestinal parasitic diseases are among the ten top causes of morbidity nationwide. These parasites are responsible for the major share of morbidity and mortality in those communities where there is over-crowding, poor environmental sanitation and personal hygienic practices, which make them a great concern in Addis Ababa. Most of the intestinal

parasites are more common and their manifestations are more severe in children than adults. Infection in children is also associated with malnutrition, growth retardation and poor school performance. Besides the health impact, intestinal parasites have significant socioeconomic impact in terms of absence from work, diagnostic and treatment expenses (EMOH, 2013).

## **1.2. Statement of the problem**

Intestinal parasites are major public health problems in several developing countries. More than a billion people suffer from both protozoan and helminths parasitic infections. In Ethiopia high burden of intestinal parasites is estimated, the overall national prevalence of any helminths infection was 29.8% with variable degree of prevalence among regions (FDRE/MOH, 2013).

The prevalence of different parasites differs between immunocompetent and immunodeficient individuals. Globally, in immunocompetent individuals *Ascaris* stands first with a prevalence of 600 million/year followed by schistosomiasis (300 million/year) and Amoebiasis (40–50 million/year) in immunodeficient individuals, on the other hand, cryptosporidiosis the commonest intestinal parasite known to occur. More than 267 million under five-aged were infected with soil transmitted helminths. In Africa more than 13.8 million under five-aged children is infected with intestinal parasites infection (WHO, 2018). In Ethiopia high prevalence of helminth infection is attributable to factors associated with low socio-economic status. Such as, poor personal hygiene, environmental sanitation, low household income, overcrowding and lack of clean water supplies (Mengistu *et al.*, 2007). There is lack of information on the prevalence of intestinal parasite and knowledge, attitude and practice of their mother on prevention and control in the present study area (Abate *et al.*, 2013).

Intestinal parasite cause most morbidity and mortality outcome of human disease. The diseases result in stunted growth, underweight, low school performance and anemia. The severities of the diseases increase in children of under-five age due to their poor body resistance to parasitic lode. More than half of all deaths from communicable diseases globally occur in children under five years of age, intestinal parasites also contribute for deaths as children are more venerable (WHO, 2009). The presence of chronic and heavy intestinal parasitic infection cause intestinal bleeding, malabsorption of nutrients, nutritional deficiency, destruction of cells and tissues and other associated effects. The overall effect of these results in growth retardation, reduced mental development and susceptible to malnutrition and infection. It is to be noted that early diagnosis, proper treatment and efficient preventive measures to control the spread of these parasites will improve the health of the community in general and the individuals in particular. Therefore, the present study was aimed to determine the Infection rate of intestinal parasite in children under five years of aged in Addis Ketema Sub-City Health Canter, Addis Ababa.

## **2. LITERATURE REVIEW**

### **2.1. Intestinal parasitic infections**

Intestinal parasitic infection is one of the major health problems globally and up to 3.5 billion people are infected and around 450 million people are ill due to intestinal parasites. The majority of these intestinal parasitic infections are concentrated in developing countries. The problems are more serious in Sub-Saharan Africa, Asia and Latin America associated with inadequate water supply, environmental sanitation, fast population growth, and other economic and social and problems (Haftu *et al.*, 2014).

Currently, the protozoan parasite (*Entamoeba histolytica* and *Giardia intestinalis*) and the soil transmitted helminthes (*Ascaris lumbricoides*, *Trichuris trichiura*, and Hookworm) are the leading intestinal parasites which cause significant morbidity and mortality in the world (WHO, 2015). Intestinal parasitic infections are more prevalent among children as compared with the general population. About 12% of the global disease burdens caused by intestinal parasites are observed among children with in developing countries. Up to 270 million preschool and 600 million school children are living in area where high transmission of parasitic worm. These indicated that children are the major risk group for parasitic infection in many developing countries (WHO, 2015).

### **2.2. Intestinal protozoan infections**

#### **2.2.1. Amoeba infections**

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 second most common cause or death due to parasitic infection after malaria as estimated by the World Health Organization (WHO, 2004). Approximately 10% of the world population is infected with *E. histolytica/dispar* (Gelaye *et al.*, 2014), but most infection occurs due to the noninvasive species. Epidemiological studies have shown that low socioeconomic status, low standards of hygiene and sanitation, in particular those related to crowding, contamination of food and water, and inadequate disposal of faeces, are all significant risk factors for infection with *E. histolytica* (Nasr *et al.*, 2013).

Amoebiasis is usually transmitted by the fecal-oral route, but it can also be transmitted indirectly through contact with dirty hands or objects as well as by anal-oral contact. Infection is spread through ingestion of the cyst form of the parasite, a semi-dormant and hardy structure found in feces. Any non-encysted amoebae, or *trophozoites*, die quickly after leaving the body but may also be present in stool: these are rarely the source of new infections (Alyousefi *et al.*, 2011),

Pathogenesis of Amoebiasis is believed to be a multi-step, multifactorial process. Though a large number of studies have attempted to unravel the factors/molecules responsible for the pathogenesis of Amoebiasis, the processes involved in pathogenesis are poorly understood. The aspects of pathogenesis which have been investigated experimentally can be broadly categorized into mechanisms involving interactions with the intestinal flora, lysis of target cell by direct adherence, lysis of target cell by release of toxins and, Phagocytosis of target cells (Sehgal *et al.*, 2010).

Symptoms of Amoebiasis 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 (WHO, 2015).

Prevention of Amoebiasis at present requires interruption of the fecal-oral spread of the infectious cyst stage of the parasite. Because cysts are resistant to chlorine or iodine, in developing countries water must be boiled before it is safe to drink, and raw vegetables must be washed and then soaked in vinegar for 15 min before they can be eaten. Since Amoebiasis often spreads within a household, it is prudent to screen family members for intestinal *E. histolytica* infection (Nyantekyi *et al.*, 2010).

### **2.2.2. Giardia infections**

Giardiasis is one of intestinal protozoan disease which is caused by *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. First observed by Anton Van Leuwenhoek in 1681 in a sample of his diarrheal stool, *Giardia* was initially thought to be a commensal and has only been recognized as pathogens in the mid-1900s (Sehgal *et al.*, 2010).

The cyst of *Giardia lamblia* is elliptically shaped, range in size from 6 to 10 microns and contains two to four nuclei (King, *et al.*, 2013). 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 (Asrat *et al.*, 2011). Cyst formation is essential for the survival of *Giardia* outside the host intestine and for the transmission of the parasite among susceptible hosts (Abossie *et al.*, 2014) Cysts can be found by examination of the deposit of a Formol-ether concentrate of a stool preparation. The flagella disintegrate and form a central streak which becomes visible when stained with iodine). Trophozoites are found by examination of saline wet preparations of fresh, diarrheic stool, duodenal or jejunal aspirate or in a permanently stained fecal preparation (WHO, 2015).

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 stained preparations (Haftu *et al.*, 2014). 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 (Gelaw *et al.*, 2013).

### **2.3. Intestinal Helminthic infection**

In children, soil-transmitted helminthiasis is the cause of common health problems. These is due to their immune systems are not yet fully developed and they also habitually playing with contaminated soil, sucking fingers and defecation in open field play. Over 1.5 billion people are infected with one or more soil transmitted helminth; there are 700 million people infected with hookworm and 807 million people infected with ascariasis according to World Health Organization estimates (WHO, 2015).

#### **2.3.1. Ascaris infection**

Ascariasis is the most common human helminthic infection. It is a soil-transmitted infection which is caused by *Ascaris lumbricoides*. Current estimates indicate that more than 1.4 billion people are infected worldwide. 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 (Sierra *et al.*, 2011).

*Ascaris lumbricoides* is the largest and the most common helminthes 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. Hand to mouth transmission is most common; it is found in association with poor personal hygiene, poor sanitation, and in places where human feces are used as fertilizer. Consumers of uncooked vegetables and fruits grown in or near soil fertilized with sewage are most at risk for acquiring infection. Water is rarely implicated as a source of *Ascaris* (Abera *et al.*, 2014).

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 lymphatic. 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 esophagus to the small intestine where they mature in 2 to 3 months (WHO, 2015).

Symptoms are 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, dyspnea and sub-sternal discomfort. Most symptoms are due to the physical presence of the worm (Gelaw *et al.*, 2013).

### **2.3.2. Trichuris infection**

*Trichuris trichiura* infection is endemic in tropical and subtropical countries, but few sporadic cases have occurred in non-endemic areas, mainly as a result of immigration. It is rare or nonexistent in arid, very hot, or very cold regions (Abossie *et al.*, 2014). It is estimated that over 40.1 million African school-aged children are infected with *T. trichiura* (Gelaw *et al.*, 2013).

According to CDC and prevention (2010 and 2011), Trichuriasis is transmitted when the infective eggs of the whipworm are unintentionally ingested, usually through consuming soil that has been contaminated with human feces via dirt covered food or hands. The spread of human whipworm eggs usually occurs in areas where outside defecation takes place or human feces is used as fertilizer (Wale *et al.*, 2013).

Frequently, infection with *Trichuris* is asymptomatic or results only in peripheria. Clinical disease most often occurs in children, as it is this population that tends to be most heavily infected and presents as *Trichuris colitis*. In fact, this is the most common and major disease entity associated with infection. Acutely, some patients will develop *Trichuris* dysentery syndrome, characterized by abdominal pain and diarrhea with blood and mucus. With severe dysentery, children develop weight loss and become emaciated. Anemia is common and results from both mucosal bleeding secondary to capillary damage and chronic inflammation. The anemia of trichuriasis is not as severe as that seen with hookworm (Stoker *et al.*, 2009).

*Trichuris* infection of the rectum can lead to mucosal swelling. In that case, tenesmus is common and if prolonged can lead to rectal prolapse, especially in children. Adult worms can be seen on the prolapsed mucosa. Chronic trichuriasis often mimics inflammatory bowel disease. Physical symptoms include chronic malnutrition, short stature and finger clubbing. These symptoms are often alleviated with appropriate anthelmintic treatment. Rapid growth spurts have been reported in children following de worming with an anthelmintic agent. Deficits in the cognitive and intellectual development of children have also been reported in association with trichuriasis (WHO, 2015).

### **2.3.3. Hymenolepis infection**

*Hymenolepis nana* / the dwarf tapeworm/, 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 cirlet of five hooks; one to three large testes and sacci form 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 *hymenolepsis* (WHO, 2015).

Diagnosis is based on recovery and identification of the characteristic ova in a Formol-ether concentrate of feces. Adult worms and proglottids are rarely seen in stool samples (WHO, 2009). The recommended drugs for the treatment of *Hymenolepis nana* are Praziquantel or niclosamide are the drugs most frequently used to treat *H. nana* infection. Developing *H. nana* cysticercoids are not as susceptible to drug therapy as adult tapeworms. Therefore either a higher dose of anti-parasitic or prolonged duration of anti- parasitic to eliminate emerging tapeworms is required to successfully treat infection (King *et al.*, 2013).

#### **2.3.4. Hook worm infection**

It is one of the common human intestinal parasitic infections. The two major species of hook worm to infect humans are *Necator americanus* and *Ancylostoma duodenale*. Eggs of both species are identical and morphological identification can be done on the basis of the adults' morphology. Hook worms are estimated to infect 151 million people worldwide and cause mortality in children. (Mohammed *et al.* 2014). 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* (Mehraj, *et al.*, 2008). 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. Human infection is acquired through penetration of the skin by the infective third stage filari form of larvae (Nasr *et al.*, 2013).

Penetration usually occurs in bare feet with skin abrasion, areas on and between the toes, or through a hair follicle (Nasr, *et al.*, 2013). 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 (Thiongo *et al.*, 2011).

#### **2.4. Epidemiology of Human Intestinal Parasitic Infections under five years**

Both protozoan and helminths affect pre-school children globally. Intestinal parasites are present throughout the world in varying degrees of prevalence. The burden of the infection remains one of the greatest health problems in children developing world, with over one billion people estimated to be infected (WHO, 2015). While most infections remain asymptomatic, the clinical spectrum of disease widespread, ranging from mild gastrointestinal symptoms to death from disseminated infection

Intestinal protozoan infections are endemic worldwide. In developed countries the prevalence of human intestinal parasitic protozoan infection is estimated to be between 1-7%, but it may

be as high as 50% in developing countries. Immuno-compromised individuals are also more commonly affected than members of the general population. *Giardia* is also a cause of “travellers’ diarrhea, in which the disease is sometimes also called beaver fever. *Entamoeba histolytica* infection is common in most developing countries. It is reported to be responsible for approximately 50 million cases of invasive Amoebiasis and upwards of 100,000 deaths each year. Thus, it is second only to malaria as the cause of mortality due to protozoan infection (WHO, 2015).

#### **2.4.1. Global distribution of human intestinal parasitic infections under five years**

Global distribution of human intestinal parasitic infections over 3.5 billion people are infected with one or more intestinal parasites, there are 700 million people infected with hookworm and 807 million people infected with ascariasis according to World Health Organization (WHO, 2015). The prevalence of helminthic infections under five years children is estimated at about 35% caused by *Ascaris*, 25% caused by *Trichuris* and about 26% are caused by hookworms. Heavy infection of intestinal parasite can cause malnutrition, loss of appetite, interfering food absorption and weight loss. Majority of intestinal parasites are more likely to make the children ill. And, this can lead to the children’s missing of school. Globally, the intestinal parasitic infections have been recognized as one of the most significant cause of illnesses and diseases especially among disadvantaged communities. With an average prevalence rate of 50% in developed world and 95% in developing countries, it is estimated that intestinal parasitic infection results in 450 million illnesses (WHO, 2015.)

#### **2.4.2. Human intestinal parasitic infections under five years in Africa**

In East Africa including Somalia, Ethiopia, Eritrea, Kenya and Sudan more than 50% of people are at risk of illness from parasitic diseases. This is due to deteriorated health service, armed conflict, famine and economic hardship (Gabbad *et al.*, 2014). There are many reports of intestinal parasite infections in different African countries. It is clear that unsanitary conditions, unclean water utilization and low health education service are common in many African countries. The idea supported by a study conducted in Democratic Republic of Congo, shows the burden of intestinal parasite among less than five years children, an overall prevalence of intestinal parasite infections were 43%. According to their report the prevalence of intestinal parasitic infection was higher among children aged between 1 and <5 years than those aged <1 year this might be to the exposure of neonate to contaminated food and water (Kandala *et al.*, 2013). According to Tina *et al.* (2013) report the prevalent parasite among less than five years children in Senegal were 26.2%, the predominant parasite form their finding were *G. intestinalis* 15.6%. However, *H. nana* 1.9%, *A. lumbricoides* and *T. trichiura* 0.1% contribute to the total intestinal parasites prevalence. A study conducted in Zanzibar infants also showed that prevalence of geohelminth infection was 26.5%. Between five and nine months of age the mean prevalence was 9.4%, while at 10 and 11 months of

age the mean prevalence was 43.4% the finding of the study indicated that, even five month age child infected with intestinal parasite unless his mother give care the child (Goodman *et al.*, 2007).

### **2.4.3. Human intestinal parasitic infections under five years in Ethiopia**

In Ethiopia intestinal parasitic infections are prevalent in varying magnitude among under-five children. Toilet utilization, hand washing, and waling bare foot has impact in the prevalence of intestinal parasites (Abate *et al.*, 2013). Intestinal parasites have been widely distributed in Ethiopia, as in most of African countries. They are more prevalent in the poor segments of the population with low household income, poor handling of personal and environmental sanitations, overcrowding and limited access to clean water (Amare *et al.*, 2007). Intestinal parasite infections are common among preschool children. There are different causes for the prevalence such as playing with soil, sucking fingers and defecation in open field. Maternal awareness for the prevention and control of intestinal parasite has its own impact on the prevalence (G/hiwot *et al.*, 2014)

As a result of low level standards of living, poor environmental sanitations and ignorance of simple health promoting factors, intestinal parasitism is very high. Even though the prevalence of individual parasite varies in different parts of the country, *A. lumbricoides* the most prevalent intestinal parasite. Many reports in Ethiopia indicated that the most prevalent soil transmitted helminthes are *A. lumbricoides* followed by *T. trichiura* (Gelaw *et al.*, 2013). A study conducted in Teda Health Centre Northwest Ethiopia, reported that the total prevalence of intestinal parasites in general population were 62.3%. The individual prevalence for each parasite was *Ascaris lumbricoides* was the most predominant parasite 23.2% followed by *E. histolytica/dispar* 12.4%, *G. intestinalis* 4.6%, hookworm 6.6%, and *Hymenolepis nana* (Abate *et al.*, 2013).

### **2.5. Factors that Affect the Epidemiology of Intestinal Parasitic Infections**

Parasitic infections depend for transmission on environments contaminated with egg-carrying feces. Consequently, intestinal parasites are intimately associated with poverty, poor sanitation, and lack of clean water. The provision of safe water and improved sanitation are essential for the control of parasitic infections. The populations in developing countries live in conditions that are highly conducive to the acquisition of parasitic infestation. Poor hygiene, crowded household conditions, dietary habits, education level of the community and deficient sanitation mark their day-to-day life (Gelaye *et al.*, 2014).

Intestinal parasitic infections are highly prevalent in warmer and moister areas. This is because hook worm, *Ascaris*, *Trichuris* and *S. mansoni* ova require humid environments Many helminths infections are more common in children than in adults. In addition to this,

multiple infections can also play a role because children tend to live more closely with nature and with their pets (Mbae *et al.*, 2013).

The high prevalence rate of intestinal infection in children is attributed to many factors, particularly environmental and personal hygiene. For reasons not well understood, children under five aged (including adolescents) tend to harbor the greatest number of intestinal worm. As a result they experience growth stunting and diminished physical fitness as well as impaired memory and cognition (Wegayehu *et al.*, 2013).

Invasive Amoebiasis is one of the world most prevalent and fatal infectious disease. Around 500 million people are infected worldwide while 75,000 die due to the disease annually. The infection is common among individuals with poor socioeconomic conditions, non-hygienic practice and malnutrition (WHO, 2015). Intestinal infection caused by *giardia* is Asymptomatic in majority cases, but sever infection can result acute watery diarrhea, abdominal pain, intermittent, often debilitating disease, which is characterized by passage of foul-smelling stools associated with flatulence and anorexia (Abossie *et al.*, 2014).

## **2.6. Control of Intestinal Parasitic Infections in children under five years**

According to World Health Organization guidelines (WHO, 2004), any health program aiming at controlling morbidity of intestinal parasitic infections should have evidence based estimates of this problem. Human intestinal parasitic protozoan infections can be controlled through proper treatment and disposal of row swage and maintaining clear water supply including the protection of open wells, springs and rivers from contamination with swage and feces. The risk for infection can also be reduced via the adequate boiling of drinking water or treatment of water with chlorine or iodine. The exterior of row vegetables and fruits should be washed with soap and soaked in vinegar for some minutes before conception (CDC, 2006).

Control programs based on sanitation aim to reduce or interrupt transmission, prevent reinfection and gradually reduce worm loads (CDC, 2010). However, to be effective in a short period of time they need to be combined at their first stage with chemotherapy. Long term sanitary control programs need to add elements to improve the economic conditions of a region, to ensure a reliable and permanent sanitation system and have permanent health education programs (Gelaye *et al.*, 2014).

Children under five years harbor the most intestinal parasitic infections with roundworm, hookworm and whip worm. Therefore, treatment of this age group which is easily accessible through the school system achieves optimal improvements in health status and educational performance. In many developed countries, the prevalence rate of the parasitic infection has been significantly reduced as a result of improved standard of living, without the adoption of specific control measures. The principal measures that should be included in a control

program consist of massive and periodic treatment of the human population to prevent environmental contamination, sanitary excreta disposal, provision of potable water and health education for the purpose of instilling personal hygiene habit in the population (Sehgal, *et al.*, 2010).

In recent studies, the best interventions follow a multidisciplinary approach by:

- ☞ Increasing environmental sanitation to promote hand washing and shoe wearing habits
- ☞ Educating children at young ages at school and at home

Specific evidence-based interventions that may lower disease prevalence include:

- ☞ Improved Interventions at schools, focusing on the construction of pit latrines (ventilated and), providing clean drinking water and educating the students about hygiene.
- ☞ The SAFE (surgery, antibiotics, facial cleanliness, environmental sanitation) strategy to address intestinal infections, primarily the facial cleanliness and the environmental sanitation components.
- ☞ Hand-washing with soap at critical times and nail clipping to decrease reinfection rates, although further research is needed to develop and implement similar interventions at scale
- ☞ Programs combining anthelmintic drug administration with interventions to increase environmental sanitation (such as decreasing fecal contamination)

### **3. OBJECTIVES**

#### **3.1. General objective**

- ☞ To assess the major intestinal parasite species and determine their Infection rate of intestinal parasite in children less than five years of age in Addis Ketema Sub-City Health Canter, Addis Ababa during Sept. 2017- May 2018

#### **3.2. Specific objectives**

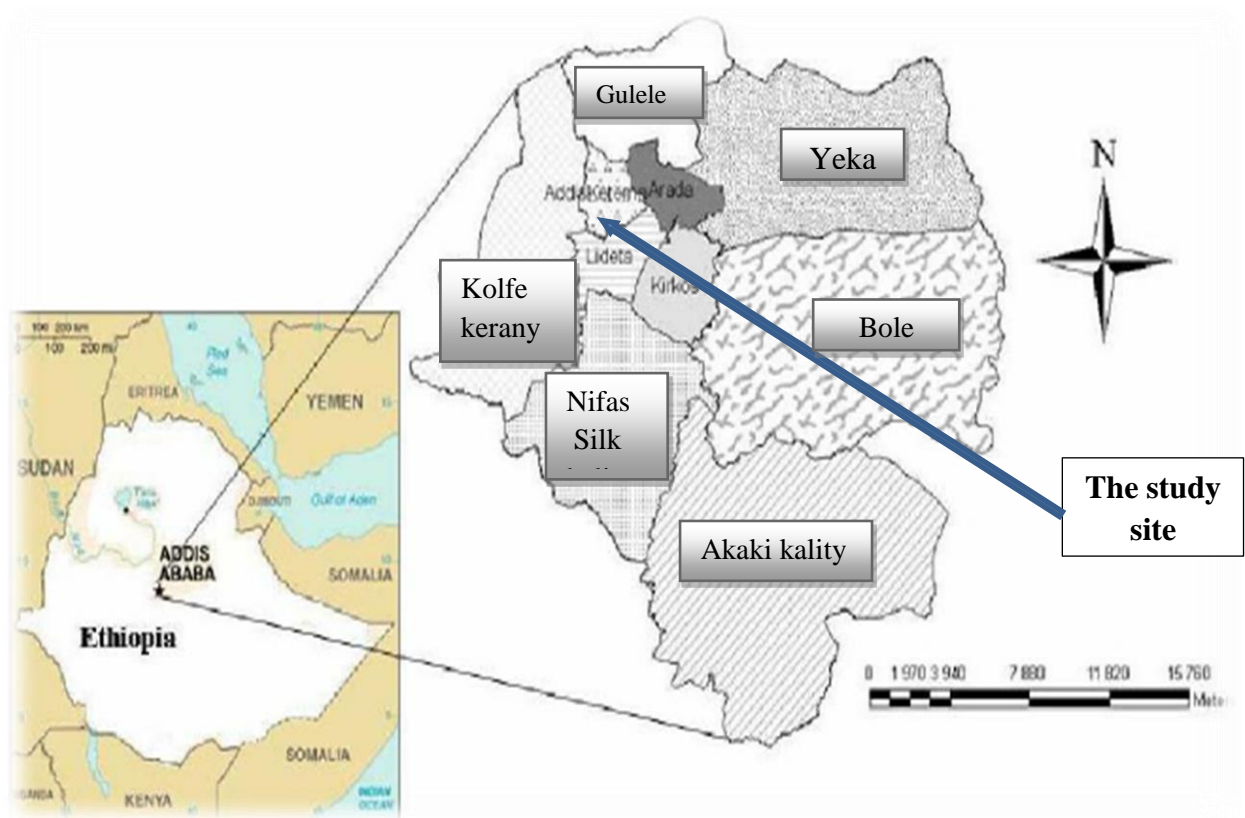
- ☞ To identify the major intestinal parasite species among under- five years old patients visiting Addis ketema sub-city health canter.
- ☞ To determine risk factors associated with occurrence of intestinal parasites in the study group.

## 4. MATERIALS AND METHODS

### 4.1. Description of Study Area

The study was conducted in Addis ketema sub city Health Center, Addis Abeba the capital city of Ethiopia (Figure 1). According to the new city administration classification, Addis Ababa is divided into ten sub-cities, Among the Ten sub cities, Addis Ketema, Lideta and Kirkos are the most disadvantaged, that is to say majority of the inhabitants are poor. The majority of population (60-70%) of such disadvantaged areas suffer from food insecurity (Kidist, 2010). Out of these disadvantaged areas, Addis Ketema sub city has been selected purposively.

Addis Ketema sub city is located in the northern part of Addis Ababa. Gullele borders in the north, Arada in the east, Kolfe Keranio in the west and Lideta in the south. It has area coverage of 742 hectares with a total population size of 255,092 (Addis Ababa City Administration, 2007).



**Figure 1:** map of the study area

**Source:** Addis ketema sub city administration office

## **4.2. Study Design**

A cross sectional study was conducted on major intestinal parasite species in children under-five years of age in Addis Ketema Sub-City Health Center during Sept. 2017- May 2018.

## **4.3. The Study participants**

All under-five children who came to Addis ketema healthy center during the study period for medication were included because of their susceptibility to intestinal parasites as a result low immunity they have. However, all patients requested for stool examination and those who were not consented, who were taking anti parasitic drugs within 14 days were excluded from this study.

## **4.4 Determination of sample size**

Sample size was determined based on the 95% confidence interval and with 5% sampling error (Daniel, 1999):-

$$n= Z^2 R (1-R)/d^2$$

Where: n= sample required

Z= 95% confidence interval (1.96)

d= margin of error (5%)

R= rate of infection.

Since the overall prevalence rate (p) of intestinal parasites is not known for the study area, prevalence rate was taken to be 50%. For the calculation, 95% confidence level (z) and 5% sampling error (d) was used. Therefore, three hundred eight four (384) children among under five years were participated in the present study in Addis ketema sub city healthy center.

## **4.5. Sampling Technique**

A sampling technique used in this study was convenient sampling technique which is used to include all consented patients requested for stool examination during the study period.

## **4.6. Method of Data Collection**

### **4. 6. 1. Stool Sample collection**

During stool collection, disposable plastic cups and spoon were distributed to each study subject along with brief instructions on how to collect the stool. They were also advised to fill up the disposable plastic cup about the size of the tip of the thumb (approximately 5g of stool) of fresh stool using disposable spoon that was given with the container. The unique code of the student was labeled on the container. The fresh stool samples were carried to the

Addis ketema sub city healthy center on the same day of collection for parasitological examination.

#### **4. 6.2. Questionnaire survey**

Information about age, sex, source of water and its handling, consumption of properly washed fruit and cooked vegetables, parents' education level, life skills, personal hygiene and level of awareness to parasitic infection were gathered using structured questionnaire after pre-test in the study area. The questionnaire was prepared in English, and translated into Amharic for communication convenience. Then, the children's families were interviewed.

#### **4.7. Laboratory Parasitological Procedures**

##### **4.7.1. Wet Mount Method**

Wet mounting is the simplest and easiest technique for the examination of faeces. Direct wet mount technique was used to assess the overall prevalence of intestinal parasitic infections in the study area. The direct wet mount was processed by conventional iodine to identify the presence of motile intestinal parasites, cysts, egg and trophozoite under light microscope at 10X and 40x magnification. Saline was used to observe cysts of intestinal parasites. About 2g of stool sample was emulsified with 3-4 ml normal saline, and then a drop of emulsified sample was placed on a clean microscopic glass slide, then a few drops of iodine solution was added and it was covered with a cover slip. The presence of intestinal parasites ova and cyst was observed under the microscope.

##### **4.7.2. Formol-Ether Concentration Method**

Using an applicator stick, approximately 2g or pea sized fecal material was placed in a centrifuge tube containing 7 ml of 10% formalin. After emulsifying the feces in the formalin, it was filtered through the nylon filter into the test tube. The filtrate was washed to discard any lumpy residue with a normal saline solution. Then after, the filtrate was washed again, by transferring into a test tube containing 7 ml of ether/ethyl acetate. The tube was closed with a stopper and it was shaken vigorously to mix. The stopper was removed and it was centrifuged at 1500 rpm for 2 minutes. The tube was rested in stand for five minutes. Four layers became visible with the top layer consist of ether, second was a plug of debris and the third was a clear layer of formalin and the fourth was the sediment. The plug of debris from the side of the test tube was removed with the cotton swab and the liquid poured off leaving a small amount of formalin for suspension of the sediment. Then after, the sediment was removed with a pipette. Then, a drop of fluid was added on the slide for examination under a cover slip. Some drop of iodine solution was added on the second glass slide. A 10x and 40x objectives was used to examine the whole of the deposit for ova and cysts and trophozoites (NCCLS, 2002).

#### **4.8. Data Processing and Analysis**

The collected data was entered into Microsoft excel sheet and mistakes were corrected after revising the original questionnaire and cleaned through phase by phase screening and exporting data to the SPSS-version 20 Statistical Package for the Social Sciences for analysis. Frequencies and cross tabulations were used to summarize descriptive statistics of the data. Tables and graphs were formed for the data presentation. Variables that were found to have an association with the dependent variable(s) were then analyzed by multivariate regressions for controlling the possible effect of confounders and finally the variables and their significance association was identified employing with 95% CI and P-value ( $P < 0.05$ ).

#### **4.9. Data Quality Control (DQC)**

To ensure quality control, the following measures were taken;

- ☞ Materials and equipment's were checked for proper functioning.
- ☞ All the laboratory procedures including collection and handling of specimens were carried out in accordance with standard protocols (WHO, 2004; NCCLS, 2002).
- ☞ Ensure general safety, disposable gloves were worn and universal bio-safety precautions Clinical and Laboratory Standards Institute (CLSI, 2009) were followed at all times.
- ☞ The calibration factors for the 10x and 40x objectives were posted on the microscope for easy access; and the weight scales were checked at the beginning of each working day.
- ☞ Stool examination results were reported after confirmed by senior laboratory technologist.
- ☞ Every collected sample test results were registered in the appropriate format. Finally, the data was analyzed and interpreted accordingly.

#### **4.10. Ethical Consideration**

The official permission letter for ethical clearance was obtained from AAU institution of review board. Further permission was obtained from Addis ketema sub city Health Center and Laboratory staffs. The ethical considerations were addressed by referring positive individuals for treatment at the Centre. The respondents were informed about the objective and purpose of the study and verbal consent was obtained from each respondent before starting the interview. The information obtained at each course of study was kept confidential.

## 4.11 Study Variables

### 4.11.1 Dependent variable

- ☞ Intestinal parasitic infection.

### 4.11.2 Independent variables

- ☞ **Use of water and its handling:** This refers to whether the community has facility of water for drinking, washing as well as cooking foods or not. It also refers to whether the source of water for drinking is protected or unprotected.
- ☞ **Parents' education level:** This variable indicates whether the parents of the participants are educated or not; as well as their levels of education, such as capable to read and write, completed primary education and had diploma and above.
- ☞ **Hand washing after defecation before eating:** This refers to hand washing practice of children.
- ☞ **Personal hygiene:** Refers to generally keeping oneself clean. This includes good personal hygiene.
- ☞ **Awareness to parasites' infection:** Refers to whether they have an idea about parasites that affect them.

## 5. RESULTS

### 5.1. Socio-Demographic Characteristics of the Study Participants

Socio-demographic characteristics of the study participants are summarized and presented in table 1.

**Table1. Socio-demographic characteristics of study participants at Addis Ketema sub city Health Center. Addis Ababa during Sept. 2017- May 2018.**

| <b>Parameters</b>                               | <b>Category</b>     | <b>Frequency n=384</b> | <b>Percent</b> |
|---|---------------------|------------------------|----------------|
| <b>Sex</b>                                      | Male                | 176                    | 45.8           |
|   | Female              | 208                    | 54.2           |
| <b>Age group</b>                                | ≤1                  | 36                     | 9.4            |
|   | 1.1-2               | 20                     | 5.2            |
|   | 2.1-3               | 24                     | 6.3            |
|   | 3.1-4               | 36                     | 9.4            |
|   | 4.1-5               | 268                    | 69.8           |
| <b>Parents educational level</b>                | Illiterate          | 94                     | 19.3           |
|   | Primary education   | 187                    | 53.9           |
|   | Secondary education | 68                     | 17.7           |
|   | Diploma and above   | 35                     | 9.1            |
| <b>Use of water and its handling</b>            | Protected           | 246                    | 64.1           |
|   | Unprotected         | 138                    | 35.9           |
| <b>Availability of latrine</b>                  | Public              | 294                    | 76.6           |
|   | Private             | 90                     | 23.4           |
| <b>Personal hygiene</b>                         | Poor                | 286                    | 74.5           |
|   | Good                | 98                     | 25.5           |
| <b>Parents awareness to parasitic infection</b> | Poor                | 298                    | 77.6           |
|   | Good                | 86                     | 22.4           |

A total of 384 children were participated in this study, among them, 176 (45. 8%) ware males and 208 (54. 2%) were females. Children age ranged between ≤1 was 36(9.4 %), 1.1-2: 20(5.2%), 2.1- 3; 24(6.3%), 3.1- 4: 36(9.4%), 4.1-5: 268(69.8%) were participated in this study. 246(64.1%) respondents said that they were using unprotected water supply whereas

138(35.9%) have a protected water supply for domestic use. With regard to parents' education, 94(19.3%), 187(53.9%), 68(17.7%), and 35(9.1%) said that they were illiterate, primary education, secondary education and had diploma and above respectively. 294(76.6%) of the children households had public latrines. The remaining 90(23.4%) had private latrines in close vicinity of their homes. 286(76.6%) and 98 (25.5%) were with poor and good personal hygiene, respectively. 298(77.6%) and 86(22.4%) were with poor and good awareness to parasitic infection respectively.

## **5.2. Infection rate of Intestinal Parasitic Infections among Under-Five years old Children**

The infection rate of intestinal protozoan and helminth parasite infections among children aged less than five years old is summarized in table 2. The infection rate of intestinal protozoan parasite infections (IPPI) and intestinal helminth parasite infections (IHPI) among children less than five years old of both sex and all age groups was 91(23.7%) and 53(13.8%), respectively; with 144(37.5%) overall ratio. Out of these, the infection rate of IPPI and IHPI among male children was 36(20.5%) and 33 (18.8%), respectively; with 69(39.2%) overall infection rate. Similarly, the infection rate of IPPI and IHPI among female children was 55(26.4%) and 20(9.6%), respectively; with 75(36.1%) overall infection rate. Although there was no statistically significant ( $p>0.05$ ) difference, the infection rate of IPPI in female children under-five years was greater than that of males. To the contrary the infection rate of IHPI in male children under-five years was greater than that of females.

As shown in table 2, Among 384 children participated in this study, 144 (37.5%) children were infected with at least one or more parasites. Children were infected with protozoan and helminth parasites with a prevalence 91 (23.7%) and 53 (13.5%), respectively. Children age ranged between  $\leq 1$  was 2(5.6 %), 1.1-2: 3(15%), 2.1- 3: 5(20.8%), 3.1- 4: 12(33.3%), 4.1- 5:122(45.5%) were infected with human intestinal parasites. The low rate of infection was observed in children aged less than 1 year old and high rate of infections was for the children aged from 4.1-5 years old. Children in 4.1-5 years old were highly infected with both protozoa and helminth infections and indicating a risk for acquiring intestinal parasite infections. The infection rate of intestinal parasite and species diversity in the study site revealed that increment with age group as the age increased; particularly it was highest in age group from 4.1-5 years old 45.5%. The rate of infection intestinal parasites in this study were not statistically significant between male and female children of different all age group ( $p>0.05$ ).

**Table2. Infection rate of intestinal protozoan and helminth parasitic infections among study participants (n=384) in Addis Ketema sub city Health Center. Addis Ababa during Sept. 2017- May 2018.**

| Age Group<br>(years)<br>Sex | No of<br>Examined | Intestinal parasitic infection |      |           |      |           |      | P-Value |
|-----------------------------|-------------------|--------------------------------|------|-----------|------|-----------|------|---------|
|                             |                   | IPPI                           |      | IHPI      |      | PHPI      |      |         |
|                             |                   | Positives                      |      | Positives |      | Positives |      |         |
|                             |                   | No                             | %    | No        | %    | No        | %    |         |
| <b>≤1</b>                   |                   |                                |      |           |      |           |      |         |
| Male                        | 16                | 1                              | 6.3  | 0         | 0    | 1         | 6.3  | 1.000   |
| Female                      | 20                | 1                              | 5    | 0         | 0    | 1         | 5    |         |
| <b>Total</b>                | 36                | 2                              | 5.6  | 0         | 0    | 2         | 5.6  |         |
| <b>1.1-2</b>                |                   |                                |      |           |      |           |      |         |
| Male                        | 10                | 0                              | 0    | 2         | 20   | 2         | 20   | .078    |
| Female                      | 10                | 1                              | 10   | 0         | 0    | 1         | 10   |         |
| <b>Total</b>                | 20                | 1                              | 5    | 2         | 10   | 3         | 15   |         |
| <b>2.1-3</b>                |                   |                                |      |           |      |           |      |         |
| Male                        | 11                | 2                              | 18.2 | 1         | 9.1  | 3         | 27.3 | 1.000   |
| Female                      | 13                | 2                              | 15.4 | 0         | 0    | 2         | 15.4 |         |
| <b>Total</b>                | 24                | 4                              | 16.7 | 1         | 4.2  | 5         | 20.8 |         |
| <b>3.1-4</b>                |                   |                                |      |           |      |           |      |         |
| Male                        | 15                | 2                              | 13.3 | 2         | 13.3 | 4         | 26.7 | 1.000   |
| Female                      | 21                | 4                              | 19.0 | 4         | 19.0 | 8         | 38.0 |         |
| <b>Total</b>                | 36                | 6                              | 16.7 | 6         | 16.7 | 12        | 33.3 |         |
| <b>4.1-5</b>                |                   |                                |      |           |      |           |      |         |
| Male                        | 122               | 31                             | 25.4 | 28        | 22.9 | 59        | 47.6 | 1.000   |
| Female                      | 146               | 47                             | 32.6 | 16        | 11.0 | 63        | 43.8 |         |
| <b>Total</b>                | 268               | 78                             | 29.1 | 44        | 16.4 | 122       | 45.5 |         |
| <b>All age group</b>        |                   |                                |      |           |      |           |      |         |
| Male                        | 176               | 36                             | 20.5 | 33        | 18.8 | 69        | 39.2 | 1.000   |
| Female                      | 208               | 55                             | 26.4 | 20        | 9.6  | 75        | 36.1 |         |
| <b>Total</b>                | 384               | 91                             | 23.7 | 53        | 13.8 | 144       | 37.5 |         |

**IPPI= Intestinal Protozoan Parasitic Infections, IHPI= Intestinal Helminth Parasitic Infections, PHPI= Protozoan and Helminth Parasitic Infections**

Among 36 participants age, ≤1, 2(5.6%) were positive for intestinal protozoan infection whereas none is infected with helminthic infection, 20 participants age 1.1-2: 1(5%) and 2(10%) infected with protozoan and helminthic infection. Out of 24 participant age 2.1-3: 4(16.7%), were infected with protozoan infection and 1(4.2%) were infected with helminthic

infection. 36 participant age 3.1-4: 6(16.7%) and 6(16.7%) infected with protozoan and helminthic infection respectively. Among 268 participants age,  $\leq 1$ : 78(29.1%) were infected with intestinal protozoan infection whereas 44(16.4%) were infected with helminthic infection

The infection rate of intestinal protozoan and helminthic parasite in the study site revealed that increment with age group as the age increased; age group  $\leq 1$ : 2(5.5%), 1.1-2; 3(15%), 2.1-3;5(20.8%), 3.1-4;12(33.3%) and 4.1-5; 122(45.5%). particularly highest infection rate was recorded in age group from 4-5 years old 122(45.5%). Among 144(37.5%) of positive cases surveyed in Addis ketema health center from children under five years, the infection rate of intestinal protozoan and helminthes parasitic infections were found to be 91(23.7%) and 53(13.8 %) respectively (Table 2). Thus, it was interesting to find that the intestinal protozoan infection seemed to be more problem than the helminthes parasites.

### **5.3. Major Intestinal Parasite Species identified in less than Five years Children**

Protozoan and helminth parasites identified in the stool samples examined among children less than five years are presented in table 3. Among 36 participants age,  $\leq 1$ : 2(6.3%) were identified with *E. histolytica/dispar/* infection whereas they were free from *G. lamblia*, *A.lumbricoides*, *T. trichiura* and *H. nana*. 20 participant age 1.1-2: 1(5%) *E.histolytica/dispar/*, 1(5%) *A. lumbricoides* and 1(5%) *T. trichiura* were identified. However, free from *G. lamblia* and *H. nana*. Out of 24 participant age 2.1-3: 2(8.3%) *E.histolytica/dispar*, 2(8.3%) *G. lamblia*, 1(4.1%) *A. lumbricoides*, and 1(4.1%) *H. nana* was identified in the stool sample. Out of 24 participants age 3.1-4: 2(6.3%) *E.histolytica/dispar*, 3(8.3%) *G. lamblia*, 2(5.6%) *A. lumbricoides*, 3(8.3%) *T. trichiura* and 1(2.8%) *H. nana* was identified in stool sample. 268 participant age 4.1-5: 44(16.4%), 34(12.7%), 23(8.6%), 14(5.2%) and 7(3.4) were infected with *E.histolytica/dispar/*, *G. lamblia* *A.lumbricoides*, *T. trichiura* and *H. nana*.

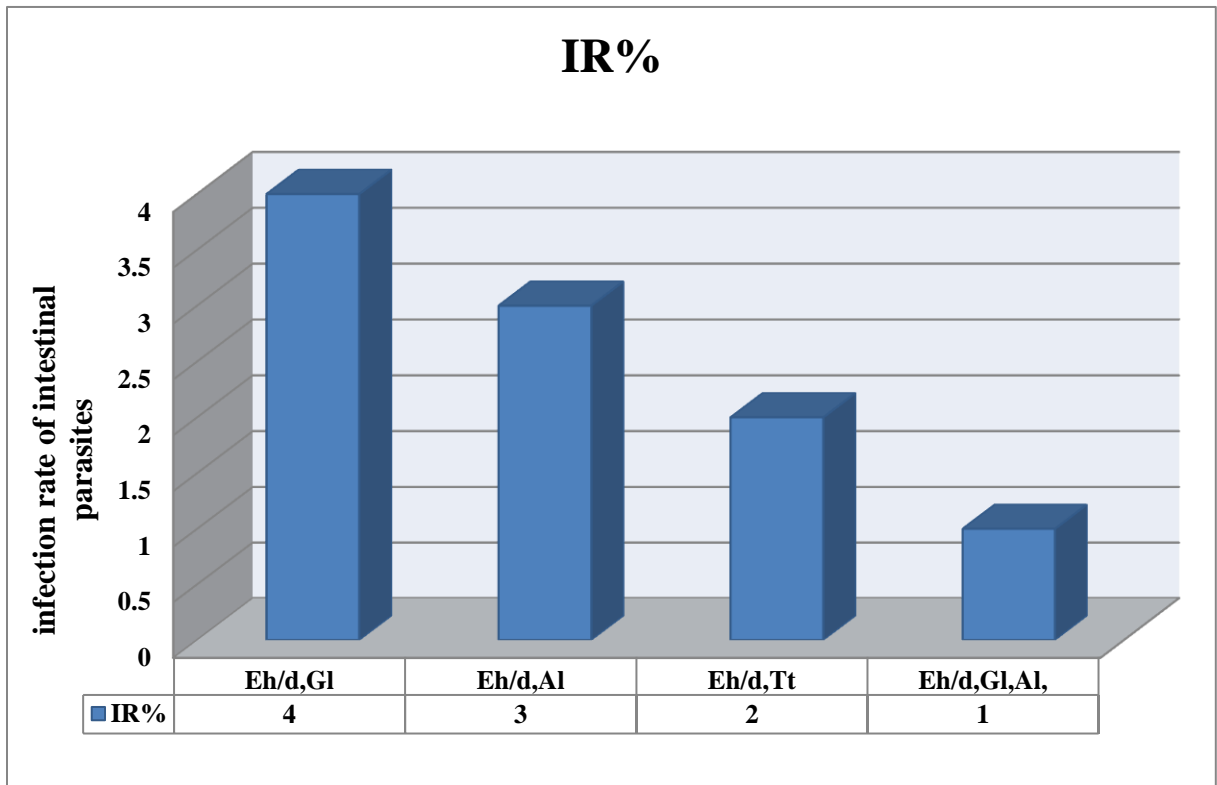
The result of parasitological investigations showed that, from 384 specimens of children under five years in Addis ketema sub city healthy center, 144 (37.7%) were positive for one or more intestinal parasites. Of these, 69(39.2) and 75(36.1) were males and females, respectively. *E. histolytica/dispar/* and *G. lamblia* the major protozoan parasites identified from children under five years with the prevalence of 52(13.5%) and 39(10.2%), respectively. Similarly, the major helminth parasites identified in the stool samples of the children were *A.lumbricoides*, *T. trichiura*, *H. nana* with the prevalence of 7%, 4.7% and 2.1% respectively. *A.lumbricoides* was the most prevalent helminth parasites in the study sites.

**Table 3: Common infection rate of intestinal protozoan and helminth parasite species identified from examined children (n=384) at Addis Ketema sub city health center, Addis Ababa during Sept. 2017- May 2018**

| Age Group (years)    | No of Examined | PPS             |                 |                | HPS            |               | MPS            |
|----------------------|----------------|-----------------|-----------------|----------------|----------------|---------------|----------------|
|                      |                | Eh/d            | Gl.             | Al             | Tt.            | Hn.           | No pos.        |
|                      |                | No pos. (%)     | No pos. (%)     | No pos. (%)    | No pos. (%)    | No pos. (%)   | No pos. (%)    |
| <b>≤1</b>            |                |                 |                 |                |                |               |                |
| Male                 | 16             | 1(6.3)          | 0               | 0              | 0              | 0             |                |
| Female               | 20             | 1(5)            | 0               | 0              | 0              | 0             |                |
| <b>Total</b>         | <b>36</b>      | <b>2(5.6)</b>   | <b>0</b>        | <b>0</b>       | <b>0</b>       | <b>0</b>      |                |
| <b>1.1-2</b>         |                |                 |                 |                |                |               |                |
| Male                 | 10             | 0               | 0               | 1(10)          | 1(10)          | 0             |                |
| Female               | 10             | 1(10)           | 0               | 0              | 0              | 0             |                |
| <b>Total</b>         | <b>20</b>      | <b>1(5)</b>     | <b>0</b>        | <b>1(5)</b>    | <b>1(5)</b>    | <b>0</b>      |                |
| <b>2.1-3</b>         |                |                 |                 |                |                |               |                |
| Male                 | 11             | 1(9.1)          | 1(9.1)          | 1(9.1)         | 0              | 0             |                |
| Female               | 13             | 1(7.7)          | 1(7.7)          | 0              | 0              | 1(4.3)        |                |
| <b>Total</b>         | <b>24</b>      | <b>2(8.3)</b>   | <b>2(8.3)</b>   | <b>1(4.1)</b>  | <b>0</b>       | <b>1(4.1)</b> |                |
| <b>3.1.4</b>         |                |                 |                 |                |                |               |                |
| Male                 | 15             | 1(6.7)          | 1(6.7)          | 2(13.3)        | 0              | 0             | 0              |
| Female               | 21             | 2(9.5)          | 2(9.5)          | 0              | 3(14.)         | 1(4.8)        | 2(9.5)         |
| <b>Total</b>         | <b>36</b>      | <b>3(8.3)</b>   | <b>3(8.3)</b>   | <b>2(5.6)</b>  | <b>3(8.3)</b>  | <b>1(2.8)</b> | <b>2(5,5)</b>  |
| <b>4.1-5</b>         |                |                 |                 |                |                |               |                |
| Male                 | 124            | 18(14.5)        | 13(10.5)        | 14(11.3)       | 9(7.3)         | 5(4.1)        | 4(3.2)         |
| Female               | 144            | 26(18.1)        | 21(14.6)        | 9(3.5)         | 5(10.3)        | 2(1.4)        | 4(2.8)         |
| <b>Total</b>         | <b>268</b>     | <b>44(16.4)</b> | <b>34(12.7)</b> | <b>23(8.6)</b> | <b>14(5.2)</b> | <b>7(3.4)</b> | <b>8(3)</b>    |
| <b>All age group</b> |                |                 |                 |                |                |               |                |
| Male                 | 176            | 21(11.9)        | 15(8.5)         | 18(10.2)       | 10(5.7)        | 5(2.8)        | 4(2.3)         |
| Female               | 208            | 31(14.9)        | 24(11.5)        | 9(4.3)         | 8(3.8)         | 3(1.4)        | 6(2.9)         |
| <b>Total</b>         | <b>384</b>     | <b>52(13.5)</b> | <b>39(10.2)</b> | <b>27(7.0)</b> | <b>18(4.7)</b> | <b>8(2.1)</b> | <b>10(2.7)</b> |

PPS= protozoan parasitic species, HPS=helminth parasitic species, MPS =multiple parasitic species, Eh/d= *Entamoeba histolytica/dispar*, Gl= *Giardia lamblia*, Al=*Ascaris lumbricoides*, Tt.=*Trichuris trichuria*, Hn= *Hymenolepis nana*

**Figure 5: Rate of infection of multiple parasites among children under five years at Addis Ketema sub city Health center, Addis Ababa during Sept. 2017- May 2018.**



**Eh/d**= *Entamoeba histolytica/dispar*, **Gl**= *Giardia lamblia*, **Al**=*Ascaris lumbricoides*, **Tt**=*Trichuris trichuria*, **Hn**= *Hymenolepis nana*, IR= infection rate

As shown in the above figure, *E. histolytica/dispar* and *G.lamblia* 4(1.04%), *E. histolytica/dispar* and *A. lumbricoides* 3(0.78), *E. histolytica/dispar* and *T. trichuria* 2(0.52%) and *G.lamblia*, *A. lumbricoides* and *T. trichuria* 1(0.26%) are double and triple infections, respectively.

#### 5.4. Association of intestinal parasitic infection with socio demographic characteristics of parents and care taker

This study has also analyzed correlation between socio-demographic factors of the children and the infection rate of intestinal parasitic infections are presented in (Table 4)

**Table.4. Associations of independent variables with intestinal parasites at Addis Ketema sub city Health center. Addis Ababa during Sept. 2017- May 2018.**

| Parameters                                      | Frequency<br>n=384 | Intestinal<br>Protozoan<br>Positive |      | Intestinal<br>Helminthes<br>Positive |      | Over all<br>Parasites<br>Positive |      | p-value |
|---|--------------------|-------------------------------------|------|--------------------------------------|------|-----------------------------------|------|---------|
|   |                    | No                                  | %    | No                                   | %    | No                                | %    |         |
|   |                    | <b>Parents educational level</b>    |      |                                      |      |                                   |      |         |
| Illiterate                                      | 94                 | 41                                  | 43.6 | 19                                   | 20.2 | 60                                | 63.0 | 0.043   |
| Primary education                               | 187                | 34                                  | 18.2 | 24                                   | 12.8 | 58                                | 31.0 |         |
| Secondary education                             | 68                 | 13                                  | 19.1 | 8                                    | 11.7 | 21                                | 30.9 |         |
| Diploma and above                               | 35                 | 3                                   | 8.6  | 2                                    | 5.7  | 5                                 | 14.3 |         |
| <b>Use of water and its handling</b>            |                    |                                     |      |                                      |      |                                   |      |         |
| Protected                                       | 246                | 40                                  | 16.3 | 17                                   | 6.9  | 57                                | 23.2 | 0.003   |
| Unprotected                                     | 138                | 51                                  | 36.9 | 36                                   | 26.1 | 87                                | 63.8 |         |
| <b>Personal hygiene</b>                         |                    |                                     |      |                                      |      |                                   |      |         |
| Poor  | 286                | 79                                  | 27.6 | 38                                   | 13.3 | 117                               | 40.9 | 0.042   |
| Good  | 98                 | 12                                  | 12.2 | 15                                   | 15.3 | 27                                | 27.6 |         |
| <b>Parents awareness of parasitic infection</b> |                    |                                     |      |                                      |      |                                   |      |         |
| Poor  | 298                | 77                                  | 25.8 | 44                                   | 14.8 | 121                               | 40.6 | 0.002   |
| Good  | 86                 | 14                                  | 16.3 | 9                                    | 10.5 | 23                                | 26.7 |         |
| <b>House condition</b>                          |                    |                                     |      |                                      |      |                                   |      |         |
| Poor  | 324                | 82                                  | 25.3 | 45                                   | 13.9 | 127                               | 39.2 | 0.042   |
| Good  | 60                 | 9                                   | 15   | 8                                    | 13.3 | 17                                | 28.3 |         |

Among the 384 participants of the study, 94 participants of the study were with illiterate parents, and infected with 41(43.6%) protozoan and 19(20.2%) helminthes parasitic infections. 187 participants of the study were parents who can read and write, and children infected with 34(18.2%) protozoan and 24(12.8%) helminthes parasitic infections, From 68

participants of the study whose parents completed Primary education, 13(19.1%) were found to be positive for protozoan and 8(11.7%) for helminthes infection. The remaining 35 participants of the study parents who had diploma and above, 3(8.6%) were found to be positive for protozoan and 2(5.7%) for helminthes infection. Parents educational level should statistically significant association with intestinal parasitic infection ( $p=0.43$ ).

246 participants of the study that used protected water, 40(16.3%) were found to be positive for protozoan parasites and 17(6.9%) for helminthic infection. From 138 participants of the study that use unprotected water, 51(36.9%) were found to be positive for protozoan and 36(26.1%) for helminthic infection. In this study, source of water and its handling were the major risk factors for the infection rate of intestinal parasites  $p=0.003$  (Table 4).

In the present study, out of 286 participants of the study who were with poor personal hygiene, 79(27.6%) and 38(13.3%) were found to be positive for protozoan and helminthes parasites infections, respectively (Table 4). About 98 participants of the study who were with good personal hygiene, 12(12.2%) and 15(15.3%) were found to be positive protozoan and helminthes parasites infections, respectively (Table 4). Children personal hygiene should statistically significance with intestinal parasitic infection ( $p=0.042$ ).

A total 298 parents with poor awareness of parasitic infection, out of these 77(25.8) and 44(14.8%) were positive for protozoan and helminths infection. From 86 parents with good awareness to parasitic infection 14(16.3%) and 9(10.5) were positive for protozoan and helminths infection. Parents and care giver life cycle and awareness to parasitic infection should statistical significance with intestinal parasitic ( $p=0.034$  and  $0.002$ ) respectively. (Table 4) About 324 parents with poor house condition, 82(25.3) and 45(14.8) were positive for protozoan and helminths infection. From 60 parents with good house condition, 9(15) and 8(13.3) were positive for protozoan and helminths infection. House condition were statistically significant with intestinal parasitic infection ( $p=0.042$ ).

Generally, highest prevalence of intestinal parasites could be due to contaminated water as this study has shown that significantly higher parasitic infections (63.8%) were found among children less than five years who drank contaminated water. Moreover, children less than five years born from illiterate mothers were more infected (63.0%). Similarly, the prevalence rate of intestinal parasitic infections were statistically significant ( $p<0.05$ ) with some risk factors such as personal hygiene, parents care giver life cycle, parents awareness to parasitic infection and house condition were the major factor for intestinal parasite infection.

##### **5.5. Parents ‘caretakers’ level of knowledge, attitude and practices of intestinal parasitic infection of children less than five years old**

Assessment parent /caretakers/ level of knowledge, attitude and practices of intestinal parasitic infection of children less than five years old is summarized and presented in table 5.

**Table.5 Association of parents'/caretakers' level of knowledge, attitude and practices with intestinal parasite infection under five year of aged**

| Character           | Number of respondents<br>N=384 | IPI            |                | p-value |
|---------------------|--------------------------------|----------------|----------------|---------|
|                     |                                | No Neg.<br>(%) | No pos.<br>(%) |         |
| <b>HWAUT</b>        |                                |                |                |         |
| Yes                 | 166                            | 139(83.7%)     | 27(16.3)       | 0.001   |
| No                  | 218                            | 101(46.3%)     | 117(53.6%)     |         |
| <b>HWM</b>          |                                |                |                |         |
| Always              | 124                            | 98(59.5)       | 26(20.9%)      | 0.002   |
| Sometimes           | 260                            | 142(54.6%)     | 118(45.4%)     |         |
| <b>W C</b>          |                                |                |                |         |
| By boiling          | 29                             | 23(79.3%)      | 6(20.6%)       | 0.014   |
| As it is(Tap water) | 355                            | 217(61.1%)     | 138(38.9%)     |         |
| <b>CM</b>           |                                |                |                |         |
| Always fresh        | 24                             | 21(87.5%)      | 3(12.5%)       | 0.012   |
| Sometimes           | 109                            | 77(70.6%)      | 32(29.4%)      |         |
| Not fresh           | 251                            | 142(56.6%)     | 109(43.4%)     |         |
| <b>NS</b>           |                                |                |                |         |
| Trimmed             | 59                             | 54(91.5%)      | 5(8.5%)        | 0.04    |
| Not Trimmed         | 355                            | 216(60.8%)     | 139(39.2%)     |         |
| <b>EPWFCV</b>       |                                |                |                |         |
| Sometimes           | 256                            | 136(53.1)      | 120(46.9)      | 0.013   |
| Never               | 128                            | 104(81.3%)     | 24(18.8%)      |         |

**HWAUT**=hand washing after using toilet, **HWM**=hand washing before meal, **WC**=Water consumption **CM**=Childs meal **NS**= Nail status, **EPWFCV**= eat properly washed fruit and cooked vegetables.

In the present study, mothers /caretakers/ limited knowledge about mode of transmission of intestinal parasitic infections as well as impact of infections on their children Among 166 participants have hand washing practice after using toilets, 139(83.7%) and 27(16.3%) negative and positive for intestinal parasites. Out of 218 participants who do not have hand

washing practice after using toilets, 101(46.3%) and 117(53.7%) were negative and positive for intestinal parasite infection. Among 124 participants, those have hand washing practice before meal, 98 (59.5%) and 26(20.9%) negative and positive for intestinal parasites. About 260 participant that have poor hand washing practice before meal, 142(54.6%) and 118(45.4%) negative and positive for intestinal parasites .The correlation between hand washing practice after using a toilet and before meal were statistically significant with intestinal parasitic infection ( $p=0.001$  and  $p=0.017$ ).

Among 29 participants who use boil water, 23(79.3%) were negative for intestinal parasite whereas 6(20.6%) were positive for intestinal parasites, 355 participant who use untreated pipe water as it is 217(61.1%) and 138(38.9%) negative and positive for intestinal parasite. There was statistically significant association between infections rate of intestinal parasitic and water consumption ( $p=0.002$ ).

Out of 24 participants who use a fresh meal, 21(87.5%) were negative for intestinal parasite whereas 3(12.5%) positive for intestinal parasite, 109 participant who eat sometimes a fresh meal 77(70.6%) negative for intestinal parasite and 32(29.4%) positive for intestinal parasite, 251participant who did not eat a fresh meal 142(56.6%) negative for intestinal parasite and 109(43.4%) positive for intestinal parasite. Childs meal condition was the major factor for the infection rate of intestinal parasite with statistically significant ( $p=0.012$ ).

In the present study, out of 59 of nail status trimmed 54 (91.5%) and 5(8.5%) were found to be negative and positive for intestinal parasites respectively (Table 5). About 355 participants who did not trim their nail 216(60.8%) were negative for intestinal parasite and 139(43.4%) positive for intestinal parasites. There was statistically significance association between intestinal parasitic infection and nail status ( $p=0.04$ ).

Among 256 participants of the study who sometimes consume properly washed fruit and cooked vegetables, 136 (53.1%) were negative for intestinal parasites and 120(46.9%) positive for intestinal parasites, 128 participants did not eat properly washed fruit and cooked vegetables 104(81.3%) and 24(18.8%) were negative and positives for intestinal parasite. There was statistically significant association between infection rate of intestinal parasitic infection and eating properly washed fruit and cooked vegetables ( $p=0.013$ )

#### **5.6. Associated morbidity related factors for intestinal parasitic infections of children less than five years old in Addis Ketema healthy center**

The study participants were examined physically for variables such as children hygienic condition children physical condition, stool type, nausea, abdominal discomfort, vomiting and other abnormalities by the physician and investigator and assessed for correlation with intestinal parasitic infection (Table 6).

**Table.6. observed clinical signs and symptoms among examined children (n= 384) of less than five years old and its relationship with intestinal parasitic infections, during Sept. 2017- May 2018.**

| Clinical manifestation      | frequency | IPI            |                | P-Value |
|-----------------------------|-----------|----------------|----------------|---------|
|                             |           | No pos.<br>(%) | No neg.<br>(%) |         |
| <b>CHC</b>                  |           |                |                |         |
| Poor                        | 116       | 91(78.4% )     | 25(21.6%)      | .000    |
| Good                        | 268       | 53(19.8%)      | 215(80.2%)     |         |
| <b>CPC</b>                  |           |                |                |         |
| Poor                        | 292       | 112(45.2%)     | 180(61.6%)     | .000    |
| Good                        | 92        | 32(34.7%)      | 60(65.2%)      |         |
| <b>Stool type</b>           |           |                |                |         |
| Diarrheic                   | 309       | 124(40.1%)     | 185(59.9%)     | .000    |
| Non diarrheic               | 75        | 20(26.7%)      | 55(73.3%)      |         |
| <b>Nausea</b>               |           |                |                |         |
| Yes                         | 225       | 117(52%)       | 108(48%)       |         |
| No                          | 159       | 27(16.9)       | 132(83%)       | .002    |
| <b>Loss of Appetite</b>     |           |                |                |         |
| Yes.                        | 302       | 132(43.7%)     | 170(56.3%)     | .000    |
| No                          | 82        | 12(14.6%)      | 70(85.4%)      |         |
| <b>Abdominal discomfort</b> |           |                |                |         |
| Yes                         | 252       | 119(47.2%)     | 133(52.8%)     | 0.001   |
| No                          | 132       | 25(18.9%)      | 107(81.1%)     |         |

**CHC=Childs hygienic condition, CPC=Childs physical condition**

The infection rate of intestinal protozoan parasite infections of both sex and all age group and clinical manifestation like poor children hygienic conditions, physical condition was highly significant (P = 0.000) (Table 6).

In present study, out of 116 participant children with poor growth, 91(78.4%) and 25(21.6%) were positive and negative for intestinal parasites. Among children with 268 good physical condition, 53(19.8%) and 215(80.2%) positive and negative for intestinal parasites. From 309

participant that have diarrhea, 124(40.1%) and 185(59.9%) were found to be positive and negative for intestinal parasites. There was statistically significant association between intestinal parasitic infection and child's physical condition and stool type ( $p < 0.05$ ).

Among 302 participants with loss their appetite, 117(52%) and 108(48%) positive and negative for intestinal parasitic infection. About 82 participants who have no problem in their appetite, 12(44.6%) positive and 70(85.4%) negative for intestinal parasites. From 252 participants with symptom of abdominal pain, 119(47.2%) and 133(52.8%) were positive and negative for intestinal parasites. Among 132 participants that do not feel abdominal pain, 25(18.9%) and 107(81.1%) were positive and negative for intestinal parasites. There was statistically significant association between intestinal parasitic infection and abdominal pain as well as loss of appetite ( $P < 0.05$ ).

The infection rate of human intestinal parasite infections in children at the study site in relation to personal hygiene and physical conditions was highly associated with intestinal parasitic infections and revealed greater significant ( $p < 0.05$ ). Human intestinal parasite infections in children at the study site in relation to clinical manifestations like abdominal pain, 119(47.2%), poor child hygienic condition 91(78.4%), loss of appetite 132(43.7%) was greatly related to IPI.

Generally, regarding the morbidity related factor for intestinal parasitic infections, almost all the mothers suggested one or more symptoms like diarrhea, vomiting, loss of appetite and abdominal pain. They also responded that infection with intestinal parasites could cause growth retardation, thinness, weakness and child death. This morbidity Related Factor for Intestinal Parasitic Infections of Children Less than Five Years were statistically significant association with intestinal parasitic infections ( $P < 0.05$ ).

## 6. DISCUSSION

In this study, the prevalence of both intestinal helminthic and protozoan infections among children under-five year old was determined in Addis ketema sub city, Addis Abeba, Ethiopia. The results of the study revealed that the presence of various intestinal parasitic infections in various degrees among children under-five year old. The overall prevalence of intestinal parasitic infection in the present study was 37.5%, out of this 23.7% protozoan and 13.8 % helminthes parasitic infections. Intestinal protozoan infection seemed to be more problem than the helminthes parasites. The overall prevalence of intestinal parasitic infection was 37.5%. This study was higher than the study conducted in Gamo area, southern Ethiopia found a prevalence of 29.4%, (Wegaheyu *et al.*, 2013); while Haftu *et al* (2014) reported 27.9% prevalence in Arbaminch town, Southern Ethiopia, 25.6% reported from Kenya (Mbae *et al.*, 2013), Tilanesh *et al.*, (2018) Debre Birhan referral hospital, North Shoa, 17.3%, Eyasu *et al.*, (2010) 34.6% in Benishangul-Gumuz, Girum, (2005) 27.2% in Babile town, eastern Ethiopia, Al-Hindi and Aboud (2008) 16.6% in Gaza, Palestine. However, other reported was lower when compared with a study done in Shesha Kekele, Wondo Genet, Southern Ethiopia that reported a prevalence rate of 85.1% (Nyantekyi *et al.*, 2010), in Yergalem hospital, 49.5%, (Firdu *et al.*, 2014) and Teda Health Center, Northwestern Ethiopia, 62.3%, (Abate *et al*, 2013), Northern Gondar (79.8%), Asrat *et al.*, (2011) and Teda Health Center, Northwestern Ethiopia (62.3%) Abraraw *et al* (2013). These reported differences in prevalence of intestinal parasites among different studies might be associated with differences in parasitological methods used, level of environmental sanitation, drinking water source, parents' educational level and personal hygiene. High prevalence of intestinal parasitic infection is a direct manifestation of poor environmental sanitation and low level of awareness.

The infection rate of IHPI in male children under-five years was greater than that of females, this might be male children have a chance to play out of their homes and increased the chance of infection with soil transmitted helminths. The infection rate of intestinal parasite and species diversity in the study site revealed that increment with age group as the age increased; particularly it was highest in age group from 4.1-5 years old 45.5% This might be due to the common childhood behaviors of eating soil, neglecting to wash hands after defecation eating meal, using non-purified water and improper cleaning of child dining utensil.

Highest prevalence of pathogenic protozoa infections are known to cause diseases in children (CDC, 2010). The transmission of these parasites occurs by ingestion of cysts through the fecal-oral route, either directly, via person to person contact or indirectly, via contamination of surface water or food (Gabbad *et al.*, 2014).Soil transmitted helminthes infections is the cause of common health problems in tropical and subtropical areas, with the greatest numbers occurring in sub-Saharan Africa, the Americas, China and East Asia (WHO,

2018). Younger children are predisposed to heavy infections with intestinal parasites since their immune systems are not yet fully developed, and they also habitually play in faecally contaminated soil. In addition to considerable mortality and morbidity, infection with intestinal protozoan helminthes parasites have been found to profoundly effect on a child's mental development, growth and physical fitness while also predisposing children to other infectious agents (Mbae *et al.*, 2013).

Among 384 children whose stool samples were examined, 62.5% free from intestinal parasitic infection, 91 (23.7%) and 53 (13.5%) were infected with intestinal protozoan and helminths parasites respectively. Pathogenic protozoa infections were higher prevalent then intestinal helminths infection. The transmission of these parasites occurs by ingestion of cysts through the fecal–oral route, either directly, via person to person contact or indirectly, via contamination of surface water or food. In the present study, the highest prevalence of protozoa parasites could be due to contaminated water and food, as this study has shown that significantly higher protozoan parasitic infections 91(23.7%) were found among under-five children. Public health interventions such as the provision of community health education, observation of food hygiene, and maintenance of functioning sanitation systems are fundamental to prevent intestinal infection (CDC, 2011). Intestinal parasitic infection, particularly IPPI and STH infections are the cause of common health problems in tropical countries. Younger children are predisposed to heavy infections with intestinal parasites since their immune systems are not yet fully developed, and they also habitually play in faecally contaminated soil. In addition to considerable mortality and morbidity, infection with intestinal protozoan and helminths parasites have been found to profoundly effect on a child's mental development, growth and physical fitness while also predisposing children to other infectious agents (WHO, 2018).

The infection rate of intestinal parasite and species diversity in the study site revealed that increment with age group as the age increased. This might be due to the common childhood behaviors of eating soil, neglecting to wash hands after defecation and eating meal, using non-purified water and improper cleaning of child dinning utensils.

*Entamoeba histolytica/dispar/* and *Giardia lamblia* were the major protozoan parasites identified in this study with the prevalence of 13.5% and 10.2%, respectively. *E. histolytica/dispar* with the prevalence of 13.5% was the most prevalent protozoan parasitic infection in the present study which is similar to a finding from a study conducted in Nigeria 13.1% (wosu *et al.*, 2014). In contrast, a study conducted Sharjah, United Arab Emirates, showed lower prevalence of *E. histolytica/dispar* 4.7% (Nihar *et al.*, 2010). Furthermore, lower prevalence 0.4% of *E. histolytica/dispar* was reported from a study conducted in Malaysia (Nasr *et al.*, 2013). In Ethiopia, a study conducted in Delgi, Northern Gondar (Asrat *et al.*, 2011) showed higher prevalence of *E. histolytica/dispar* (27.3%) than the present study. In contrast, lower prevalence of *E. histolytica/dispar* was reported from

Southern Ethiopia, 2.1%, (Haftu *et al.*, 2013) and Northwestern Ethiopia, 4.6%. (Gelaw *et al.*, 2013).

The major helminth parasites identified in the stool samples of children were *A.lumbricoides* (7%), *T. trichiura* (4.7%), *H. nana* (2.1%). *A.lumbricoides* was the most prevalent helminth parasites in the study sites. The prevalence of intestinal helminthes was in agreement with previous studies conducted in Northern Gondar (Asrat *et al.*, 2011). For instance, as compared to the present study higher prevalence of *A. lumbricoides* (48%) and *H. nana* (11.5%) were reported among Delgi school children, Northern Gondar (Asrat *et al.*, 2011). Hand washing habit before eating and after defecations and finger nail cleanness were strongly associated with intestinal parasitic infection in this study. This was in agreement with a study conducted in Delgi, Northern Gondar (Asrat *et al.*, 2011), in Teda Health Center, Northwestern Ethiopia (Abate *et al.*, 2013). Similar association of intestinal parasitic infection with the hand washing habit after defecations and before eating was reported from Ethiopia (Gelaw *et al.* 2013) and Saudi Arabia (Nihar *et al.*, 2010). Hands and fingers of children might be easily contaminated with soil that contains cyst and eggs of parasitic organism that leads to intestinal infection. Furthermore, a significant correlation was observed in hand washing practice before meal and after defecation and finger nail cleanness with IPI.

Regarding the morbidity related factors for intestinal parasitic infections, almost all the parents and caregiver suggested one or more symptoms like diarrhea, vomiting, loss of appetite and abdominal pain. Infection with intestinal parasites could cause growth retardation, thinness, weakness, and child death. This morbidity related factor for intestinal Parasitic Infections of Children Less than Five Years were statistically significant association with intestinal parasitic infections. In this study, infection rate of intestinal protozoan parasite infections in all age group and clinical manifestation like poor children hygienic conditions, physical condition was highly significant ( $P = 0.000$ ). This result was consistent with a study conducted in Debre Birhan referral hospital, North Shoa, Ethiopia (Telanesh *et al.*, 2018).

In conclusion, the results of the present study revealed that intestinal parasitic infections were prevalent in various magnitudes among children under-five years old in the study area. The study also revealed that parents and care giver life skill, parent's awareness to parasitic infection and house condition were the major factors for intestinal parasite infection. In addition to this poor hand washing practice after defecations and before eating, water consumption, nail cleanness and eating unwashed fruit and vegetables also involve in the prevalence of intestinal parasites. Therefore, improvement of sanitation and provision of health education are required to control and eliminate all intestinal parasitic infections of children under-five years of age in the study area.

## **7. CONCLUSION AND RECOMMENDATIONS**

### **7.1. Conclusion**

The common intestinal parasite species diagnosed among under-five aged children of Addis Ketema Sub-City Health Center were *E.histolytica/dispar*, *G.lamblia*, *A.lumbricoides*, *T. trichiura* and *H. nana*. The finding reported in the present study shows that intestinal protozoan and helminthes parasitic infections represent a health problem among under-five aged children of Addis Ketema Sub-City Health Center. Most intestinal parasitic infections represent a child health threat because of their contaminated water and foods born transmission. *E. histolytica*, *G.lamblia*, *A. lumbricoides* and *T. trichiura* were found as a dominant species of intestinal protozoans and helminth parasites diagnosed in the stool samples of the children and have a higher Infection rate in the age group of 4.1-5 years old. Association was observed between prevalence of human intestinal infection and children eating unwashed fruits and uncooked vegetables and hand washing practice before meal and after defecation. Providing of washed fruits and cooked vegetables, proper hand washing practice, well protected and treated drinking water, proper education on hygienic and environmental sanitation would help in reducing the prevalence of intestinal parasites infection and need more medical attention to avoid the intestinal parasites consequences.

### **7. 2. Recommendations**

The findings of the present study showed that human intestinal parasite infections were prevalent among under- five aged children. The Infection rate of intestinal parasite infections in the study area indicated that much work remains to be done in improving the health of the children from intestinal parasitic infections. This calls for the initiation of control measures including treatment of infected children, improvement of personal hygiene and environmental sanitation, and provision of clean water and foods. The impact of each measure would be maximized through the health education program directed to families and their children in particular, and to communities level in general.

Generally, health authorities should make concerned efforts to ensure the prevention of these parasitic protozoan and Helminthes from infecting children. For the control of these parasitic infections, a half-yearly repeated anti parasitic treatment is recommended for children as well as the community to reduce re-infection. This is because if one is de-wormed at intervals, there is a possibility of killing most parasitic helminthes and protozoan parasite cysts in the intestine +before they cause heavy infestation leading to severe health consequences. Therefore, to reduce the prevalence of intestinal soil-transmitted helminth and protozoan infections, increase the knowledge and awareness about the causes and prevention mechanism of intestinal parasitic infections through:

- ☞ Providing training and creating awareness to children families about personal hygiene, environmental sanitation, proper waste disposal, transmissions and preventions of human intestinal parasite infections.
- ☞ Establishing and maintenance of a network for the treatment of intestinal parasitic infections and provision of health education program in family and community level.
- ☞ Further studies should be required in the study area such as, a longitudinal study on the prevalence of intestinal parasite infections and associated risk factors.
- ☞ Prevent faecal contamination of the environment by using latrines and protecting water supply from faecal contamination.

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## Appendices-I English questioners

### CONSENT FORM

An ensuring format of parents whose children are not old enough to begin schooling:

My respectful greetings go to you here

I am a post graduate student from Biology department, Addis Abeba University. I am here to study the current status of intestinal parasitic infection in children under 5 years of age. The information provided by you in this questionnaire will be used for research purposes. It will not be used in a manner which would allow identification of your individual responses. Stool examination may be necessary if your child has fever, or the stool is mucoid and bloody. I am planning to study the rate of Intestinal parasite by examining stool. On your agreement I would like to examine the stool of your child. If you agree to participate in this study you may expect the following:

- ☞ Stool samples will be taken processed for direct microscopy and concentrated techniques. The result will be informed to the respective physician.
- ☞ Despite your willingness, the researcher kindly request you to give your genuine response for each question

If the above conditions are acceptable to you, please sign on this form

Investigator

Signature

Date: \_\_\_\_\_

Parent/ Guardian

Signature

Date: \_\_\_\_\_

## Questionnaires format

1. Code No. \_\_\_\_\_
2. Age: \_\_\_\_\_ months. Sex: \_\_\_\_\_ (M / F). Child lives with parents: \_\_\_\_\_ (Yes / No).
3. Father Age \_\_\_\_\_ years. Health status \_\_\_\_\_  
A=Healthy  
B=Sick  
C=Died).
4. Mother Age \_\_\_\_\_ years. Health status \_\_\_\_\_  
A=Healthy  
B=Sick  
C=Died).
5. Maternal Education: \_\_\_\_\_  
A=Illiterate                      C= Secondary education  
B=primary education        D =diploma and above
6. Total monthly family income: \_\_\_\_\_ in birr.
7. Duration of diarrhoea \_\_\_\_\_ days. History of fever \_\_\_\_\_ days.
8. Do you wash your hands before meal and after latrine use?  
A. Always                      B. sometimes        C. Never
9. Do you eat properly cooked washed fruits and vegetables? A) sometimes B) never
10. Which latrine type do you use?  
A. Private                      B. Public
11. Water consumption;  
A. By boiling                      B. as it is
12. Your child meal is;  
A. always fresh                      B. sometimes fresh        C. not fresh
13. Your child playing ground is:  
A. clean                      B. not clean
14. Do you cut your child nail when grown?  
A. Always                      B. sometimes                      C. Never
15. Did you get information and training about personal and environmental hygiene and sanitation respectively before?  
A. Yes                      B.No

Appendix-II-Amharic questioners

በጎፈቃደኝነት ማረጋገጫ

እድሜያቸው ለትምህርት ያልደረሱ ህጻናት ወላጆች መረጃ መስጫ ና በጎፈቃደኝነት ማረጋገጫ ቅፅ

ጤና ይሰጣልኝ !!

እኔ በአዲስ አበባ ዩኒቨርሲቲ ባዮሎጂ ዲፓርትመንት የድህረም ረቃተማሪ ነኝ።እዚህ የተገኘሁበት ዋና አላማ እድሜያቸው 5 አመት በታች የሆኑ ህጻናትን ስለሚያጠቃው የአንጀት ጥገኛ ተህዋስ በሽታ ለማጥናት ነው ።ለመጠየቁ የሚሰጡት መረጃ ለጥናታዊ ምርምር የሚውል ነው።ይሁንና የእርሶን ማንነት ለማጥናት አይውልም ።በጎፈቃደኛ ከሆኑ ልጅዎ ትኩሳት፣ሰገራው ደም ያዘለ ወይም ንፍጥ መሰል ዝልግልግ ነገር ካለበት ሰገራ እንዲሰጥ ሊጠየቅ ይችላል። የተሰበሰቡ የሰገራ ናሙናዎችን በማጥናት የአንጀት ጥገኛ ህዋስ በሽታን ስርዐት ማጥናት የዚህ ጥናታዊ ፅሁፍ ዋነኛ እቅድ ነው።በዚህ ጥናታዊ ጽሁፍ ለመካተት ከተስማሙ የሚከተሉትን እንዲያሟሉ ይጠየቃሉ።

- ☞ ልጅዎ ከላይ የተዘረዘሩ ምልክቶች ካለበት የሰገራ ናሙና እንዲሰጥ ይጠየቃል።
- ☞ መጠየቆቹ በሚያዙት መሰረት እውነተኛ እና ትክክለኛ መልሶችን እንዲሰጡ በትህትና ይጠየቃሉ።

ከላይ በተዘረዘረው ማብራሪያ መሰረት በዚህ ጥናታዊ ፅሁፍ ለመሳተፍ ከተስማሙ እባክዎ ከታች በተጠቀሰው ቅፅ ይፈርሙ።

|             |                  |
|-------------|------------------|
| መጠየቁን ያደረገው | ያጠነከረው የወላጅ/የሳዳጊ |
| ፊርማ         | ፊርማ              |
| ቀን          | ቀን               |

**መጠይቅ**

1. መለያ ቁጥር
2. የልጁ/ጄን ጸድማ ወር ጾታ/ወ/ሴ ልጅ/ጄን ከወላጆቹ ጋር ነው የሚኖረው/አዎ/ አይደለም
3. የአባት ጸድማ አመት:: የጤና ሁኔታ  

ሀ= ጤናማ
ለ= ታማሚ
ሐ= ህይወቱ ያለፈ
4. የእናቱ ጸድማ \_\_\_\_\_ :: የጤና ሁኔታ  

ሀ= ጤናማ
ለ= ታማሚ
ሐ= ህይወቱ ያለፈ
5. የእናት ትምህርት ሁኔታ  

ሀ= ያልተማሩ
ለ= የመጀመሪያ ደረጃ ትምህርት የተማሩ
ሐ= ሁለተኛ ደረጃ የተማሩ
መ= ዲፕሎማና ከዚያ በላይ የተማሩ
6. የቤተሰብ የገቢ ሁኔታ-----ብር
7. የተቅማጥ የጊዜ ቆይታ ለ----- ቀን:: ከዚህ በፊት የትኩሳት ሁኔታ ለ\_\_\_\_\_ ቀን::
8. እጅዎትን ምግብ ከመመገብ በፊት እና ከሽንት ቤት መልስ ይታጠባሉ?  

ሀ= ሁሉም
ለ= አልፎ አልፎ
ሐ= በፍጹም አልታጠብም
9. በአግባቡ ያልታጠቡ ና ያልበሰሉ አትክልት እና ፍራፍሬ ትመገባላችሁ  

ሀ= ሁሉም
ለ= አልፎ አልፎ
ሐ= በፍጹም አንመገብም
10. የምትጠቀሙት የመጻፍት አይነት ምንድን ነው?  

ሀ= የግል
ለ= የህዝብ
11. የውሃ አጠቃቀም ምን ይመስላል?  

ሀ= በማፍላት
ለ= እንዳለ
12. የልጅዎ ምግብ  

ሀ= ሁልጊዜ ትኩስ የሆነ
ለ= አልፎ አልፎ ትኩስ
ሐ= ብዙ ጊዜ የዋለ
13. የልጁ/ጄን የመጫወቻ ቦታ  

ሀ= ፅዳት ያለው
ለ= ፅዳቱ የጓደለ
14. የልጅዎ ጥፍር ሲያድግ በዎቅቱ ይቆርጣሉ?  

ሀ= ሁልጊዜ
ለ= አልፎ አልፎ
ሐ= የለም
15. ከዚህ በፊት ስለግልና አካባቢ ጎጂና ትምህርት አግኝተው ያውቃሉ?  

ሀ= አዎ
ለ= የለም

**Appendices-III** Data collection format for parasitological analysis

| Lab. Code No | Sex | Age | Parasite | Single infection | Double infections | Multiple infections | Direct Microscopy | Conc. Method | Remark |
|--------------|-----|-----|----------|------------------|-------------------|---------------------|-------------------|--------------|--------|
|              |     |     |          |                  |                   |                     |                   |              |        |

**Appendices-IV** Result report for parasitological examination

**Code No.** \_\_\_\_\_ **Sex** \_\_\_\_\_ **Age** \_\_\_\_\_

Address Woreda \_\_\_\_\_ Kebele \_\_\_\_\_ Tel. \_\_\_\_\_

Type of specimen \_\_\_\_\_ Appearance \_\_\_\_\_

Date of collection \_\_\_\_\_

Ova/parasite

Parasite identified:      Positive \_\_\_\_\_      Negative \_\_\_\_\_

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

Remark: \_\_\_\_\_

\_\_\_\_\_

Date Reported \_\_\_\_\_      Signature \_\_\_\_\_

**Appendices V; Observed Clinical Signs and Symptoms recording format**

|                                      |  |  |
|--------------------------------------|--|--|
| <b>Children's hygienic condition</b> |  |  |
| Poor                                 |  |  |
| Good                                 |  |  |
| <b>Children's physical condition</b> |  |  |
| Poor                                 |  |  |
| Good                                 |  |  |
| <b>Stool type</b>                    |  |  |
| Diarrheic                            |  |  |
| No diarrheic                         |  |  |
| <b>Abdominal discomfort</b>          |  |  |
| Yes                                  |  |  |
| No                                   |  |  |
| <b>Nausea</b>                        |  |  |
| Yes                                  |  |  |
| No                                   |  |  |
| <b>Loss of appetite</b>              |  |  |
| Yes                                  |  |  |
| No                                   |  |  |
| <b>Vomiting</b>                      |  |  |
| Yes                                  |  |  |
| No                                   |  |  |

**X= for agreement**

**Y= for disagreement**



**Declaration**

I, the undersigned declare that thesis is my original work in partial fulfillment of the requirement for the master of general Biology. I also declare that it has never been presented in this or any other university and that all resource and materials in the proposal have duly acknowledged.

Student name Genene Teshome

Signature \_\_\_\_\_

Date of submission \_\_\_\_\_

This thesis has been submitted for examination with my approval as a university advisor.

Advisor Name \_\_\_\_\_

Signature \_\_\_\_\_

Date of submission \_\_\_\_\_