PREVALENCE OF INTESTINAL PARASITIC INFECTIONS AND ASSOCIATED RISK FACTORS AMONG SCHOOL CHILDREN IN GORA PRIMARY SCHOOL, IJAJI TOWN, ILU GELAN WOREDA, WEST SHOA, OROMIA REGIONAL STATE, ETHIOPIA

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Prevalence of Intestinal Parasite Infections and Associated Risk Factors among School Children in Gora Primary School, Ijaji Town, Ilu Gelan Woreda, West Shoa, Oromia Regional State, Ethiopia

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DEDICATION

I dedicate this thesis to my whole family for their endless love, support, and encouragement during this study.

STATEMENT OF THE AUTHOR

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BIOGRAPHICAL SKETCH

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LIST OF ABBREVIATIONS AND ACRONYMS

CDC	Center for Disease Control
CI	Confidence Interval
DALY	Disability Adjusted Life Years
Epg	Eggs per gram of feces
IPI	Intestinal Parasite Infections
NCCLS	National Committee on clinical Laboratory Standard
NTD	Neglected Tropical Diseases
OR	Odd ratio

P-value	Probability Value
SBB	School of Biological Sciences and Biotechnology
SD	Standard Deviation
SPSS	Statistical Package for the Social Science
WHO	World Health Organization

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Prevalence of Intestinal Parasitic Infections and Associated Risk Factors among School Children in Gora Primary School, Ijaji Town, Ilu Gelan Woreda, West Shoa, Oromia Regional State, Ethiopia.

ABSTRACT

Intestinal parasite infections constitute major public health challenges among school children in developing tropical and sub-tropical countries. They are distributed throughout the world with high prevalence rates especially in developing countries including Ethiopia. The objective of the present study was to determine the prevalence of intestinal parasite infections and associated risk factors among school children in Gora Primary School of Oromia Region, Ethiopia. The design of the study was cross- sectional survey, involving 408 participants (203 males and 205 females, age ranging from 7-18 years). The children were selected using stratified random sampling method to participate in this study. Fresh stool samples were collected and processed for microscopic examinations using direct wet-mount and Formol-Ether concentration methods. Structured pre-tested questionnaires were administered to gather relevant information on demographic data of the school children. The data were analyzed using SPSS version 16 software. The overall prevalence of parasitic infections were 27.9 % (31.01% for males and 24.8% for females). Multiple infections with three parasites were found in 1.2 % (5/408) of the sample participants. The prevalence of Entamoeba histolytica, Ascaris lumbricoides, Giardia lambilia, Hymenolepsis nana and hookworm infections were 15.2%, 6.9%,2.4%, 2.2%, and 1.2%, respectively. The prevalence of intestinal parasite infections were significantly associated with washing hands after

defecation (p=0.007). Most of the socio-demographic factors, (family size, parents' occupation, parent educational level, and personal hygiene, source of water and its handling, shoes wearing and residence) were not significantly associated with intestinal parasite infections. Coordinated work with health officers and school community is required on the investigation of intestinal parasite infections.

Keywords*/Phrases:* Ijaji town, Parasitic Infections, Prevalence, Risk factors and school children, Oromia.

1. INTRODUCTION

Intestinal parasite infections were major public health problems in several tropical and subtropical developing countries like Ethiopia with poor socio-economic status. This was more common in school going children and was associated with high morbidity, mortality and economic loss to the country (Mengistu and Berhanu, 2004.)

The parasitic infections had a far reaching impact on human health, economics and culture. Although individuals from all societies and regions harbor parasites at some time in their lives, the highest rates of infections occur among children in rural areas (Brooker, *et al*., 2006). It was estimated that about, more than 3.5 billion people were infected with intestinal parasites with an average prevalence of 50% in developed world and almost 95% in developing countries (WHO, 2014). In addition approximately 300 million people were severely ill with parasites and of these, at least 50% were school-age children (WHO, 2010).

The common intestinal parasites of humans are *Entamoeba histolytica, Giardia lamblia and Cryptosporidium* and intestinal helmith parasites such as *Ascaris lumricoides, Trichura trichiura, Ancylostoma duodenale and Nector americanus* (WHO, 2007).

Amebiasis is an infection caused by intestinal protozoan parasites, *Entamoeba histolytica* which was the most common cause of death from parasitic disease. Most developing countries were the highest prevalence areas of this disease due to inadequate sanitation and crowding (Fayer and Ungar, 1986). Humans are the only host for virulent cysts of *E. histolytica /dispar* (Bethony *et al*., 2001; Haque *et al*., 2003).

Giardia lamblia is another major intestinal protozoan parasite commonly causes diarrheal disease throughout the world. Mostly it infects children younger than 10 years than adults particularly those who were malnourished (Marco *et al*., 2008). The prevalence rates of giardiasis had been found to be 2 to 7% in developed countries and 20 to 30% in developing countries (Sehgal, *et al*., 2010). The variation in prevalence depends on factors such as the geographical area; the urban or rural setting of the society, the age group

composition and the socio economical conditions of the study subject (Sebastian *et al*., 2007).

Cryptosporidiosis was another intestinal protozoan parasite infection which was caused by *Cryptosporidium* species. It causes severe diarrhea in immune compromised patients (Edelduok *et al*., 2013).

Intestinal parasitic infections caused by pathogenic helminths and protozoan species were prevalent throughout the world. Developing countries including Ethiopia were reported to be the most affected parts of the world in which the majority of the cases occur among school age children (WHO, 2012).

The major intestinal parasitic infections were transmited by the fecal oral route and facilitate through poor personal hygiene, environmental conditions like contaminations of food and water sources with human feces, sewage, contaminated irrigation water and improper handling of human food (Daryani *et al.,* 2008).

The distribution of intestinal parasitic infection depends on many factors. These include poverty, illiteracy, poor hygiene, lack of access to potable water and existence of semi arid and humid tropical climate were the factors associated with intestinal parasitic infections (Abebe *et al*., 2011). Indeed, intestinal parasitic infections have been linked with an increased risk for nutritional anemia, protein-energy malnutrition and growth deficits in children, low pregnancy weight gain and intrauterine growth retardation followed by low birth weight (Sackey *et al.,* 2003). Many infections caused by intestinal protozoan and helminths parasites were cosmopolitan in distribution (Crompton and Nesheim, 2002).

The public health importance of intestinal parasitic infections ranked highest in morbidity rate among school age children who often possess heavy worm infections because of their vulnerability to nutritional deficiency (Bethony *et al*., 2006).

Intestinal parasite infections cause serious public health problem in Ethiopia. Moreover, a number of surveys had shown that intestinal protozoa and nematode parasites were prevalent in varying magnitudes. The prevalence of hookworm, *Ascaris lumbricoides,* and *Trichuris trichiura* were estimated to be 16%, 37% and 30%, respectively (Tadesse and Tsehaye, 2008). The distribution of these parasite species varies by place and with age (Belyhun *et al.,* 2010).

It is well established fact that intestinal parasites are common in school going children and they are associated with high morbidity and mortality and economic loss to the country. Therefore, it was very crucial to know the prevalence of intestinal parasite infections of school children and its association with socio demographic characteristic ofpa rents /caretakers of school children as well as anthropometric measurements of school children. So far, there was no published information in the study area regarding the prevalence of intestinal parasitic infections in children. Thus this research was designed to determine the prevalence of intestinal parasitic infection and associated risk factors among Gora Primary School children in Ijaji town Ilu Gelan Woreda West Shoa, Oromia Regional State.

General objective

The general objective of this study was to assess the prevalence of intestinal parasitic infections and associated risk factors among Children at Gora Primary School, Ijaji town Ilu Gelan Woreda, West Shoa, Oromia Regional State.

Specific objectives were

1. To determine the prevalence of intestinal parasitic infections of primary school Children in the study area.
2. To identify the major intestinal parasitic species in the study population.
3. To identify risk factors associated with intestinal parasites infection.

2. LITERATURE REVIEW

2.1. Intestinal Parasites

Intestinal parasites were those parasites which enter and infect both animal and human. Even though, they located and live throughout the body, they particularly prefer the intestinal wall (Louko, 2007).

Even though, most of human gastrointestinal parasites were cosmopolitans in their distribution, some of them were endemic in tropical and subtropical regions and most parasitic infection were common in area where there were low standards of hygiene and sanitation, and in tropical regions, the use of human faeces as a fertilizer was also common factor for prevalence of these infection (Mengistu, *et al.,* 2004).

Transmission of intestinal parasites usually conducted through directly or indirectly faecal contamination, but their distribution in different geographical location would vary depending on many factors involved in the maintenance of life cycle of each parasite and the majority did not require intermediate hosts and had a wider distribution, while other need obligatory hosts, climatic condition and habitat requirement naturally found or modified by human activity (Tilahun *et al*., 2010)

Infection brought by protozoan and helminthes have variation in both host immune response and epidemiology in that helminthes were macro parasites which reproduce sexually within the definitive hosts where they can lived for several years, while protozoan were micro parasites that were able to reproduced within the host and cause relatively short lived infection (Maizels *et al,*2009). According to WHO estimation, approximately 50 million people worldwide suffer from invasive amoebic infection each year (WHO, 2012, Petri *et al*., 2000).

The cause of acquiring intestinal parasites depends on several factors and the worldwide distribution of parasites determined by geographical factors, socio-economic, age, and crowding with poor food preparation and lack of standard clean water and personal sanitation being the major factors (Ronald, *et al.*, 2007). Most of population in developing world, especially children infected with intestinal parasites (Allen and Maizels, 2006).

As a result of their closed linked with lack of sanitation, lack of access to safe water, and improper hygiene, intestinal parasitic infection become a disease of poverty and under

development (WHO,2002) and infections of school age children by poly parasitism with intestinal parasites became the greatest heath burden in developing countries (Drake, *et al*.,2005). Even though intestinal parasitic infections rarely cause death, they have high burden of disease which was related to less mortality to the chronic and accidental effects on health and nutritional status of the host (Stephenson *et al.,* 2004). Intestinal parasites not only affect the health condition of the children, they can also impair the physical and mental growth of children, educational achievement and hinder economic development (Drake *et al*., 2003). So, intestinal parasites had a negative consequence on children through becoming barrier to the children's progress in the school (Wang *et al*., 2012).

2.2. Life cycle and transmission of intestinal parasites

2.2.1. Life cycle and transmission of intestinal protozoan parasites

Several members of the genus *Entamoeba* infect humans. Among these only *E. histolytica* is considered pathogenic and the disease it causes was called amoebiasis or amebic dysentery. It is estimated that up to 10% of the world's population may be infected with either *E. histolytica* or *E. dispar* and in many tropical countries the prevalence would approach 50%. It is also estimated that about 100,000 deaths and 50 million cases of amoebiasis occur per year in the world and humans were the only host of *E. histolytica* and there were no animal reservoirs (Haque *et al.*, 2003).

The life cycle of *Entamoeba histolytica* as showed in figure-1(in the next page) includes the infective cyst and the invasive trophozoite forms. Infection was acquired by ingestion of infectious cyst through water or undercooked food contaminated by human feaces. After ingestion of the cyst, which was resistant to gastric acids and enzymes, excystation occurs in the ileoceacal area of the intestine to form trophozoites. The trophozoites were larger in size and actively motile organisms. According to the bind-lyses-eat model, the trophozoites bind to the large intestine and invade the wall releasing amoeba pores and phospholipidases, causing ulceration of the mucous membrane (called flask shaped ulcers), and sometimes large vessels may be eroded and severe intestinal hemorrhage result (Petri and Singh,1999).

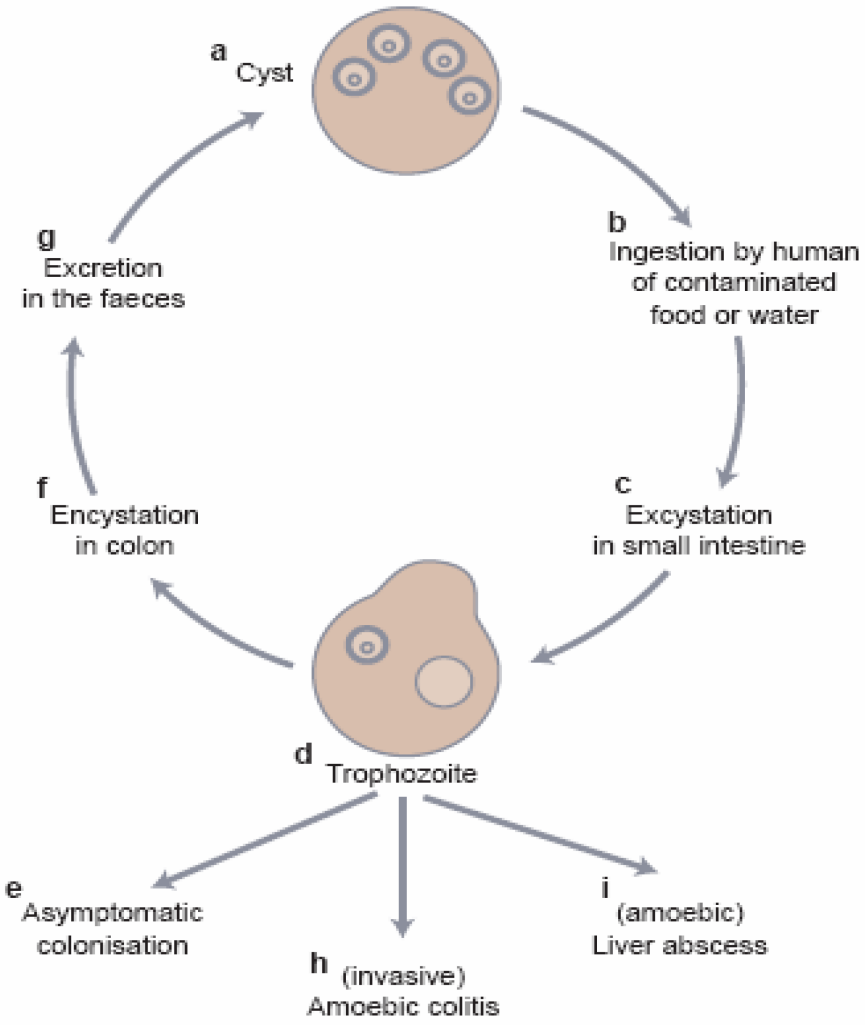


Figure 1 Life cycle of *Entamoeba histolytica. (*Source*:http:www.*dpd*.gov/*dpdx*)*

The parasite *Giardia lamblia* reproduces by binary fission which was a type of reproduction in which one cell divided into two new cells by mitosis. During the growth cycle the components of the Giardia cell multiply so that each daughter cell would be a complete copy of the original parent cell. The newly formed cells then pinch off from each other; in so doing a complete reproduction cycle would occur the infective stage of *Giardia lamblia*, the cyst was elliptical inshape and its size ranges from 6 to10 microns and contains two to four nuclei. The cyst possesses a structure that enabled it to be resistant to most environmental factors and disinfection and make it successful in being the infective stage of the parasite. The cyst has a thin and protective wall that allows it to survive in feces for weeks or for about 3 months in water at 40 C^0 (Tanner *et al.,* 2000). Giardiasis could be contracted through drinking contaminated waters or ingestion of contaminated foodstuffs. The cyst passes through the stomach and enters the small intestine. The acidic environment of the stomach could not harm the cyst because it had a thin protective wall to protect it until it reached the alkaline environment, the small intestine. This alkaline environment initiates excystment of the cyst. During excystation, the cyst wall raptures at the pole opposite to the nuclei so that the flagella and other projections emerge from the rupture point. The cyst wall was then completely shed and the parasite would enter into its trophozoite stage (Erlandsen and Mayer, 1984).

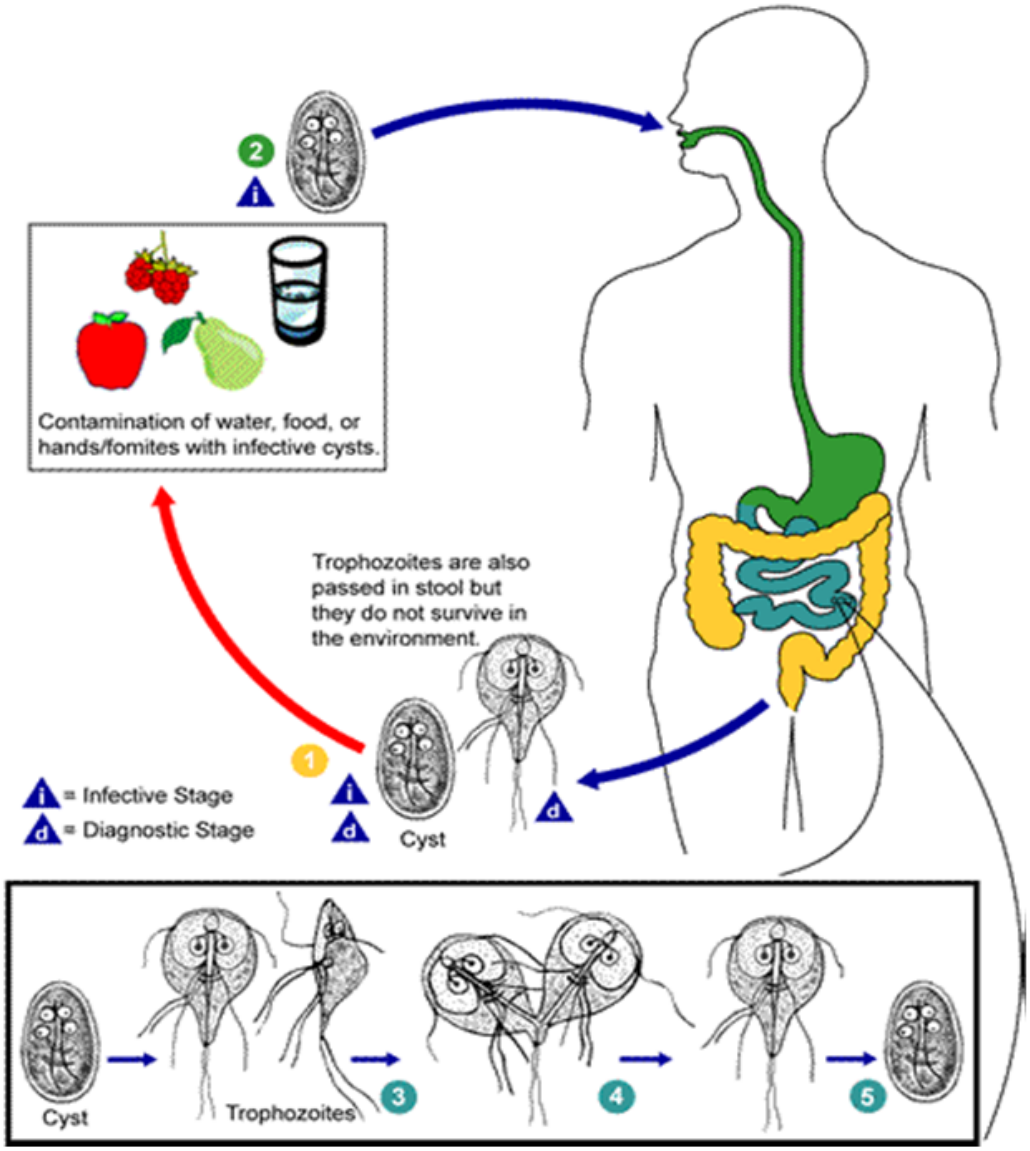
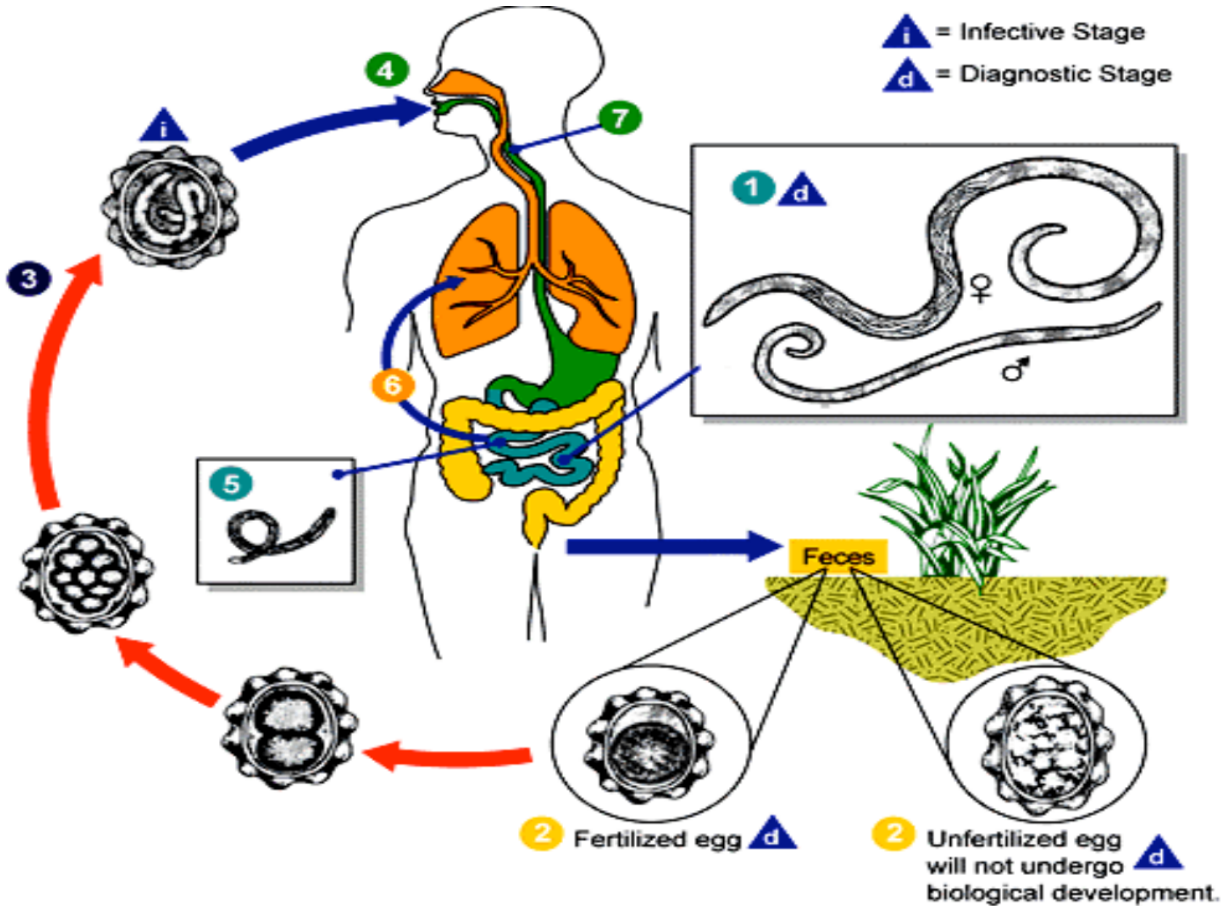

2
i
Contamination of water, food, or hands/fomites with infective cysts.
Trophozoites are also passed in stool but they do not survive in the environment.
1
i
d
Cyst
d
i = Infective Stage
d = Diagnostic Stage
Cyst
Trophozoites
3
4
5

Figure 2 Life cycle of *Giardia lamblia (Source:http://www.dpd.cdc.gov/dpdx).*

2.2.2. Life cycle and transmission of intestinal heminths parasites

Ascaris lumbricoides is the most common and important soil-transmitted helminth. It 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 (Wang *et al.,* 2012). *A. lumbricoides* have been shown to play a significant role in childhood malnutrition, which leads to growth retardation, cognitive impairment, and poor academic performance, resulting in a poorer quality of life and less ability to contribute to society (Drake *et al*., 2000).The infection occurs by ingestion of food contaminated with infective eggs which hatch in the upper small intestine. The larvae (250 x 15 micrometers) penetrate the intestinal wall and enter the venules or lymphatics. The larvae pass through the liver, heart and lung to reach alveoli in 1 to 7 days during which period they grow to 1.5 cm. They migrate up the bronchi, ascend the trachea to the glottis, and pass down the oesophagus to the small intestine where they mature in 2 to 3 months (WHO, 2002). Its life cycle is presented in Figure 5.



Key: 1. Adult worm 2. Unfertlized egg 3. Fertelized egg becomes infective 4. Infective stage swallowed 5. Larvae hatch.

Figure 3 Life cycles of *Ascaris lumbricoides* **(**Source**:** CDC, 2009.)

Hymenolepis nana **(**Helminths**)** eggs are immediately infective when passed with the stool and cannot survive more than 10 days in the external environment. When eggs are ingested by an arthropod intermediate host, they develop into cysticercoids, which can infect humans or rodents upon ingestion and develop into adults in the small intestine. A morphologically identical variant, *H. nana* var. fraterna, infects rodents and uses arthropods as intermediate hosts. When eggs are ingested (in contaminated food or water or from hands contaminated with feces), the oncospheres contained in the eggs are released. The oncospheres penetrate the intestinal villus and develop into cysticercoid larvae. Upon rupture of the villus, the cysticercoids return to the intestinal lumen, evaginate their scoleces, attach to the intestinal mucosa and develop into adults that reside in the ileal portion of the small intestine producing gravid proglottids. Eggs are passed in the stool when released from proglottids through its genital atrium or when proglottids disintegrate in the small intestine. An alternate mode of infection consists of internal autoinfection, where the eggs release their hexacanth embryo, which penetrates the villus continuing the infective cycle without passage through the external environment (Figure 3). The life span of adult worms is 4 to 6 weeks, but internal autoinfection allows the infection to persist for years (CDC, 2009).

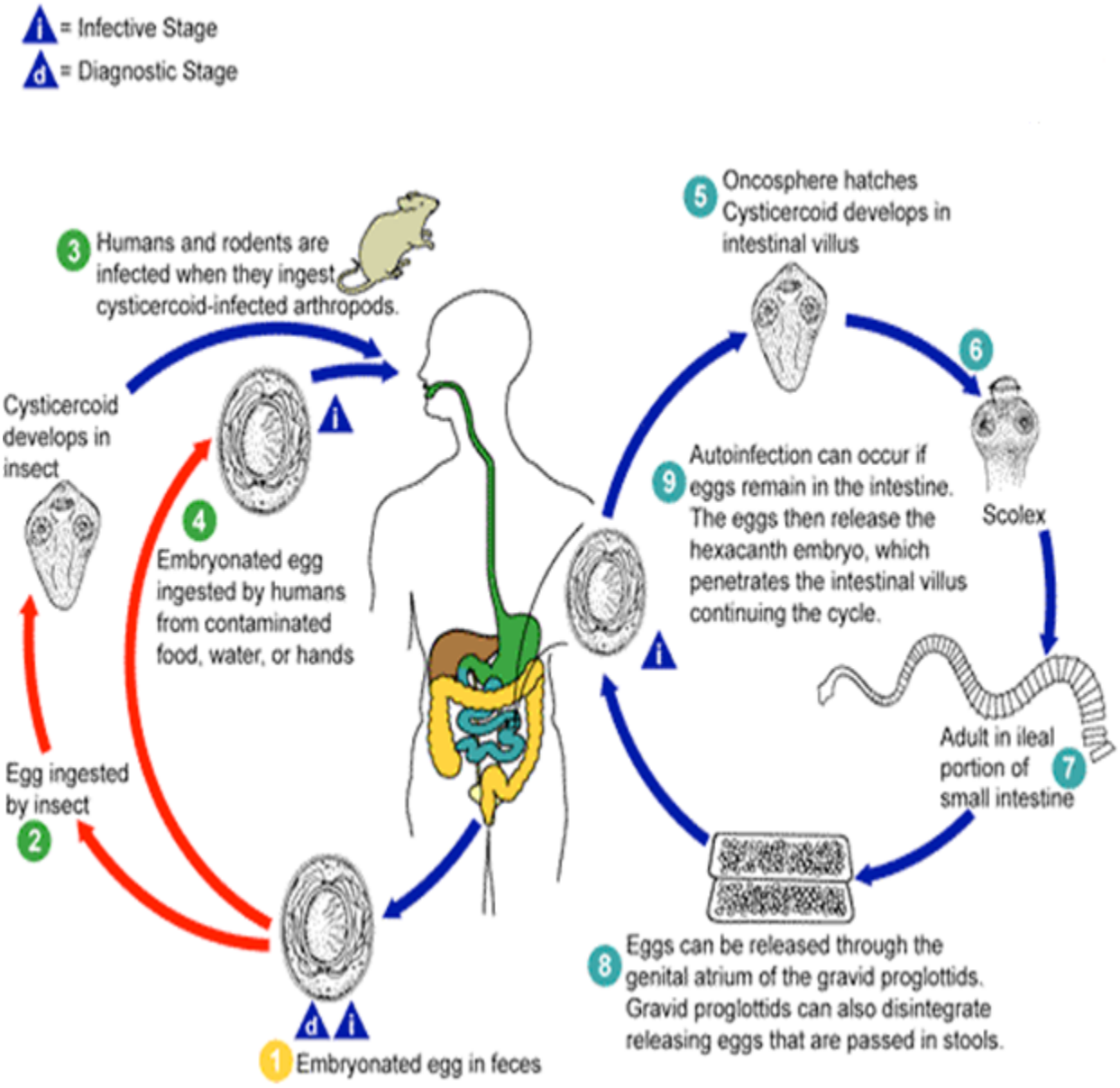

i = Infective Stage
d = Diagnostic Stage
3 Humans and rodents are infected when they ingest cysticercoid-infected arthropods.
Cysticercoid develops in insect
4 Embryonated egg ingested by humans from contaminated food, water, or hands
Egg ingested by insect
2
1 Embryonated egg in feces
5 Oncosphere hatches Cysticercoid develops in intestinal villus
6
Scolex
Adult in ileal portion of small intestine
7
8 Eggs can be released through the genital atrium of the gravid proglottids. Gravid proglottids can also disintegrate releasing eggs that are passed in stools.
9 Autoinfection can occur if eggs remain in the intestine. The eggs then release the hexacanth embryo, which penetrates the intestinal villus continuing the cycle.

Figure 4 Life cycle of *Hymenolepis nana* **(**Source**: CDC, 2009).**

Like the other parasites, hookworms were spread when an infected person did not use a latrine but defecates outside. Hookworm larvae could enter the body through any part that comes in contact with infected soil, although most often they penetrate the skin of the feet. In the body they traveled through the lungs to the intestine, where they would grow into adults. The soil becomes infected with eggs from the parasite. The eggs hatch into larvae and the larvae burrow through the skin into the body. Others in the village become infected, especially if they do not wear shoes (Crompton and Nesheim, 2002). Eggs were passed in the stool, and under favorable conditions (moisture, warmth, shade), larvae hatch in 1 to 2 days. The released rhabditiform larvae grow in the feces and/or the soil, and after 5 to 10 days (and two molts) they become filariform (third-stage) larvae that were infective. These infective larvae could survive 3 to 4 weeks in favorable environmental conditions. On contact with the human host, the larvae penetrate the skin and were carried through the veins to the heart and then to the lungs. They penetrate into the pulmonary alveoli, ascend the bronchial tree to the pharynx, and were swallowed. The larvae reach the small intestine, where they reside and mature into adults. Adult worms live in the lumen of the small intestine, where they attach to the intestinal wall with resultant blood loss by the host. (Drake *et al*., 2005).

Most adult worms were eliminated in 1 to 2 years, but longevity records could reach several years. Some A*scuris duodenale* larvae, following penetration of the host skin, could become dormant (in the intestine or muscle). In addition, infection by *A. duodenale* would probably also occured by the oral and Trans mammary route *Nector americanus*, however, requireed a Trans pulmonary migration phase (Sehgal *et al*., 2010).

2.3. Clinical Manifestation of Intestinal Parasitic Infections

Intestinal protozoan parasite infection could result in Gastro intestinal disease in humans. As a result of infection of the parasite more or less similar clinical sign and symptom could be observed. For example Infections with *E. histolytica* have no symptoms in many individuals, and most can clear their infection without any signs of disease. For un explainable reason, however, 4-10 % of asymptomatic individuals infected with E. *histolytica* developed disease over a year. In other words, different studies indicated that

up to 90 % of *E. histolytica* infections, the symptoms were absent or very mild (Ravdin & Petri, 1995).

There was a wide spectrum of clinical presentations of *E. histolytica* infections. Symptomatic amebiasis was primarily an intestinal disease, and when it becaome extra intestinal, it usually involves the liver. Pathogenesis of amebiasis was believed to be a multi step, multi factorial process. Symptoms of Amebiasis could be acute (Frequent dysentery with necrotic mucosa and abdominal pain) and chronic (Recurrent episodes of dysentery with blood and mucus in the feces). There were intervening gastrointestinal disturbances and constipation. Cysts were found in the stool. The organism would invade the liver, lung and brain where it produces abscesses that result in liver dysfunction, pneumonitis, and encephalitis (WHO, 2002).

G. lamblia was usually weakly pathogenic for humans. Cysts would be found in large numbers in the stools of entirely asymptomatic persons. In some persons, however, large numbers of parasites attached to the bowel wall would cause irritation and low-grade inflammation of the duodenal or jejunal mucosa, with consequent acute or chronic diarrhea associated with crypt hypertrophy, villous atrophy or flattening, and epithelial cell damage. The stools would be watery, semisolid, greasy, bulky, and foul-smelling at various times during the course of the infection. Malaise, weakness, weight loss, abdominal cramps, distention, and flatulence could be occured. Children were more liable to clinical Giardiasis than adults. Immuno suppressed individuals were especially liable to massive infection with severe clinical manifestations. Symptoms would continue for long periods (Butel and Stephen, 2007).

As in any parasitic infections, host parasite interaction was the initial steps in the pathogenesis of giardiasis. In this interaction, first the *Giardia* trophozoites attached to the cell surface of villi by means of a disk on their posterior or ventral surface. Lectin, a protein on the trophozoite lining, recognizes specific receptors on the intestinal cell and would be partly responsible for the tight attachment between the parasite and the villi

following attachment of trophozoites, there would be major structural and functional abnormalities in the small intestine (Nokes and Bundy, 1993).

The pathogenesis of *Cryptosporidium were* associated with diarrhea, weight loss and mortality were not well understood but recent research in animal models had provided insight into the patho-physiology of the disease and understanding of the clinical signs (Bethony *et al.,* 2001).

2. 4. Epidemiology of Intestinal Parasitic Infections

2.4.1. Global distribution of parasitic infections

Globally prevalence of parasitic infections in school age children was estimated at about 35% caused by Ascaris *lumbricoides*, 26% were caused by hookworms and about 25% caused by Trichuris *trichiura*. Heavy infection of intestinal parasite could cause malnutrition, loss of appetite, interfering food absorption and weight loss (Nokes and Bundy, 1993).

Majority of intestinal parasites were more likely to make the children ill and this could lead to the children's missing of school. Intestinal parasitic infections had been recognized as one of the most significant cause of illnesses in the communities. With an average prevalence rate of 50% in developed world and 95% in developing countries. These infections were ubiquitous with high prevalence among the poor and socio economically deprived communities where overcrowding, poor environmental sanitation, low level of education and lack of access to safe water were prevalent (WHO, 2009).

2.4.2. Intestinal parasitic infections in Ethiopia

Several studies stated that, Ethiopia had one of the lowest qualities of drinking water supply and latrine coverage in the world. According to ministry of health (1996), more than half a million annual visits of the out patients' services of the health institutions were caused by intestinal parasitic infections. This estimated were in accurate, because most of the health institutions lack appropriate diagnostic tools to detect low level of parasite burden. Still data on intestinal parasites in Ethiopia was inadequate (hall, *2008*).

As a result of low level standards of living, poor environmental sanitations and ignorance of simple health promoting factors, intestinal parasitism was very high. The highest

prevalence of infection was recorded at altitude more than 2400m above sea level and it was also known by commonly affecting school age children (Brooker and Michael, 2000). In Ethiopia, infection of intestinal parasite remains among the most ubiquitous and serious health problems with strikingly high prevalence rates of the major protozoan and helminth infections.

2.5. Factors Affecting Epidemiology of Intestinal parasites

The attributable factors for the high prevalence of intestinal parasitic infections in developing country including Ethiopia were low socio-economic status. Such factors include poor personal hygiene and environmental sanitation, with low household income, overcrowding and lack of clean water supplies for most parts of the country. For instance, Ethiopia has one of the lowest quality drinking water supply and latrine coverage in the world. (Kumie and Ali, 2005).

2.5.1 Behavior, household clustering and occupation

Specific occupation, household clustering and behaviors influence the prevalence and intensity of parasitic infections, particularly for hook worm, in which the highest intensity occur among adults. Engagement in agricultural pursuits, a common denominator for parasitic infections (Brooker *et al*., 2009).

2.5.2 Poverty, sanitation and urbanization

The transmission of Intestinal Parasitic infections depend on environments contaminated with egg carrying feces. Consequently, parasites were intimately associated with poverty, poor sanitation, and lack of clean water and latrines. The provision of safe water and improved sanitation were essential for the control of parasitic infections. Although the intestinal parasite infections were neglected diseases that occur predominantly in rural areas, the social and environmental conditions in many unplanned slums and squatter settlements of developing countries were ideal for the persistence of *A. lumbricoides* (Nissapatorn, 2008).

2.5.3 Climate, water and season

Climate and topography were important determinants of the distribution of parasitic infections. Intestinal parasitic infections were highly affected by surface temperature, altitude, soil type, and rainfall (Teshima *et al.,* 2009).

School aged children and preschool children tend to harbor the greatest numbers of intestinal parasitic infections as a result experience growth stunting and diminished physical fitness as well as impaired memory and cognition Changes with age in the average intensity of infection tend to be convex, rising in childhood and declining in adulthood(Crompton and Nesheim, 2002).

A number of epidemiological studies had shown that individuals infected with multi (Poly) species of intestinal parasites infections often harbor heavier infections than individuals infected with a single intestinal parasite species (Brooker and Michael, 2000).

2.6. Associated Risk Factors of Intestinal Parasitic Infections

Family size, sources of water, hand washing habit before meal, water storing habit, shoe wearing habit and availability of toilet with intestinal protozoa and nematode parasite infections had significantly associated (Kariuki *et al.,* 2004).

2.7. Diagnosis of Intestinal Parasitic Infections

Diagnosis was by use of clinical signs that include; Loss of appetite and reduced absorption of food, vitamin A deficiency (results in blindness, dry eyes), anemia (hookworm only), malnutrition, intestinal obstruction and abdominal pain result in cases of heavy infections (Edelduok, *et al.,* 2013).

Also physical performance decreases and a child do not do well at school (Hall, 2008). Laboratory diagnosis including several egg concentration techniques e.g.formolin ethyl acetate sedimentation can detect even light infections. The Kato-Katz fecal-thick smear and the McMaster method are used to measure the intensity of infection by estimating the number of egg counts per gram of faces. Ultrasonography and endoscopy were useful for diagnostic imaging of the complications of ascariasis, including intestinal obstruction and hepatobiliary and pancreatic involvement (Santos, *et al.,* 2005).

2.8. Prevention, Control and Treatment of Intestinal Parasitic Infections

According to World Health Organization guidelines (WHO, 2002), any health program aiming at controlling morbidity of intestinal parasitic infections should have evidence based estimate of this problem. Human intestinal parasitic 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 sewage and feces.

The risk for infection could 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 soup and soaked in vinegar for some minutes before consumption (Petri and Singh 2000).

Control programs based on sanitation aim to reduce or interrupt transmission, prevent re infection and gradually reduce worm loads (Bundy, 2003). However, to be effective in a short period of time they need to be combined at their first stage with chemotherapy (Mengistu, 2007).

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 (Sackey *et al*., 2003).

Health education and promotion of healthy behaviors could play a key role in reducing the incidence of human intestinal parasitic infections. However, the effectiveness of those activities in reducing transmission of infection varies according to different reports. In some cases, health education could decrease costs, increase levels of knowledge, and decrease re-infection rates. Health education efforts could build trust and engage communities in aspects that were crucial to the success of public health initiatives (Gillespie, 2001)

Iodoquinol was used to treat asymptomatic infections and Metronidazole was used for symptom can be chronic Amebiasis, including extra-intestinal disease. In acute clinical cases of giardiasis the disease was often self-limiting and therefore would required only supportive therapy, which usually consists of fluids to compensate for fluid losses in the diarrhea. Metronidazole was the drug of choice for *Giardia* infection (Gardner and Hill, 2001).

Recommended drugs used in the treatment of parasitic infections were albendazole, mebendazole; and older drugs including pyrantel, tri abendazole and niclos amide (WHO,

2009). This drug was highly effective and was once the drug of choice for treating intestinal obstruction; however, it could be neurotoxic and hepatotoxic and was no longer widely available (Maguire, 2005).

3. MATERIALS AND METHODS

3.1. Description of the Study Area

This study was conducted from February to April in 2017 at Gora Primary School, Ijaji Town, Ilu Gelan Woreda, West Shoa, Oromia regional state. The study area was 215 Km far from Addis Ababa to the west 90 km far from Zonal City Ambo (Figure 4). Ijaji is the central town of the district and is located on geographical coordinate of 8° 59' 51''N and 37° 19' 49''E. the current population size is 120975(Ilu Gelan Woreda Land use and Management Office 2007).

The total area of the woreda was 65,919 hectare with altitude of 1500m-2200m, that bordered on the north and East by Chalia Woreda , West by Bako Tibe Woreda, South by Dano Woreda and Jimma Zone. The climatic condition is 27.8% was covered by midland (*weina dega*) and 72.2% lowland (*kola*) and generally characterized by mild dry climatic condition. The basic (major) economic source of the population was agriculture. (Ilu Gelan woreda land use and management office report, 2015).

Concerning to educational status of the woreda, there were 34 Primary Schools, one high schools and one preparatory school with total coverage of 98% (Ilu Gelan woreda education office report, 2016).

The total water coverage of the woreda was 63% among this almost 50% is river and ground water. The major water source for human consumption is collected from deep wells (from pulling system), river, spring and drinking water also available in seasonal pools and minor rivers (Ilu Gelan woreda water office report, 2016).

Concerning to health service status of woreda, there are 3 Health Centers with total coverage of 97%. Ijaji Health Center is one of the three Health Centers in Ilu Gelan woreda. It gives services for cases like; emergency, pre-natal, during delivery and different disease like intestinal parasitic infection (Ilu Gelan woreda health office report, 2017).

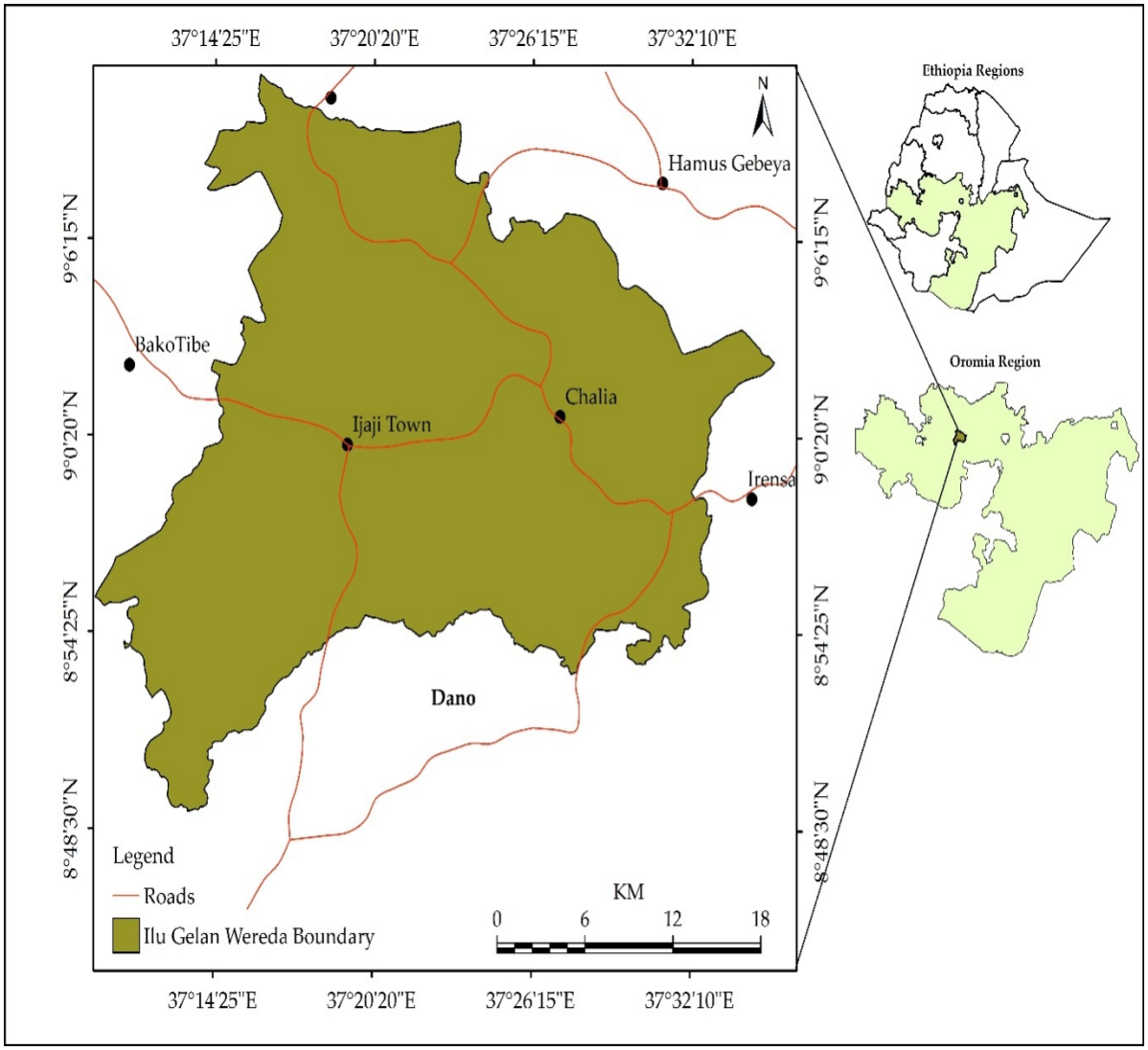


Figure 5 Location of the study area (Source GIS).

3.2. Design of the Study

A descriptive cross-sectional survey was carried out among childrens to determine the prevalence of intestinal parasitic infections. Laboratory examination of stool sample was carried out using direct wet mount and formol ether concentration method.

In addition structural and pre-tested questionnaire were used to collect data regarding socio demographic characters, environmental related factors, sanitary indicators, water source, latrine facility and resident areas. A respondent will be obtained from study population of KG children's family.

3.3. The Study Population

The total population of grade 1-8 children/students enrolled during the 2016/2017 academic year in Gora primary School was 1560 (727 males and 733 female) and the study population consist of 408 children in the study area and all grades 1-8 students aged between 7-18 years, those who were volunteers to participate in the study were involved(Table 1) . Before the commencement of the study, a clear explanation about the objectives of the study and their involvement (consent) was given to school director, teachers and school children. Then, those children who were volunteer to participate in the study participated.

Table 1 Total population of the study from the selected school in February-April 2017.

Grades	Students population			Sample population		
	Male	Female	Total	Male	Female	Total
1-4	432	484	916	112	123	235
5-8	295	249	544	91	82	173
1-8	727	733	1560	203	205	408

3.4. Sample Size Determination

The sample size (n) was determined using the statistical formula

$$n = \frac{(Z\alpha/2)^2 P(1-P)}{d^2}$$ (Kish,1965).

Where n= no of sample size,

p=prevalence of parasitic infection and

Zα/2=critical value at 95% certainty (1.96).

d= a 5% margin of error

Since the overall prevalence rate (p) of intestinal parasitic infections was not known in the study area, probability has been taken 50%. For calculation, a 95% confidence interval (z) and a 5% margin of error (d) were used.

3.5. Method of Data Collection

3.5.1. Questionnaire survey

The researcher used both open ended and close ended questionnaires in order to gather reliable and accurate data from the selected school children and their families as sample respondents. To ensure reliability and validity of the serving, before data collection period the questionnaires were pre tested and the children were interviewed by trained interviewer. All the distributed questionnaires were returned after completely filled by the study participants.

3.5.2. Clinical examination

Each study participant was examined by health professional, physical and clinical conditions were recorded using appropriate format which was developed for these purpose.

3.5.3. Stool sample collection

About 3 grams of specimen of fresh stool sample was collected from each study participant using a plastic container. All the collected stool samples were transported to the laboratory for examination by the use of microscope. At the time of sampling; date of

sampling, age, sex, presence or absence of intestinal parasitic infections and code number were recorded for each children on the record format.

Data collectors and assistants (health workers and community member of the town) were involved in the data collection. A total of 408 stool samples were collected from selected school children and the laboratory examination of the stool samples were carried out in Ijaji Health center.

3.6. Laboratory Examination

3.6.1. Direct wet mount method

Direct smears were prepared with normal saline solution for microscopic observation (Garcia, 1999). About 1g of stool sample was emulsified with 3-4 ml normal saline solution and then a drop of emulsified sample was placed on a clean microscopic glass slide. Following this, a few drops of iodine solution was added and covered with a cover slip. The resulting smear was viewed under the microscope using the 40x objective for presence of ova of the parasites at Ijaji Health Center during February-April, 2017.

3.6.2. Formol ether concentration method

The concentration procedure recommended was the formalin-ether method.According to WHO (2000) all types of worm's eggs and other fluke eggs, larvae and protozoan cysts were recovered by this method. During stool collection, the school children were provided with small plastic sheets and clean wooden applicator sticks. Two grams of stool sample was added into 10ml of 10% formalin in a small beaker and was thoroughly emulsified and brought in to suspension. The suspension was strained through a double layer of wet gauze directly in to a 15ml centrifuge tube. The gauze was then discarded, and more 10% formalin was added into the suspension in the tube to bring the total volume to 10ml, 3ml of ether was added to the suspension in the tube, and closed with a rubber stopper and shaken vigorously for 10 seconds. With an applicator stick the plug of debris was loosen by a spiral movement and the supernatant (comprising the top 3 layers) was decanted in a single movement into a bowel containing disinfectant; allowing the last few drops of residual fluid to flow back onto the sediment. The sediment was re suspended in a saline solution and collected with a disposable Pasteur pipette. A few drops of the suspension was transferred onto a microscope slide and covered with a cover slip. Then the prepared

sample was scanned using the low power (10 xs) objective in a systematic manner to observe the entire cover slip area.

3. 7. Data analysis

Appropriate descriptive and inferential statistical analysis was carried out using SPSS, Windows Version 16 Software. Descriptive statistics was used to describe prevalence and logistic regression was used to determine the associated risk factors of Intestinal parasitic infections. The significance of the differences in frequency distribution was tested by using chi-square analyses. P-values ≤ 0.05 were considered statistically significant.

3.8. Quality control

To ensure quality control, all the laboratory procedures including collection and handling of specimens were carried out in accordance with standard protocols (WHO, 1991; NCCLS, 1997). All the reagents were checked for communication each time used. To ensure general safety, disposable gloves were used and universal bio-safety precaution (NCCLS, 2000) was followed at all times.

For quality control of the concentration method, preserved stool specimens known to contain parasite ova and larvae were included in each batch of samples to be concentrated to ensure that the procedures are precise. The microscope used for this research was calibrated and the objectives and oculars used for the calibration procedure were used for all measurement done with the microscope. The calibration factors for the 10x and 40x objectives were posted on the microscope for easy access; and the Hemo Cue was cleaned after every 10 samples examination to avoid error.

3.9. Ethical consideration

Supportive letter was obtained from Haramaya University school of Biological Sciences and Biotechnology, Ilu Gelan Woreda Health Office, Woreda Educational Office and School principals. The objective of the study was explained to the study participants and the sample was collected from consented child.

4. RESULTS AND DISCUSSION

4.1 Socio-Demographic Characteristics of the Study Participants

The present study attempted to assess the prevalence of intestinal parasitic infections and associated risk factors among school children in Gora Primary School at Ijaji Health Center. A total of 408 203(49.8%) male and 205 (50.2%) female students were participated in the present study. The age distribution ranged from 7-18 years; 203 (49.8%) students were in the age group 7-10 years, 172 (42.1%) were 11-14 years and 33 (8.1%) were 15-18 years old.

The majority of the households 149 (36.5%) had 3-5 family size, 156 (38.2%) households had greater than five family size and 103 (25.2%) had less than three family size. 185 (45.3%) of household had reported being farmers, 85 (20.8%) were daily workers, 81 (19.9%) were governmental-employed, and 57 (14.0%) were traders.

Regarding to caregivers' educational status about 57 (14.0%) were illiterates, 149 (36.5%) could read and write, 167(42.2%) of the caregivers had completed primary education while 35 (8.6%) had secondary education and above. About 313 (76.7%) of the children reported that they did not wash their hands after defecation and only 95 (23.3%) washed their hands. Among those who washed their hands, 65 (68.4%) used only water

while 30 (31.6%) used water and soap. Children who washed hands before meals were 360 (88.2%) while those who did not wash hands before meals were 48 (11.8%).

Majority (89.0%) of the children reported wearing of shoes while 45 (11.0%) of the children did not wear shoes (Table 2). of the children households' source of water was tap water followed by spring 96 (23.5%), river 85 (20.8%) and 43 (10.5%) of the households had dung/well water as source of drinking water. 58.3% of the households did not treat water before drinking and 170 (41.7%) households treated their water before drinking.

Households that had toilet facility were 244 (59.8%) while 164 (40.19%) did not have toilet facility hence practiced open defecation (Table 2).

Table 2 Socio-demographic characteristics of school children's in Gora Primary School during February-April, 2017.

Characteristics	Number (%)	Characteristics	Number (%)
Sex		Children's way of hand washing	
Male	203(49.8)	Only water	65(68.4)
Female	205((50.2)	Water & Soap	30(31.6)
Age group(in years)		Children's practices of	
7-10	203(49.8)	washing their hands before	
11-14	172(42.2)	meal	
15-18	33(8.1)	Yes	360(88.2)
Family size		No	48(11.8)
<3	103(25.2)	Wearing of shoes by children	
3-5	149(36.5)		
>5	156(38.2)	Yes	363(89.0)
Residence		No	45(11.0)
Urban	258 (63.2)	Water Source	
Rural	150 (36.8)	Tap water	189(45.2)
Occupation		River	85(20.8)
Governmental Worker	81(19.9)	Dung(Well)	43(10.5)
Farmer	185(45.3)	Spring	96(23.5)
Trader	57(14.0)	Water treatment before	

Daily laborer	85(20.8)	drinking	
Education level		Yes	170(41.7)
Illiterate	57(14.0)	No	238(58.3)
Read & write	149(36.5)	Presence of toilet facility	
Primary Edu.	167(42.2)	Yes	244(59.8)
Secondary & above	35(8.6)	No	164(40.19)
Children practice of washing their hands after defecating			
Yes	95(23.3)		
No	313(76.7)		

4.2. Prevalence of Intestinal Parasitic Infections among School children

Prevalence of intestinal parasitic infections among primary school children at Ijaji town in terms of the age and sex of the respondents are presented in Table 3. Of the total 408 children examined, 27.9 % (114/408) of them were positive for one or more of intestinal parasitic infections (Table 3).

The prevalence of intestinal parasitic infection among the infected children was 31.03% (63/408) and 24.8% (51/40 8) for males and females respectively (Table 3). Although gender was not a significant risk factor for the prevalence of parasitic infections, in the present study, male pupils showed a bit higher prevalence of parasitic infections than female (Table 3). This difference may be due to the fact that, males are more engaged in playing outdoors particularly in faecally contaminated soil (Wani *et al.,* 2010). So, environmental contamination is one of the most common ways of transmission which would contribute for sex associated infections (FMN, 2005).

As the result shown in Table 3 the prevalence of intestinal parasitic infections among the age groups ranging from 7-10 years, 11-14 years and 15-18 years was 15.3%, 38.4% and 51.5%, respectively. The prevalence of parasitic infections among the age group 7-10 years was 15.3% (31/203) was less than the other age groups and it was not statistically significant (p=0.772),(Table 3).The higher prevalence rate was seen among 15-18 years age group which was 51.5% (17/33).

The prevalence of parasitic infections among the age group in the 7-10 years were 15.3% which was less than the other age groups and the highest prevalence rate seen in among 15-18 years age groups which was 51.5% due to highly risk for environmental contamination, especially, the soil where the children work in the field to help their parents and ate food without washing their hands (Alemnesh A. 2013).

In the present study, the result showed that there exists lower prevalence of intestinal parasitic infection as compared to the result of the study conducted in school-aged children in Babile, Eastern Etiopia (41.2%), by Grum (2005), from Lake Zway, 43.7%, by Gezahegn (2008), from Hossaena, 52.9%, by Baruda (2013). The differences in findings among different studies can be explained by variations in geographical area, socio-economic conditions, cultural practices of the population under consideration, age category of the study population, the methods employed for stool examination and the time of the study may have contributed to the differences (Amha Admasie, 2007).

Table 3 Prevalence of intestinal parasitic infections by age and sex among school children in Gora primary school during February-April, 2017.

Age group (in years)	Male		Female		Both sexes		X^2	P-value
	No. Ex.	No. Pos. in (%)	No. Ex.	No.pos.in (%)	No. Ex.	No.pos.in (%)		
7-10	97	14(14.4)	106	17(16)	203	31(15.3)	0.039	0.844
11-14	85	37(43.5)	87	29(33.3)	172	66(38.4)	0.084	0.772
15-18	21	12(57.1)	12	5(41.6)	33	17(51.5)	1.310	0.252
All age group	203	63(31.03)	205	51(24.8)	408	114(27.9)	0.381	0.827

Key: No. Ex. =Number of Examined, No. Pos= Number of positive, X^2 =Chi/square

4.3. Major Intestinal Parasitic Species Identified in Examined Children

The major intestinal parasites identified in the stool samples of the school children were *Entamoeba histolytica, Ascaris lumbricoides, Giardia lambilia, Hymenolepis nana* and hookworm species with the prevalence of 15.2%, 6.9%, 2.4%, 2.2% and 1.2%, respectively (Table 4)**.**The predominant parasite was *E. histolytica* which was observed in 62 (15.2%) students followed by *A. lumbricoides* in 28 (6.9%) of the examined students and the least prevalent parasite infection in the present study was hookworm species (1.2%).

The overall prevalence of *E. histolytica* infection among the study participants in the present study was 62(15.2%. It was higher than report of previous study from Alemketema town, Central Ethiopia (Fetlework, 2010) which was 13.7%. However, it was lower than the one done in Dire Dawa, Eastern Ethiopia, which was 38% (Ayalew, 2006). In this study, the prevalence of *E. histolytica* infection (15.2%) was higher than the prevalence of infection with *G. lamblia* (19.3%) and *Cryptosporidium species* 2.6% (Endaeshaw, 2005).

In the present study, *A. lumbricoides* was the 2ndmost prevalent parasite species (Table 4). Its prevalence (6.9%) was almost similar with previous report in Lake Langano, (6.2%) by Mengistu and Berhanu (2004), but higher than that reported from Babile town (3.9%) by Tadesse (2005). Conversely, the result of the present study was lower than the prevalence reported in northwest Ethiopia, Chilga district, (42.9%) by Leykun (2001) and different parts of Ethiopia, (37%) by Gezahegn, (2008).

The overall prevalence of *G.lamblia* infection was 10 (2.4%) among the study participants in the present study which was lower than the previous report (9.3%) by Ayalew, (2006) from eastern Ethiopia (Dire-Dawa) and 23% by Endeshaw *et al*. (2004) in school children in Central and Northern highlands of Ethiopia. The prevalence of *G. lamblia* infections in age group 7-10 years old was 2.1% and 1.9% in males and females, respectively (Table 4). While, for the age group 11-14 years old the prevalence of *G. lamblia* infection in males and females pupils was 3.5% and 2.3%, respectively (Table 4). The prevalence of *G.*

lamblia infection for the age group of 15-18 years was 0% for males whereas it was 8.3% for females (Table 4).

The prevalence of *H. nana* infection in the present study was 2.2%. This was in agreement with the former report (3.6%), in Southern Negeria (Nmor *et al*., 2009), 2.3% in Debub Achefer district, northwest Ethiopia (Tilahun, 2010) and 20.5% in Zarima town, northwest Ethiopia (Abebe *et al.,* 2011). However (Adamu et al., 2006) conducted a study in South west Ethiopia and found 57.4% prevalence of *G. lambilia* infection. The prevalence of the same parasite infection in South Gonder was 21.08% (Amha, 2007) as in south Ethiopia, Abosa, around Lake Ziway south Ethiopia (Gezahegn, 2008) which was much higher than the prevalence of *G. lambilia* infection in the present study (2.4%).

The prevalence of hookworm infection 5 (1.2%) was lower among the present study participants which was lower than the prevalence reports of 46.9% by Tilahun (2010), 33.3% by Walelign (2014) and 14.3% by Gezahegn (2008). On the other hand, the findings of the prevalence of hookworm infection recorded in the present study were almost similar with the former report (1.0%) in North Ethiopia, Adwa (Alemu, 2011).

Regarding the number of intestinal parasitic infections per individuals, more than one parasite was found in few study subjects. Multiple infections were seen in 5 cases out of the total 408 examined stool samples of the school-children with the prevalence of 1.2 %. The prevalence of multiple infection (1.2%) was lower as compared to the studies carried at different places of Ethiopia, 8.9% in south Ethiopia, Abosa, around Lake Ziway (Gezahegn,2008) and 8.6% in Debub Achefer district, northwest Ethiopia (Tilahun, 2010).

The low prevalence parasitic infections attribute to the fact that the parasite requires host and humid weather. Because the present study was undertaken in sub tropical area which has semi dry weather, soil and environmental factors can affect the survival of the ova of these parasites in the external environment, so that rate of transmission can be hindered. Climate is an important factor that determines the distribution of these parasitic infections, with adequate moisture and warm temperature essential for larval development (Brooker and Michael, 20000).

Even though there was no significance difference in the prevalence of multiple parasitic infections, there was a difference in the prevalence of multiple parasitic infections between male and female students in the study area. Thus, in the present study, male students showed a higher prevalence of multiple parasitic infections (1.5%) than that of the female (1.0% (Table 4).

The overall prevalence of intestinal parasite infections (27.9%) in the present study was lower than the prevalence of intestinal parasite infections of school children reported in different parts of Ethiopia. For example, Ayalew (2006) reported 38% prevalence of intestinal parasitic infections among school children from eastern Ethiopia (Dire-Dawa). According to the study conducted by Mengistu Legesse and Birhanu Erko (2004) on the school children in Lake Langano showed that the prevalence of intestinal parasitic infections was 60.2%.

Variability in prevalence of this infection might be due to variation in the degree of environmental contamination, variations in the local environments with regard to soil type, temperature, etc., that determine the transmission of the parasite. In addition, environmental sanitation and difference in exposure to infections and inability of the parasitic eggs to with stand diverse temperature could partly explain the observed difference as reported by (Gezahegn, 2008)). This variation could also indicate that infection rates depend on such factors as local personal hygiene and sanitary conditions.

Table 4 Major intestinal parasite species identified in Examined children (408) in Gora Primary School during February - April, 2017.

Age groups (years) and Sex	No.Exam ind (%)	Intestinal parasitic infections					Multiple infection
		Eh	Al	Gl	Hn	Hw	
		No.pos. (%)	No.pos. (%)	No.pos. (%)	No.pos. (%)	No.pos. (%)	No.pos. (%)
7-10							
Male	97 (47.8)	5(5.1)	5(5.2)	2(2.1)	2(2.1)	-	1(1.1)

Female	106(51.7)	6(5.7)	7(5.7)	2(1.9)	2(1.9)	-	-
11-14							
Male	85(41.9)	23(27.1)	7(8.2)	3(3.5)	3(3.5)	1(1.2)	2(2.4)
Female	87(42.4)	16(18.4)	7(8.0)	2(2.3)	2(2.3)	2(2.3)	2(2.3)
15-18							
Male	21(10.3)	10(47.6)	1(4.8)	-	-	1(4.8)	-
Female	12(5.9)	2(16.7)	1(8.3)	1(8.3)	-	1(8.3)	-
All age groups							
Male	203(49.8)	38(11.7)	13(6.4)	5(2.5)	5(2.5)	2(2.4)	3(1.5)
Female	205(50.2)	24(15.2)	15(7.3)	5(2.4)	4(1.9)	3(1.5)	2(1.0)
Total	408	62(15.2)	28(6.9)	10(2.4)	9(2.2)	5(1.2)	5(1.2)

Key: Al=*Ascaris lumbricoid*, Eh=*Entamoeba histolytica*, Gl=*Giardia lambilia*, Hn=*Hymenolepis nana* HW=*Hookworm,* No.pos. (%) =number of positive in percent.

4.4. Association of Intestinal Parasitic Infections with some Socio-demographic Characteristics of School Children

Figure 5 presents the overall prevalence of parasitic species diagnosed in the study subjects and their association with different socio-demographic factors of school children during the study period. The factors assessed in the present study were, age, family size, residence, parents occupation and parents educational status. Among some socio-demographic listed risk factors, the prevalence of parasitic infections were high in males (31.03%), 15-18 age groups (51.51%), >5 family size (28.84%), in rural (42.6%), in daily workers (45.88%) and in illiterate parent education status (49.12%).

Generally, in this study all the socio- demographic characteristics had not statistically significant association with intestinal parasitic infections in the study population (Table

5). This might be due to variations in geographical area, socio-economic conditions, cultural practices of the population under consideration, age category of the study population, the methods employed for stool examination and the time of the study contributed to the insignificant associations (Amha Admasie, 2007). This result in line with, Andrea *et al*., (2012),who reported that social determinants for example poverty that mostly lead to low level of education of mothers has been associated with intestinal parasites in children. Parents with high levels of education provide good sanitary practices to their children as compared to children whose parents have low levels of education especially in socio economic challenged areas.

Table 5 Association of intestinal parasitic infections with socio-economic, conditions of school children of the study participants in Gora Primary School during February - April, 2017.

Risk factors	Frequency	Parasitic infections		OR(95.0%Cl)	X^2	P-value
		No.positive (%)	No.Negative (%)			
Sex of children						
Male	203 (49.8)	63(31.03)	140 (68.96)	0.989	0.001	0.973
Female	205 (50.2)	51(24.87)	154 (75.12)	(0.522-1.873)		
Age of children						
7-10	203 (49.8)	31 (15.27)	172 (84.72)	0.852	1.183	0.523
11-14	172 (42.2)	66 (38.37)	106 (61.62)	0.762		
15-18	33 (8.1)	17 (51.51)	16 (48.48)	0.832 (0.859-1.392)		

Family size						
<3	103 (25.2)	28 (27.1)	75 (72.87)	0.522	2.917	0.233
3-5	149 (36.5)	41 (27.51)	108 (72.48)	1.184		
>5	156 (38.2)	45 (28.84)	111(71.15)	1.096 (0.193-2.508)		
Residence						
Urban	258 (63.2)	64 (24.80)	194 (75.19)	0.846	0.237	0.627
Rural	150 (36.8)	50 (42.6)	100 (66.66)	(0.430-1.662)		
Parent occupation						
Governmental workers	81 (19.9)	24(29.62)	57(70.37)	1.551	1.438	0.697
Farming	185(45.3)	40(21.62)	145(78.37)	0.789		
Traders	57 (14.0)	20 (35.08)	37 (64.91)	0.830		
Daily workers	85 (20.8)	39 (45.88)	46 (54.11)	1.342(0.264-5.261)		
Parent Educ. Level						
Illiterate	57 (14.0)	37 (64.91)	20 (35.08)	2.915	1.463	0.691
Read & write	149 (36.5)	39 (26.17)	110 (73.82)	1.664		
Primary Educ.	167 (40.9)	34(20.35)	133 (79.64)	1.664		
Secondary Educ.	35 (8.6)	4 (11.43)	31 (88.57)	1.526(0.159-17.252)		

Table 6 presents the overall prevalence of parasitic species diagnosed in the study subjects and their association with school children during the study period. The risk factors explored in the present study were environmental sanitation and hygiene practice of the school children such as washing hands after defecation, mode of hand washing, washing hands before meal, source of drinking water, treatment of water before drinking availability of latrine and wearing shoes.

Among the risk factors only washing hands after defecation was significantly associated with intestinal parasitic infection with (p=0.007). This might be due to the fact that their

body is more exposed to collect ova of different parasitic infections on their hand along with defecation that harbors intestinal parasites.

Improper hygiene in children was closely associated with parents' level of education. Environmental factors known to cause intestinal parasites were related to water supply and availability of toilets and behavioral habits. According to Ziegelbauer *et al*. (2012), systematic review and study on effect of sanitation on intestinal parasitic infection found that the availability and use of sanitation facilities were associated with a reduction in the prevalence of infection with intestinal parasites.

Generally the results of the questionnaire survey for risk factors and their associations with the intestinal parasitic infection of the school children are presented in the above Table 5 and 6. The majority (28.84%) of participants' family size was greater than five, 27.15% had a family size of 3-5 while 27.1% had family size of <3. There was no statistically significant association between family size and infection with intestinal parasites ($p>0.05$), due to economic condition of the societies. Protected water (tap water) supply was the major source (45.2%) of water for domestic purposes. Out of the (54.6%) children that obtain water from unprotected source (River, Dung/Well and spring), 75 (37.65%) were positive for intestinal parasitic infections. Logistic regression analysis on parasitic infections indicated that unprotected water was one of the major risk factors and not significant association was found between infection rates of parasite and the use of unprotected water, (OR, 0.582 for un protected water versus protected water, 95% CI 0.76-1.281) (Table 6),this indicate that even though they use un protected water they treat with chlorines.

Three hundred sixty (88.2%) of the children were regularly practicing hand washing before meals, but 70(19.44%) of them didn't know the purpose. About 244(59.8%) of the students had latrine while 164(40.19%) had no latrine. The majority of the children 263 (64.5%) had shoe wearing habit. Logistic regression analysis on parasitic infections indicated that not wearing shoe was a risk factor and no significant relation between infection rates of parasites and not wearing shoe was observed (OR, 2.183 for not wearing

shoe versus wearing shoe, 95% CI 0.229-1.917) and its p-value was (P≥0.05).

The test for possible association of risk factors like family size, hand washing habit before meal, water handling practice and latrine availability with intestinal parasitic infections did not show statistically significant associations because although latrines were available, they were not utilized.

Table 6 Association of intestinal parasitic infections with Environmental Sanitation and Hygiene practice of the study participants in Gora primary school during February – April, 2017.

Risk factors	Frequency	Parasitic infections		OR<(95%Cl)	X^2	P- value
		No.pos. (%)	No.Neg.(%			
Washing hands after defecating						
Yes	95(23.3)	38(40.0)	57(60.0)	0.169	7.158	0.007*
No	313(76.7)	76(24.28)	237(75.71)			
Mode of hand washing						
Only water	220(68.4)	59(26.81)	161(73.18)	1.292	0.088	0.767
Water&sop	188(31.6)	55(29.25)	133(70.74)			

Washing hands before meal						
Yes	360(88.2)	70(19.44)	290(80.55)	0.952	0.008	0.929
No	48(11.8)	44(91.66)	4(9.8)			
Water sourcefor house hold						
Tap water	184(45.2)	39(21.19)	145(78.8)	0.987	0.299	0.920
River	85(20.8)	30(35.29)	55(64.7)	0.582		
Dung/well	43(10.5)	24(55.81)	19(44.18)	1.476		
Spring	96(23.5)	21(21.87)	75(78.12)	0.879		
Water treatment before drinking						
Yes	170(41.7)	53(31.17)	117(68.82)	0.947	0.027	0.869
No	238(58.3)	61(25.63)	177(74.36)			
Use of toilet facility						
Yes	244(59.8)	58(23.77)	186(76.23)	1.175	0.244	0.622
No	164(40.19)	56(34.14)	108(65.85)			
Wearing shoes						
Yes	263(64.5)	55(20.91)	208(79.08)	0.663	0.561	0.454
No	145(35.5)	44(30.34)	101(69.65)			

*=significant

5. SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1. Summary

A total of 408 stool specimens were collected and examined using Direct Wet Mount and Formol Ether Concentration techniques by laboratory technician at Ijaji health center. The prevalence of *E.hstolytica, A. lumbricoides, G.lambilia*, *H.nana* and Hook worm was found to be 15.2%, 6.9%, 2.4%, 2.2% and 1.2%, respectively. Multiple infections with three parasites found in 1.2% of the sample participants and the overall prevalence of parasitic infections were 27.9% (31.03% of males and 24.8% of females). The predominant parasite detected in this study was *E.histolytica,* which was observed in

62 (15.2) of the school children, *A. lumbricoide,* was the second predominant parasite found in 28(6.9) of the study participants and less frequently observed parasite species was Hook worm 5(1.2%) among the study participants.

The prevalence of intestinal parasitic infections was significantly associated withwashing h ands after defecation (p=0.007). Most of the socio- demographic factors, (family size, parents' occupation, parent education level, and personal hygiene, source of water and its handling, shoes wearing and residence) were not significantly associated with intestinal parasitic infections.

5.2. Conclusion

The findings of the present study show that intestinal parasitic infections was prevalent and one of health problem among school children of Gora Primary School Children inIjaji town.The common human intestinal parasitic species diagnosed among school children in Gora primary school of Ijaji town were *E. hstolytica, A. lumbricoides, G. lambilia*, *H. nana* and Hook worm species.

Washing hands after defecation was significantly associated with parasitic infections and play a great role in affecting prevalence in the study area. This problem can create condition on those children to be exposed to different intestinal parasitic infections. Providing well treated water, hygienic practice, Encouraging healthy behaviors and environmental sanitation for children in the study area could help in reducing the prevalence of intestinal parasitic infections.

5.3. Recommendations

Based on the finding of the present study, to reduce the prevalence of intestinal parasitic infections, among school children in the study area the following recommendations can be made.

- Encouraging healthy behaviors to reduce transmission and re infections, through health education.
- Delivering health education program to society to increase the knowledge, attitude and practice of school children regarding to transmission and prevention of the parasites.

- Prospective studies of growth after treatment are recommended to fully elucidate the effect of parasite on growth.
- Regular deworming program for school children should also be put in place to keep intestinal parasitic infection low.

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APPENDIX I

Questioners

Dear children, how are you? My name is Chala Meshesha, Msc student in Haramaya University College of Natural & Computational science, biology department and now I am starting my research thesis on intestinal parasitic infection & associated risk factor among children in your School.

Dear children, this research work is very crucial for obtaining information about the prevalence of these parasites and related factors contributing for the distribution of them in this woreda as well as controlling the impact of intestinal parasites which affect your day to day activities in your teaching learning process and economy of your families.

This work without your active participation it cannot reach in to its end, so you are request to give your answer for the following questions honestly and actively.

N.B. For multiples questions you can make a **circle** and for open questions you are request to give your own possible answers or if you cannot write, tell your true life history to any trained professional who will ask you.

Dear parent(s), Also you are invited to help your child while he/she answer questions provided for her/him to avoid bias by tell real image of your family life status. I would like to say my heart full thanks for your honestly and actively involvement in writing and giving your suggestions without feeling boring and tiredness

Directions.

I. Demographic Data

1). Name of Child…….

2). Gender i) male ii) female

3).Age i) 7-10 ii) 11-14 ii) 15-18

4). What is your family size? 1. <3 2. 3 – 5 3. >5

5). Level of education i) illiterate ii) grade 1-4 iii) grade 5-8

6). Residence/Kebeles/ i. Urban ii) rural

7). Your family level of education

A) Primary school B) Secondary school C) Technical and vocational D) University and other E) illiterate

II Socio-economic data.

1. Does your family have a job? A) Yes B) no

2. If your answer for number 1 is yes what is that? A) Farmer C) Government employee E) Daily labor B) Merchant D) Private employee F) other

3. Do you have latrines in your home? A) Yes B) no.

4. What was your main source of water supply?

A) Pipe B) River C) Stream D) spring E) ground water F) other.

III Behavioral data.

1. Do you have habits of washing your hand before and after eating?

A) Yes, some times. B) Yes, always. C) no.

2. Are you able to use the latrine properly in your home/ school? A) Yes B) no.

Gaafannoo

Kabajamoo Daa'imman ,akkam jirtu? Ani maqaan koo **Caalaa Mashashaan** jedhama. Yuunversiitii Haramayaa Koollejjii Saayinsii Uumamaa Muummee Baayolooojiitti Barataa Digirii 2ffaa ti. Yeroo amma kana immoo Mana Barumsaa keessanitti mata-duree < **Prevalence of Intestinal Parasitic infections and intensity among school children at Gora primary School, West Shoa, Oromia regional state,Ethiopia>**jedhu irratti qorannoo eegaleen jira.

Kabajamoo daa'imman, hojiin qorannoo kun odeeffannoo faffaca'insa dhukkuba kanaa fi rakkoo (hawwasummaa fi dinagdee) dhimma kana faana wal qabatu argachuuf,dhiibbaa dhukkubichi barnoota keessan fi diinagdee maatii keessanii irratti qabu fi akkasumas mala ittisa dhukkubichaa kallattii argisiisuuf murteessaa dha. Egaa xumura hojii kanaaf hirmaanaan isin gootan murteessaadha. Kanaafuu,gaafannoo armaan gaditti isiniif dhihaatu kana iftoomina fi amanamummaan akka deebiftan kabajaan sin gaafadha.

Kabajamoo maatii Daa'immanii, isinis yeroo mucaan keessan gaafannoo kanaaf deebii laatu/ttu dhugaa jiru ibsu akka danda'uuf/suuf tumsa (deeggarsa) akka gootaniif affeeramtaniirtu. Gaafannoo si dhihaateef nuffii fi dadhabbii tokko malee deebii kenniteef/nneef gamanumaan guddaan si galateeffadha.

HUB;Gaaffiiwwan filannoo siniif dhihaate qubee filannoo deebii sirrii ta'e qabatee jira jetee/ttee yaade/dde achumatti itti mari.Gaaffiiwwan banaa ta'aniif immoo deebii barbachiisaa ta'e kenni.

Kallattii

I. Oddeffannoo Dhunfaa(Demographic Data)

A).Maqaa daa'ima……..

B). koorniyaa i) dhiira ii) dhalaa

C).Umurii i) 7-10 ii) 11-14 ii) 15-18

D).Sadarkaa barnoota i) hin barane ii) 1-4 iii) 5-8

E).Ganda i) Baadiyaa ii) magaalaa

II. Odeeffannoo Hawas-Dinagdee (Socio-economic data).

1. Maatiin kee hojii qabuu? A) heeyye B) lakki

2. Yoo deebiin kee lakk.1ffaaf heeyye ta'e ,gosti hojii isaanii maali? A) Qonnaan bula B) Daldala C) Hojjetaa mootummaa D) Hojjetaa guyyaa E) Kan bira

3.Maddi galii maatii keetii inni guddaan maal?.....

4. Sadarkaan barnoota Maatii keetii hammam? A) Sadarkaa 1ffaa B) Sadarkaa 2ffaa

C) Teknika fi Oogummaa D) Yuunversitii fi ol E) Hin barane

5.Mana fincaanii mana keessanii qabdu?. ? A) heeyye B)lakki

6.Maddi bishaan keessanii inni guddaan maali?

A) ujummoo B) burqaa C)bishaan bollaa D) laga E) kaneen biroo

III Odeeffannoo amala hirmaattotaa(Behavioral data).

1.Amala nyaata dura fi booda harka dhiqachuu qabda?

A)Heeyye,yeroo tokko tokko. B). Heeyye,yeroo hundaa C) lakki.

2.Deebiin kee gaaffii 1ffaaf heeyye yoo ta'e,maal fayyadamtee dhiqataa?

A) Bishaan fi Saamunaa B) Bishaan qofa

3.Mana keessanitti amala dhaabataan mana fincaanii fayyadamuu qabda? A)heeyye B) lakki

4.Yeroo mana fincaaniitti deebitu harka kee ni dhiqataa? A) Heeyye bishaan fi Saamunaa fayyadamuun B) Heeyye bishaan qofa fayyadamuun C) lakki.

5.Yeroo bobbaa bahaatu qaama bobbaa keetii maaliin qulleeffata?

A)Waraqaan B)baalan C) Harkaan D) dhagaa xixiqqoon

6.Amala yeroo hundaa itti fufinsaan kophee kaa'achuu qabdaa? A) heeyye B) lakki

Dear respondents, the main purpose of this study is to find out the prevalence and risk factors associated with parasitic infections among students. It is also very important to create awareness on its prevalence and controlling measure among all concerned bodies. Therefore, I kindly request you to give your genuine response for each question. Thank you

Socio-demographic characteristics

1. Age _____

2. Sex: M _____ F _____

3. Age i) 7-11 ii) 12-15 ii) 15-1

4. What is your family size? 1. <3 2. 3 – 5 3. >5

A. Socio-economic factors

5. Caregiver occupation a. governmental work b. farming c. trade d. daily worker

6. Caregiver education level a. Illiterate b. Read and Write c. Primary education d. Secondary education & above

B. Hygiene Practices

7. Did your child wash his/her hands after toilet? A. Yes B. No

8. If your answer is yes for question no 7 what is the mode of his/her hand washing?

A. only water B. water and soap

9. Did your child wash his/her hands before meal? A. yes B. no

C. Environmental sanitation

10. Where do you get drinking water for your household? A. Tap water B. River

C. Dung/well D. Spring

11. Do you treat water before drinking? A. Yes B. No

12. Do you have a toilet facility? A. Yes B. No facility/ Open defection

Kabajamoo hirmaattotaa,kaayyoon qorannoo kanaa inni guddaan dhiibbaa maxxantoota garaa keessaa fi hariiroo isaan qabattoota naannoo waliin qaban qorachuu ta'a. akkasumas haala faca'insaa fi ittisa isaanii irratti hubannoo uumuuf gargaara. Kanaafuu, milkaa'ina hojii kanaaf deebiin isin naaf deebistan murteessaa waan ta'eef tokkoon tokkoo gaaffilee dhiyaataniif deebii akka nuuf kennitaaniif kabajaan isin gaafanna.

Galatoomaa!

1.Umurii _____

2. Saala A. Dhiira_____ B. Dhalaa_____

3. Baay'inni maatii keessanii meeqa? A. sadii gadi B. 3-5 C. Shanii ol

4. Bakka jireenyaa A. magaalaa B. baadiyyaa

5. Hojii maatii maali? A. hojjetaa mootummaa B. qonnaan bulaa C. daldalaa

D. hojjetaa guyyaa

6. Sadarkaa barumsa maatii A. kan hin baranne B. barreessuuf dubbisuu kan danda'u

C. barumsa sadarkaa 1ffaa D. barumsa sad.2ffaa E. Sadarkaa 2ffaa fi isaa ol

7. Bishaan dhugaatii essaa fayyadamtu? A. boombaa B. laga C. boolla D. burqaa

8. Bishaan dhugaatiin dura ni qulqulleessitu? A. eeyyee B. lakki

9. Tajaajila mana fincaanii qabdu? A. eeyyee B. lakki

10. Mana fincaanii erga dhaqxanii deebitaniin booda harka ni dhiqattu? A. eeyyee B. lakki

11. Gaaffii 10ffaa eeyyee yoo jettan maaliin dhiqattu? A. bishaa qofaan

B. bishaanii fi saamunaan

12. Nyaata dura harka ni dhiqattu? A. eeyyee B. lakki

Appendix II

CONSENT FORM

For participation as volunteer in the research undertaking

Code number----------

Name of the study subject ----------

Explanation on procedures and condition of the agreement

I am from Haramaya University, College of Natural and Computational Sciences. I am here to study The Prevalence and Factors Associated with Parasitic Infections among students in Gora primary school. The objective of this study is to determine prevalence and factors associated with parasitic infections among children in Gora primary school. The information obtained from this study will provide the current status intestinal parasitic infection in the study area.

I am asking you to participate in the study investigation for parasitic infections. The investigation will involve collection of faeces for parasitological examination and interview through pre-structured questionnaire for demographic and associated risk factors of the disease.

If the investigation is confirmed intestinal parasite, you will be treated with appropriate drug. The information that you provide me in the questionnaire and the results of the laboratory investigation would be kept confidential.

If you have any questions regarding the purpose of the study, you have the right to ask question and get clarification. It is your right to refuse this study if you are not interested to participate in the study.

Finally, if you have understood the explanation well enough, I am asking you kindly to participate in this study, and put your signature as illustrated below.

With full understanding of the situation that I agreed to give the informed consent voluntarily to the researcher. I agree that I am contributing to design and implement prevention and control strategies of the disease in the study area, by participating in this project.

Signature of participants (parent) _____ Date_____

Signature of investigator (researcher) _____ Date_____

Appendix III

Laboratory Form

Code _____

1. Laboratory Parasitological Examination Procedures

1.1 Microscopic Examination of Stool:

a. Positive b. Negative

1.2 Concentration technique:

a. Positive b. Negative

1.3 Status of the infections:

A. Single infection with _____

B. Double infection with _____ and _____

C. Multiple infections with _____, _____ and _____

2. Anthropometric measurements:

A. Height _____ B. Weight _____

Appendix IV

Intestinal parasites identified in children in Gora primary school, February - April, 2017

Age groups(years) and Sex		No. Examined (%)	Intestinal parasitic infections					Multiple infection
			Eh	Al	Gl	Tr	Hw	
			No.pos.	No.pos.	No.pos.	No.pos.	No.pos.	No.pos.
7-10								
	Male	97	5	5	2	2	0	1
	Female	106	6	7	2	2	0	0
11-14								
	Male	8 5	23	7	3	3	1	2
	Female	87	16	7	2	2	2	2

15-18								
	Male	21	10	1	0	0	1	0
	Female	12	2	1	1	0	1	0
All age group								
	Male	203	38	13	5	5	2	3
	Female	205	24	15	5	4	3	2
Total		408	62	28	10	9	5	5

Al =*Ascaris lumbricoid*, Eh=*Entamoeba histoltica*, Gl=*Giardia lambilia*, Hn=*Hymenolepis nana*, Hw=*Hookworm.*

Appendix V

Laboratory data collecting format for stool sample

No.	**code**	**sex**	**Age group**	**Type of IPIs**						**Infection**		**Rem ark**
										Single Infection	**Multible Infection**	

Ethical Consideration /Letter/

Date :May:14,2017

To: Haramaya University

We are Writing this reference letter for **Mr. Chala Meshesha** to witness that he has worked his **Labaratory work** in stool test examination on Gora Primary school Children's to differentiate **"Prevalence of intestinal parasitic infections and Associated Risk factors amoung school children** .Therefore we kindly request that he completed his Laboratory activities in our health Center with the help of our Laboratory technician.

With Best Regards!

Tarreessaa Sobbooqaa Hammagahuu
ተራፊ ሰቢቆ ሀማጊሁ
Irfi gaafatamaa Buufata Fayyaa Ijaajjii
የሕዝ ጤና ጣቢያ ኃላፊ