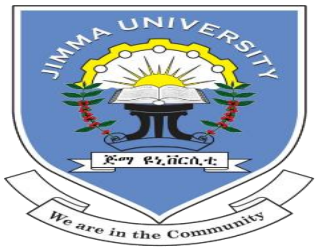

JIMMA UNIVERSITY

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DEPARTMENT OF ENVIRONMENTAL HEALTH SCIENCE AND TECHNOLOGY

PREVALENCE OF INTESTINAL PARASITIC INFECTION AND ASSOCIATED FACTORS AMONG SCHOOL CHILDREN IN SHEKO PRIMARY SCHOOL, SOUTH-WEST ETHIOPIA

BY: NETSANET GIRMA (BSC)

A THESIS SUBMITTED TO JIMMA UNIVERSITY, INSTITUTE OF HEALTH SCIENCES, DEPARTMENT OF ENVIRONMENTAL HEALTH SCIENCES AND TECHNOLOGY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTERS IN ENVIRONMENTAL HEALTH.

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ABSTRACT

Background: Worldwide, about 3.5 billion people are affected by intestinal parasitic infections, and the majority of them are children. Intestinal parasitosis is a major concern for public health, especially in children from middle and low-income populations of tropical & subtropical areas. Intestinal parasitic infection is still common in Ethiopia. Ethiopia, nearly one-third of school children are found to be infected by some sort of intestinal parasites. Periodic evaluation of the current status of human intestinal parasitic infections (HIPIs) is a prerequisite to controlling these health threats.

Objective: To determine the prevalence of intestinal parasitic infection and associated factors among school children in Sheko Primary School, southwest Ethiopia.

Methods: A school-based cross-sectional study was conducted among 422 Sheko primary school children in Sheko town from May to June 2021. A Semi-structure and pre-tested questionnaire were used. Data was entered and analysed by using SPSS version 25.0 software after checking its completeness. It was processed by using descriptive analysis including frequency distribution, cross-tabulation, and summary measures. Bivariate and multivariate logistic regression and odds ratio with 95% confidence interval was used to identify the associated factors with Intestinal parasite. A p-value of less than 0.05 was considered statistically significant.

Results: The prevalence of Intestinal Parasite among Sheko primary school was 31.8%, (95% CI; 27.5-36.3). The likelihood of intestinal parasite was lower among female school children (AOR=0.60, 95% CI: 0.39-0.91) compared to male school children. Similarly, the odd of the intestinal parasite was lower among school children Wearing shoes regularly (AOR= 0.52, 95% CI: 0.28-0.97) than school children who didn't wear shoes regularly.

In the current study, the likelihood of intestinal parasites was higher among school children their age lies between ≤ 9 years (AOR= 3.77, 95% CI: 1.26-11.30) and 10- 14years (AOR= 4.60, 95% CI: 1.51-13.98) compared to school children their age is greater than 15 years. Similarly, the odd of the intestinal parasite was higher among school children didn't wash their hand with soap regularly (AOR= 1.54, 95% CI: 0.93-2.54) than school children did wash their hand with soap regularly.

Conclusion: The finding implies that intestinal parasitic infections among elementary school children in Sheko woreda were prevalent. sex, age, wearing shoes and washing hand with soap were significantly associated with intestinal parasite infection

Keywords: Intestinal parasitic infections, Prevalence, Primary school children, the Risk factor

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ABBREVIATIONS

AOR: Adjusted Odd Ratio

CDC: Center for Disease Control and Prevention

CI: Confidence Interval

COR: Crude Odds Ratio

FMOH: Federal Ministry of Health

IPI: Intestinal Parasitic Infections

NTDs: Neglected Tropical Diseases

OR: Odd Ratio

PI: Principal Investigator

SOP: Standard Operation procedure

SPSS: Statistical Package for Social Sciences

STH: Soil-Transmitted Helminths

WaSH: Water Sanitation and Hygiene

WHO: World Health Organization

CHAPTER ONE

1. INTRODUCTION

1.1. Background

Intestinal parasitic infections (IPIs) have been a big concern for low-income countries as they are the major cause of high morbidity and mortality. Most infectious diseases caused by members of the intestinal parasites (protozoan and helminths) have been considered as Neglected Tropical Diseases (NTDs) (WHO, 2010 & Hotez et al., 2014) and are affecting a large section of poor communities. Intestinal helminthiasis and protozoan infections are widespread throughout the world (Ojha et al., 2014 & Efstratiou et al., 2017) and in particular, millions of people in low-income countries are infected and/or ill with parasitic infections (PIs).

Soil-transmitted helminth infections – roundworm, whipworm, and hookworm – affect millions of people worldwide (WHO, 2015). More than a third of the world's population is infected with soil-transmitted helminths (STH), mainly in the developing nations of Asia, Africa, and Latin America (G. Ross et al., 2017 & Hernández et al., 2019). The main species that infect people are the roundworm (Ascaris lumbricoides), the whipworm (Trichuris trichiura), and the hookworms (Necator americanus and Ancylostoma duodenale) (WHO, 2020).

Globally, millions of pre-schoolers and schoolchildren are vulnerable to infections by parasitic worms and pathogenic protozoan species (Hotez et al., 2014) and are demanding urgent treatment and preventive interventions. Children are disproportionately at risk for the infections, amongst others, owing to their increased nutritional requirements and less developed immune systems (WHO, 2020). Intestinal parasite diseases are linked with intestinal bleeding, nutrient malabsorption, nutrient deficiency, and cell and tissue destruction, anemia, intestinal obstruction, and mental and physical development retardation among children. Overall, these results in delayed growth, decreased mental development, school absenteeism, low academic achievement, prone to malnutrition and infection (WHO, 2010, Ali, 2016 & Tegen et al., 2020).

Intestinal protozoan infections, particularly Entamoeba histolytica (E. histolytica) and Giardia lamblia (G. lamblia), also cause significant morbidity and mortality in developing countries where water quality, waste disposal, sanitation, and hygiene conditions are poor (Kunwar et al., 2016).

Poverty-linked factors such as poor sanitation, scarcity of potable water, unsafe human waste disposal systems, open field defecation, the prevailing bad climate, and local environmental conditions are the most important risk factors identified (Kunwar et al., 2016). In addition, insufficient health services, as well as lack of the required awareness, due probably to the absence of effective health education are among the contributing factors for the elevated IPIs among poor communities (Sitotaw et al., 2020).

Interestingly, Ethiopia contributes to the highest burden of IPIs and accounts for 8% of the global STH infections (Pullan et al., 2014). In the country, IPIs are the second most predominant cause of outpatient morbidity among preschool-age and school-age children (Tefera et al., 2017). According to studies conducted in Ethiopia, nearly one-third of schoolchildren are found to be infected by intestinal parasites (Yeshitila et al., 2020). A. lumbricoides, T. trichiura, H. nana, histolytica/dispar, and S. mansoni are highly spread in the country (Abera and Nibret, 2014b).

High prevalence rates of HIPIs (as high as 84%) were reported among primary school children (Damtie et al., 2021). There are, however, still several locations for which epidemiological data, including the research region, is not accessible (Dessie et al., 2017).

Determining the status of intestinal parasitic diseases and their correlates is crucial not only to formulate appropriate control strategies but also to envisage the risk to considered groups. Existing knowledge indicated the problem is differing from location to location based on the different variables enlisted in Ethiopia and there is scanty information in the study area.

1.2. Statement of the problem

Human intestinal parasitic infections (HIPIs) have been a worldwide public health threat (Ojha et al., 2014). 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 age ranges from 5 to 14 years in developing countries (WHO,

UNICEF & USAID, 2015). Up to 270 million preschool and 600 million school children are living in the area where high transmission of parasitic worm (WHO, 2015). These indicated that children are the major risk group for parasitic infection in many developing countries (WHO, 2017a).

Intestinal parasitic infections (IPIs) are major health problems in many developing countries, particularly among pre-schooled and schooled children (Gizaw et al., 2019). (Chelkeba et al., 2020). The high prevalence rate of IPIs in developing countries depends on several factors. Socio-demographic variables associated with poverty such as reduced access to adequate sanitation, scarcity of potable water, unsafe human waste disposal systems, open field defecations and unavailability of sufficient health care as well as the prevailing bad climatic and environmental conditions are the most important risk factors, Birke and Zawide, 2019).

Young children are reported to be disproportionately affected by IPIs compared to adults due to their increased nutritional requirements and a less developed immune system (Gizaw et al., 2019). IPIs in this age group have been linked with significantly reduced growth, increased risk of protein-energy malnutrition, iron deficiency anemia, and reduced cognitive/psychomotor development (Worku, 2017). The infections may lead to impaired growth, stunting, physical weakness, and low educational performance of infected children Intestinal helminth worm infections can damage a child's internal mucosa, leading to impaired digestion and poor absorption of nutrients (G. Ross et al., 2017).

In Ethiopia, infections with intestinal parasites are toping the morbidity list in different health facilities. A. lumbricoides, T. trichiura, H. nana, histolytica/dispar, and S. mansoniare highly spread in the country (Abera and Nibret, 2014a). A high prevalence of Schistosoma mansoni infection with light, moderate and heavy infection intensity was reported among school children in Ethiopia (Hailegebriel, 2017). Studies in different areas of Ethiopia have shown a high prevalence of IPIs in poor families (Sitotaw et al., 2020). A number of other studies have also shown a considerably high prevalence of IPIs in Ethiopia. For instance, extreme prevalence (84%) was reported among Debre Elias Primary School children (north-west Ethiopia) (Workneh et al., 2014).

A study done on IPIs of elementary school children in Merawi Town, Northwest Ethiopia, show that, out of the 403 students, the overall prevalence of HIPIs was 173 (42.9%) (Damtie et al.,

2021). Another study done in Jawi primary school children, Jawi town, northwest Ethiopia indicated that, of 406 students examined for IPIs, 235 (57.88%) were positive for one or more intestinal parasites. Single, double, and triple infections were 41.9, 6.2, and 1.2%, respectively (Sitotaw et al., 2019). Among the risk factors assessed, age, hand washing habit before meals, open field defecation habit, consistency of wearing shoes, a habit of eating raw and unwashed vegetables, and finger nail cleanliness and trimming habit were found to be the most important predictors associated with a high risk of IPIs (Sitotaw et al., 2019).

Despite the great efforts by the ministry of health, Ethiopia is still known to be heavily affected by IPIs due to the aforementioned socio-demographic variables, behavioural factors, personal hygiene, and environmental sanitation factors (WHO, 2010) (Dessie et al., 2017) (Damtie et al., 2021). In line with this, continuous monitoring of intestinal parasitic infections and their associated risk factors are essential among school children in the country (Hailegebriel, 2017).

Several studies have been conducted on the prevalence and associated factors of IPIs among school children in Ethiopia. But in many parts of the country at large and specifically in the South region there are still localities with no epidemiological information on the prevalence of IPIs among vulnerable groups like school children. Among those localities, Sheko, District, in Bench which is located in southwest Ethiopia is the one. Therefore, this study aimed to assess the prevalence of intestinal parasitic infection and associated factors among students at Sheko primary school, southwest Ethiopia.

1.3. Significance of the study

This study will help us to design strategies that involve schools about school health services, which will provide invaluable support for schools in order to achieve the collective goals of promoting healthier environments.

The findings of this study will help in strengthening the information available so far and will be helped to design effective strategies to combat intestinal parasitic infections and associated risk factors in the study area.

This study will be provided the current prevalence of intestinal parasite infection and its associated risk factors among the study subjects and will be used to plan intervention activities in the future.

The information generated from this study and the suggested recommendation can also be used as input for, nongovernmental organizations, academic institutions health planners, and woreda administrators to make measures that mitigate the transmission of the intestinal parasite to students and the total population in which they live. Therefore, the information generated from this study can be used as a reference for further similar studies.

CHAPTER TWO

2. LITERATURE REVIEW

2.1. Global prevalence of Intestinal Parasitic Infections (IPIs)

Human intestinal parasitic infections (HIPIs) have been a worldwide public health threat (Ojha et al., 2014). According to the Centre for Disease Control (CDC) stated that Intestinal parasitic infections (IPI's) enjoy a wide global distribution (CDC, 2018).

Intestinal parasitosis refers to a group of diseases caused by one or more species of protozoa, Cestodes, trematodes, and nematodes (Enrique and Cruz, 2017). Several infectious diseases caused by some members of these previously listed organisms have been considered as Neglected Tropical Diseases (NTDs) (WHO, 2015). Such infectious diseases are already identified as neglected tropical diseases (NTDs) and received attention very recently (Hotez et al., 2014).

APIs are among the most prevalent human parasitic infections worldwide and constitute a global health burden causing clinical morbidity and mortality (CDC, 2017a). According to the world health organization (WHO,2017), 3.5 billion people are infected, out of which, about 450 million are infected due to IPIs (WHO, 2017a). The prevalence and distribution of IPIs differ from region to region due to several environmental, geographical, and social factors (Pullan et al., 2014).

The major IPI's of global public health concern is the protozoan species E. histolytica and G. lamblia and the soil-transmitted helminths' Ascaris lumbricoides. The incidence and prevalence of these parasitic pathogens vary both between and within countries (Pullan et al., 2014). The majority of infections are associated with poverty conditions such as reduced access to safe drinking water, adequate sanitation and hygiene, housing, and inadequate access to health care (Raj Tiwari et al., 2013).

Globally, millions of preschoolers and schoolchildren are vulnerable to infections by parasitic worms and pathogenic protozoan species and are demanding urgent treatment and preventive interventions (Bintsis, 2017a).

The risk of contracting parasitic infections via food in the developed world is presumed to be relatively low (CDC, 2017a). It is certainly lower than in developing countries, because of the accompanying features of poverty i.e. lack of sanitation and control measures, malnutrition, illiteracy, and overcrowding (CDC, 2017a). Nevertheless, most food-borne parasites have a worldwide distribution. Even in developed countries estimating the risk of food contamination is often difficult due to the lack of awareness of (public) health professionals and researchers in this field (Becker et al., 2018).

In the European Union (EU) for the year 2015, 26 member states reported a total of 4,362 food-borne outbreaks, including waterborne outbreaks. Most of the outbreaks reported in 2015 were caused by bacterial agents (33.7% of all outbreaks), in particular Salmonella spp. (21.8% of all outbreaks) and Campylobacter spp. (8.9% of all outbreaks), even though the reporting of outbreaks involving these agents has been declining over the recent years (EFSA, 2016).

Parasites and other causative agents, in particular histamine, were reported in less than 3% of the outbreaks. Furthermore, for a third of the reported outbreaks (34%) the causative agent remained unknown (EFSA, 2016). In 2015, 156 confirmed trichinellids and 41 cases of congenital toxoplasmosis were reported in the EU. Lithuania reported the highest notification rate followed by Romania and Bulgaria. France reported data with 2-year delay, 216 confirmed congenital toxoplasmosis cases in 2014 (EFSA, 2016).

Total control of the transmission of HIPIs and the reduction of possible aggravating factors are among the components of the sustainable development goals of the United Nations (2030 Agenda; Goal 3.3). Despite the efforts, intestinal parasites remain to be public health burdens, specifically in the tropical and subtropical regions (Hotez et al., 2014). Intestinal parasitosis alone is one of the most common public health problems all over Nepal (Raj Tiwari et al., 2013). Intestinal parasitosis has been a major public health issue for a long time, and the prevalence varies from 13 to 81% while the rate is even a hundred percent in some rural areas (Gupta et al., 2020).

In developing regions, particularly Africa, the protozoan parasite (Entamoeba histolytica and Giardia intestinalis/lamblia) and soil-transmitted helminths (Ascaris lumbricoides, Trichuris trichiura, and hookworm) are the most prevalent intestinal parasites causing high morbidity and mortality in sub-Saharan Africa, affecting nearly all inhabitants at some point in their lives

(WHO, 2010, Erismann et al., 2016 & Ajayi et al., 2017). The prevalence of IPIs in the region is reported to be as high as 84% in Ethiopia (Yeshitila et al., 2020), 90% in Central Sudan (Ahmed et al., 2010), and 84.7% in Burkina Faso (Emile et al., 2013). Like other developing countries IPIs are common in Ethiopia and cause serious public health problems such as malnutrition, anemia, and growth retardation as well as a higher susceptibility to other infections (Gadisa and Jote, 2019) and causes of outpatient morbidity in the country (Belete et al., 2021). Studies in different areas of Ethiopia have shown a high prevalence of IPIs in poor families (Sitotaw and Shiferaw, 2020). A perusal of the literature indicates that in Ethiopia, nearly one-third of school children are found to be infected by some sort of intestinal parasites (Yeshitila et al., 2020).

According to study on intestinal parasites among primary school students in different study area prevalence show that 37.2% in north Thailand (Kunwar et al., 2016) 46.3% in Gambia (CDC, 2017a)34.9% in Bandar abbas, southern Iran (Bintsis, 2017a) 8,14.4% in Nairobi Kenya (Raj Tiwari et al., 2013), 81% in Chencha town southern Ethiopia (Abossie and Said 2014),33.68 in Wolaita sodo town (Solomon and Abraham 2016),44.1% in Yebu town western Ethiopia (Tefera et al., 2017) and 14.5 in northern Ethiopia Axum town (Tegen et al., 2020).

The study revealed that finger nail contents examined among primary school students in different study area prevalence of ova of intestinal parasites were 29.1% in university of Indonesia (Ogunyemi et al., 2015),21% in Lahore Punjab Pakistan (G. Ross et al., 2017),57.2% in ebony state Nigeria (WHO, 2010,)2% in sohag Egypt (Ajayi et al., 2017)and for Lumbricids9.52% in Lahore Punjab Pakistan 20% in Ebony state Nigeria and 2% in sohag Egypt.

According to study conducted in Bagalcot city, India on prevalence of intestinal parasites and its associated socio- demographic factors among primary school students show that 39 (14.7%) were tested positive for intestinal parasitic infection. most common parasite isolated was Lumbricids (5.3%) followed by Histolytic (1.5%), T. solium (0.8%), T. trichuria (0.8%) H. Nana (0.8%). mixed infection constituted 4.1% (Erismann et al., 2016)

According to study conducted in merawi primary school students' northern part the prevalence of intestinal parasites and associated risk factors reveals that from 172 stool specimens,78(45.3%) were positive for different intestinal parasites. The most abundant parasite was E. Histolytic/dispar 68(70.8%) followed by giardia lambia 18(18.8%), taenia saginata 5(5.2%), ascaris lumbricoides 2(2.1%), trichuris trichiura 1(1.1%) and hookworm2(2.1%).

among 78 positive students,18(18.8%) had mixed infections. The dominant parasites among mixed infections were E. histolytic and giardia lambia (Sitotaw et al., 2020)

According to guide lines for the evaluation of soil transmitted helminthiasis and schistosomiasis at primary school level prevalence is high when it is >50%, moderate 20%-50% and low <20% (Workneh et al., 2014).

2.2 Transmission risks of intestinal protozoan and helminthiasis infection

The risks associated with transmission of intestinal parasites are personal hygiene practice factors, environmental factors and social economic status and knowledge factors.

2.2.1 Personal hygiene factors

As the study in Dire Dawa university students revealed that statistical analysis of hand washing habit after toilet shows that there is statically significant difference in isolation rate of shigella between students that washed their hands with soap and water and only with water after toilet ,p=0.01-0.91%.stastically significant association was also seen between isolation rate of shigella and finger nail status , p=0.026.therefore chance of getting shigella infection while finger nails are trimmed is 91% less than while having semi trimmed finger nails AOR =0.09;with a CI=0.01-0.7(Sitotaw and Shiferaw, 2020)

According to study conducted in Arbaminch town shige primary school children Students, the practice of hand washing after toilet (p=0.029) and before food eating (p=0.034) was significantly associated with parasitic infection among the study participants. Students who using water only when they washed their hands after toilet had a more likely risk of infection (with71%) for intestinal parasites AOR;1.71,95%CI=1.057-2.765 than Students who use water and soap and water only with 71%, AOR;1.71with 95%CI=1.057-2. .765(Abera and Nibret, 2014b).

According to study done in harbu town primary school students northern Ethiopia practices and prevalence of intestinal parasites among students the total respondents ,195(70.4%) of them stated that they have a habit of hand washing with soap and water 85% AOR;0.15with 95% CI=0.06-0.38.one hundred two (36.8%) respondents had medical check-ups and 117(42.2%) respondents had a history of deworming either once (73.5),twice(17.9)or thrice(4.3), 202(72.9%)

used soap when their wash their hands before preparing food in any situations. the majority ,245(88.4) reported that they kept their finger nail cut short (Ali et al, 2016).

According to study conducted in Aksum town in northern Ethiopia 310(77.5%) reported that they always wash their hands before food preparation ,295(73.8%) always use soap and water after visiting toilet and 303(75.8%) washing their hands after touching dirty materials and different body parts (Sitotaw et al., 2020)

According to study conducted on prevalence of intestinal parasites and associated risk factors among asymptomatic students in Haramaya university showed that lack of hand washing after use of toilet with soap and water with 65%,AOR=2.43with 95%CI=1.22-4.86 and untrimmed finger nails[AOR3.31,95% CI1.999,5.49] were significantly associated with IPIs (Ahmed et al., 2010).

Cross-sectional study on prevalence of intestinal parasites and associated risk factors in Teda health center, north west Ethiopia indicate that swimming and less shoes wearing habit showed stastistically significant association with prevalent. S, mansoni and hook worm infections respectively. The prevalence of s. mansoni was higher in study participant who had swimming habit (18.9%) than who did not. This might indicate the presence of infested water bodies in the study area (Shiferaw, 2020)

2.2.2. Socio- demographic and economic factors

Cross-sectional study on prevalence of intestinal parasitic infections and their relation socio-economic factors and hygienic habits shows that intestinal parasitic infections prevalence was not significantly associated with age and gender(p=0.053), with years of service(p=0.086) (Damtie et al., 2021).

Study conducted in India revealed that among primary school children, majority of students were males73.7%. most students (44.7%) are young between 10-14 years age group,59.4%were from urban area (Gebretsadik et al., 2020).

According to study in Iran the prevalence of intestinal parasitic infection in Iran was 10.4%.in this study statically significance difference in the prevalence of parasite infection was reported

between males and females(p=0.024), while there was no difference among different educational groups (Sahiledengle et al., 2020).

2.2.3. **Environmental factors**

According to study poor sanitation problems water source were contaminated by human faeces.so that parasites easily transmitted by faeco orally. The parasite eggs and cysts were adhering to dust, utensils, finger nails, door handlers and currency notes and coins. Flies and cockroaches may serve as vectors by ingesting the cysts and /or eggs present in faeces and depositing them in food or mechanically carry them on their body (Pullan et al., 2014).

According to this study factors affect transmission of helminthiasis were improper cleaning after using the latrine bad habit of defecation, use of unclean soil contaminated feeding equipment, eating unwashed vegetable and fruits and other utensils(Kunwar et al., 2016). most intestinal parasites were transmitted through ingestion of faecal contaminated food and water .shoes prevent larvae from penetrating feet (Worku, 2017). Washing hand frequently is one the simplest and effective means of infection prevention which is also true for protection from the intestinal parasite (Dessie et al., 2017).

2.2.4. **participants knowledge about intestinal parasites**

Study conducted in high end hotels in Nairobi Kenya on prevalence of intestinal parasitic infections among primary schools 92.3% were knowledgeable about the intestinal parasite and 7.7%were not aware of the intestinal parasites. among those asked about infectivity of intestinal parasites 75.8% said infected. of 75.5% of the study participants strongly agreed that washing hands before eating food was very important .70.1% were not aware on the purpose for the routine medical examination (Hotez et al., 2014).

Study conducted in south western Nigeria on knowledge, practice and attitude reveal that among the study participants 62.6% were have knowledge of parasitic worms while 88.4%do not actually know how to avoid getting infected with worms. analysis showed that a significantly lower proportion of respondents (11.6%) reported that clean water and clean environment could prevent transmission of STH(Ojha et al., 2014).

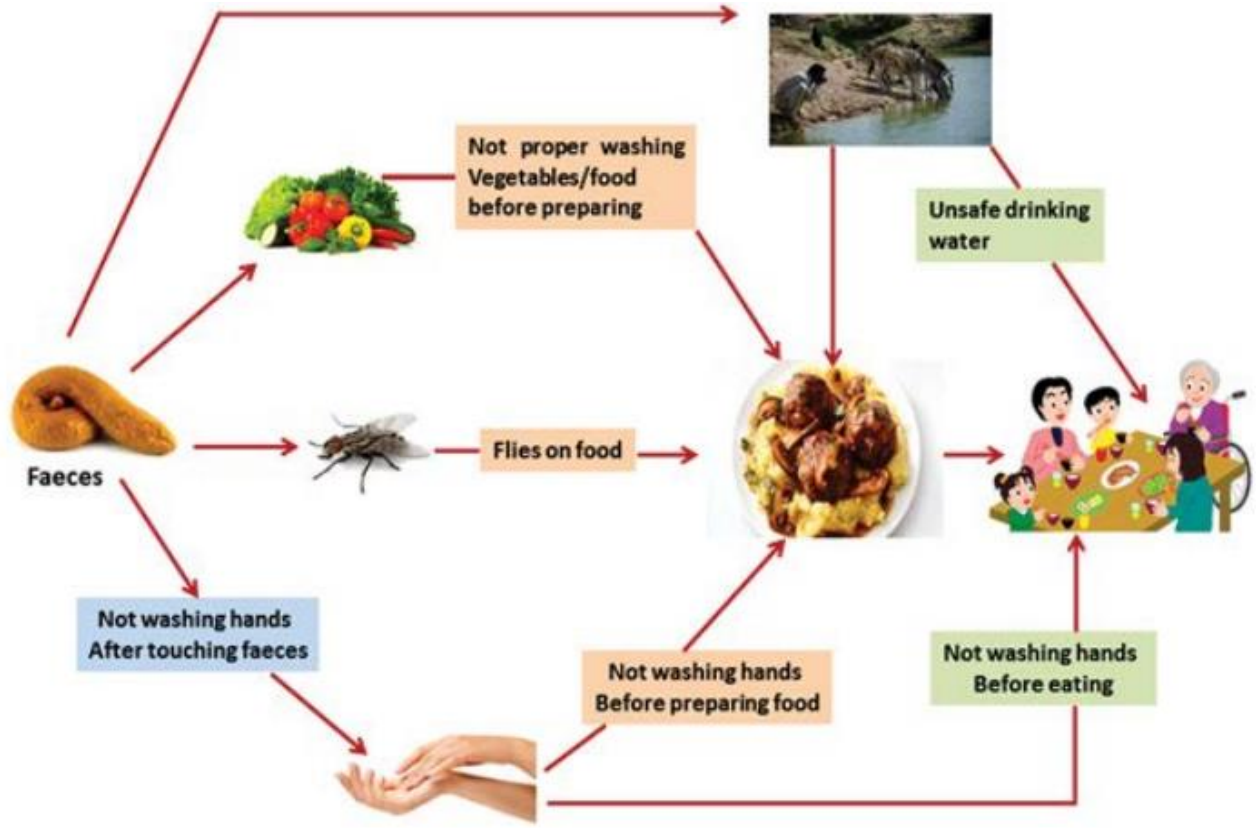


Figure 1: Showing various routes of fecal-oral transmission with feces directly or indirectly to someone's mouth could potentially transmit the pathogen (Meena et al., 2019).

2.5. Risk factors & Greatest Risk Group

Most studies show that potential risk factors with the prevalence of intestinal parasites among school children. Socio-demographic, Environmental, behavioral factors (Rivero et al., 2017)and different sanitation facilities had a significant contribution to the presence of IPIs (G. Ross et al., 2017). Among the potential risk factors, the unavailability of washing facilities constructed at home had also a contributing effect on the presence of intestinal parasites. Home cleanness conditions also had a contribution to the existence of IPIs (Ali, 2016) & (Rivero et al., 2017).

Foodborne illnesses have the greatest impact on the young, elderly, and people who may be immunocompromised or have other existing health conditions (Weninger et al., 2012). While

everyone is potentially susceptible to foodborne disease, certain vulnerable groups are often at greater risk of contracting a foodborne disease and/or suffering more severe consequences from the disease, including death (Reta et al., 2017).

Children deserve added attention in the study of microbial foodborne illness because the risks of some foodborne illnesses, such as salmonellosis, are relatively higher for children than for other demographic groups (Rivero et al., 2017). According to Canadian statistics shows that children from birth to four years of age are more likely to be reported with an infection from Campylobacter, Giardia, Salmonella and Shigella species and Verotoxigenic Escherichia Coli than any other group (Ogunyemi et al., 2015). Children's immune systems are not fully developed, placing them at a relatively higher risk for some foodborne illnesses. A child's lower weight means that it takes a smaller quantity of pathogens to make a child sick than it would a healthy adult. Also, children have limited control of food safety risks because their meals are usually prepared by others (Vandeputte, 2014).

Children deserve added attention in the study of microbial foodborne illness because the risks of some foodborne illnesses, such as salmonellosis, are relatively higher for children than for other demographic groups (Becker et al., 2018). Young children are reported to be disproportionately affected by IPIs compared to adults due to their increased nutritional requirements and a less developed immune system. IPIs in this age group have been linked with significantly reduced growth, increased risk of protein-energy malnutrition, iron deficiency anemia, and reduced cognitive/psychomotor development (WHO, 2017b).

Parasitic infections can also occur from eating contaminated raw vegetables and fruits, soil-eating behavior (Damtie et al., 2021). IPIs are most common among the poorest, school-age children, pregnant, immune-compromised patients, poor hygiene, and occupational contact with soil (Omrani et al., 2015).

2.6. Intestinal parasitic infections (IPIs) in Ethiopia

Gastrointestinal diseases including those caused by intestinal parasites rank the first among communicable diseases in Ethiopia as well as in other developing countries (Gebrie and Alebel, 2020). Despite the efforts, Ethiopia is still at a high burden of IPIs due to the aforementioned sociodemographic variables, behavioral factors, personal hygiene, and environmental sanitation

factors (WHO, 2010, Abossie and Sied, 2014). Particularly, ascariasis, hookworm, and trichuriasis are listed among the most common public health burdens in Ethiopia (Ali, 2016).

Studies in the different regions of Ethiopia have shown a considerably high prevalence of IPIs. According to studies conducted in Ethiopia, nearly one-third of schoolchildren are found to be infected by intestinal parasites (Yeshitila et al., 2020). For instance, an extremely high prevalence (84%) was reported among Dumal Town, Bale Zone, Ethiopia (Gadisa and Jote, 2019). In other studies, conducted in the different regions of Ethiopia, the overall prevalence of IPIs, ranging from 54.5% to 83%, was reported from primary schoolchildren (Damtie et al., 2021). A similar study has not been conducted in Sasiga District given that the area is possibly at high risk of IPIs due to the prevailing risk factors (Sitotaw and Shiferaw, 2020).

According to a study done in Berber primary school, Bahir Dar, Ethiopia showed that among the 359 students participated in the study, 235 (65.5%) were infected by one or more parasitic organism. The prevalence of intestinal parasitic infection was 32% and 33.5% among female and male students, respectively (Hailegebriel, 2017). The rate of single, double, and triple parasitic infections were 174 (48.5%), 58 (16.2%), and 3(0.8%), respectively (Hailegebriel, 2017).

Another, study done on the prevalence and associated risk factors among elementary school children in Merawi town, northwest Ethiopia, showed that a relatively high prevalence of HIPIs (42.9%) was observed among students. Single infections accounted for 39.7% of the infections followed by double infections (3.2%) (Damtie et al., 2021).

2.7. Conceptual Framework

Conceptual Framework shows the occurrence of intestinal parasites among students were interlinked to cause illness and that one factor alone might not lead to an intestinal parasite but a combination of factors can cause disease. The dependent variable is the status of the intestinal parasite. The dependent variable was affected by independent variables like Socio-

demographic/economic condition of primary school students like Sex, Age, Residence, parental educational, Parental occupation, Family size, Personal hygiene practices like handwashing habit, wearing shoes, Finger nail status, Swimming, Eating raw /uncooked Environmental risk factor like Water source, Availability of water and soap, Toilet facility, Shower facility, hand wash facility, Farming activity and Knowledge of student were used to predict intestinal parasite. (Rivero et al., 2017).

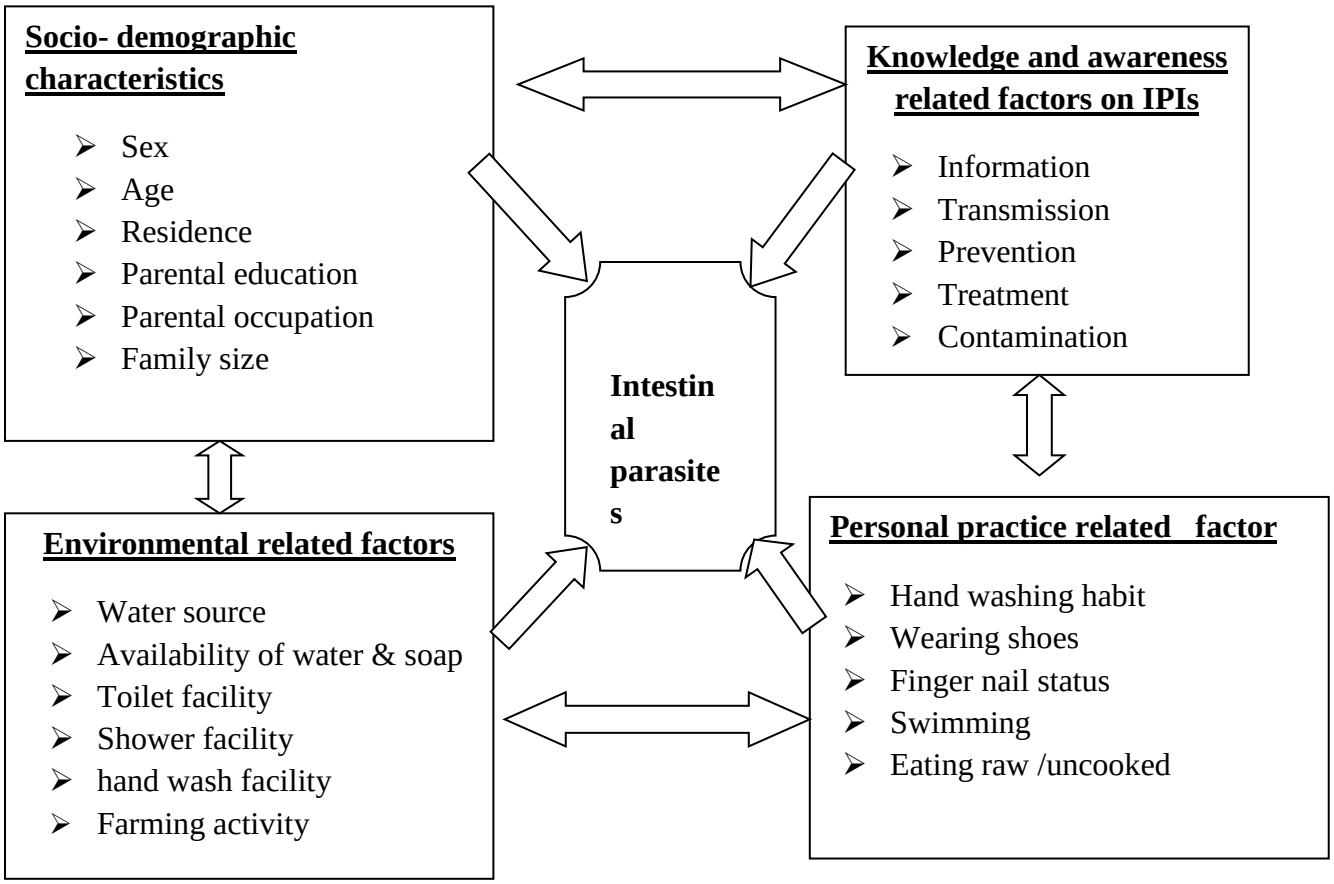


Figure 2: Conceptual framework was developed for factors associated with Intestinal parasitic infection and associated risk factors among school-age children from different literatures (Rivero et al., 2017), (Gadisa and Jote, 2019) & (Sahiledengle et al., 2020).

CHAPTER THREE

3. OBJECTIVES

3.1. General objective

- To assess the prevalence of Intestinal parasitic infections and associated factors among school children in Sheko primary school, Southwestern part of Ethiopia.

3.2. Specific Objectives

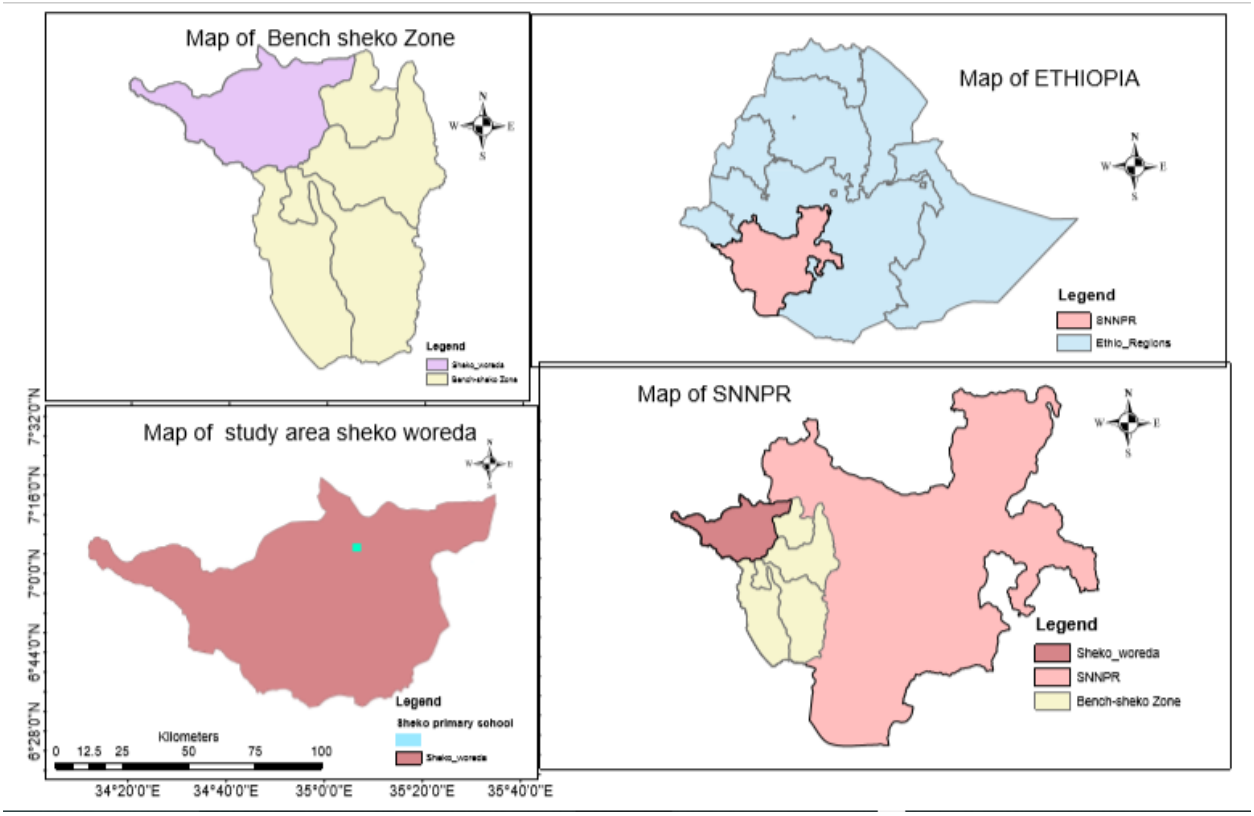
1. To assess the prevalence of IPIs among school children.
2. To determine the risk factors associated with the occurrence of IPIs.

CHAPTER FOUR

4. MATERIALS AND METHODS

4.1. Study Area and Period

The study setting was Sheko Woreda which is located in the Bench-Sheko zone in the Southern Regional State of Ethiopia and it is located 572 km away from Addis Ababa, and 872 km away from Hawassa which is the regional capital city, and 17 km from Bench Sheko zone. Sheko Woreda is one of the 10 Woreda in Bench Sheko zone Southern Ethiopia, with an area of 48,089 square kilometres with a total population of 53,724. The Woreda is located at the geographical location of 9° 10′N and 36° 30′E and elevations of about 1,242 to 1,532 meters above sea level. Seventy percent of the woreda is midland to highland while 30% is a lowland agro-ecological zone. The annual mean temperature in the woreda ranges from 26°C to 33°C while the annual rainfall ranges from 1,200 mm to 1,800 mm. The area is known for its favourable agroecology, with year-round rainfall and Enjera, Godere (taro root), maize, vegetables, and fruits are among the common staple foods in the study area. The people in the rural parts are economically dependent on agricultural products while the urban residents are mainly engaged in market-oriented business activities and services (WASH, 2016). The study was conducted from May to June 2021.



4.2. Study Design

A school-based cross-sectional study was conducted.

4.3. Populations

4.3.1. Source population

All school children enrolled in Sheko Primary School (from grades 1 to 8).

4.3.2. Study population

Those children were randomly selected at shako primary school.

4.4. Eligibility Criteria

4.4.1. Inclusion criteria

Those volunteers with families who signed informed consent delivered stool specimens and those who did not receive any anti-parasitic treatments in the last 2weeks before sampling are included.

4.4.2. Exclusion criteria

Students who did not have signed informed consent, school children who were not willing to give stool samples, students who did not answer the questions on the form for sample collection, and subjects who had taken anti-parasitic drugs in the last two weeks or during data collection were excluded.

4.5. Sampling techniques and sampling procedure

4.5.1. Sample Size determination

The sample size was calculated using a sample size determination formula for the estimation of a single population proportion.

$$n = \frac{(Z\alpha/2)^2}{d^2} \times P(1-P)$$

Where: Where: n = the required sample size,

Zα/2= 95% confidence interval (level of significance) (1.96).

P = proportion (*P*) value of 0.46 was chosen from the previous study done in Rama Town, Northern Ethiopia (Yeshitila *et al.*, 2020). And

d = desired precision (the margin of error) (5%).

The final sample size was 382 samples were taken as a calculated sample size. And after adding an 11% non-response rate, the total sample size was 424.

Table 1: Sample size calculation based on the double population proportion formula

Variables	**Assumptions**									
	Proportion		**Power**	**CI**	**Ratio**	**AOR**	**Sample size**	**Non-response (10%)**	**Total sample size**	**Ref.**
	P1 (Expo.)	P2 (Unexp.)								
Open field defecation	31.3%	20.3%	80%	95%	1:1	2.3	194	19.4	214	(Sitotaw et al., 2019)
Washing hands at critical times	70%	23.8%	80%	95%	1:1	0.20	142	19.4	161	(Sitotaw et al., 2019)
Clean finger nail	16.6	9.7	80%	95%	1:1	0.08	242	24.2	266.2	(Dessie et al., 2017)
Shoe wearing habit	48.6%	17%	80%	95%	1:1	2.44	244	24.4	268.4	(Dessie et al., 2017)

Therefore, by taking a larger sample size a total of 424 study participants were included in this study.

4.5.2. Sampling technique and procedure

One elementary school was selected from the twenty schools found in shako town by simple random sampling technique using lottery method. To select the study participants, after finalized the sample size calculation, the allocation of students was done proportional to the number of students in each grade level (grades 1–8). Finally, the study participants were selected by a simple random sampling technique using computer-generated numbers.

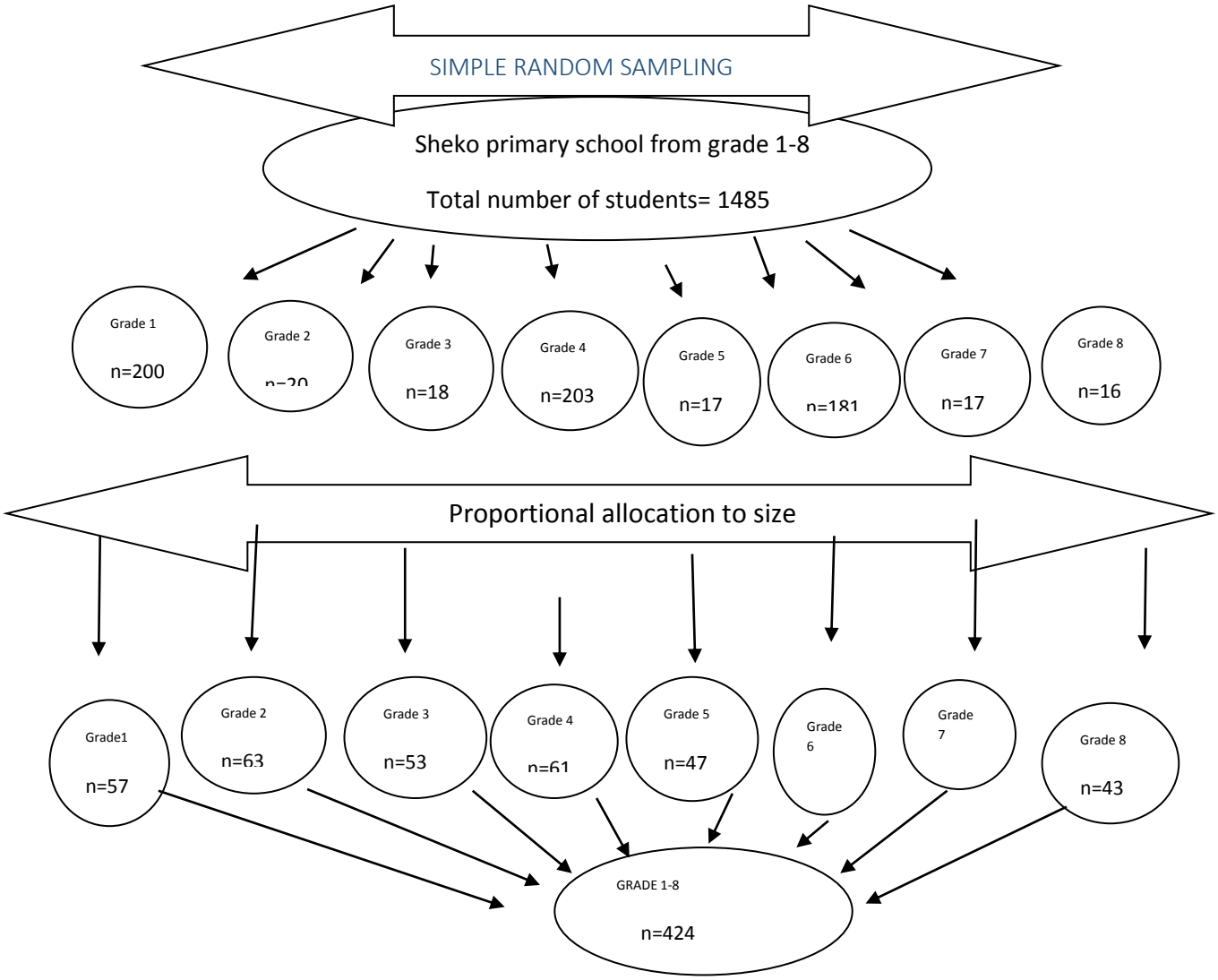


Figure 3: Schematic presentation of the sampling procedures and techniques among school children in sheko primary school,south west Ethiopia. (source from shako primary school,2013E.C)

4.6. Data Collection tools and procedure

4.6.1. Data collection tools

Data were collected using face-to-face interviews by using a semi-structured questionnaire from school children. The questionnaire was developed in English and translated into Amharic (local language). participants of the study (parents in the case of younger children) were interviewed to obtain socio-demographic data, environmental, sanitary facilities, behavioral and hygienic practices. Then, the responses were translated back into English. A pre-test was conducted out of the study area by recruiting 21 students (5% of the total sample size) on a non-study sample population to assess problems related to questionnaires. Problems identified during the pre-test were corrected before the start of actual data collection.

Socio-environmental Questionnaire.: Data about the socio-demographic (age, sex, religion, level of education, family size, monthly family income, and level of education of both parents (father and mother) and environmental and behavioural factors (source of drinking water, availability of latrine in the house, hand washing habits before meals, hand washing habits after defecation, presence of dirty materials under their fingernails, the practice of nail trimming, the practice of teeth brushing, wearing shoes regularly, and habit of swimming in a stream) were solicited by face-to-face interview using a structured questionnaire.

Stool Specimen Collection and Examination: For parasitological analysis, fresh stool samples were collected. The children were instructed properly and given clean labeled collection cups along with applicator sticks, and from each student about 2 g of fresh stool was collected. At the time of collection, date of sampling, the code of the participant, age, and sex were recorded for each subject in a recording format. The stool sample was preserved in 10% formalin before being transported to the Sheko health center laboratory. A portion of each of the stool samples was processed and examined microscopically using direct wet-mount and formal-ether concentration techniques following the procedures in WHO guidelines (WHO, 2000). All developmental stages of the parasites (cyst, egg, larvae, and adult) were recorded.

4.6.2. Data collectors

Data were collected by four trained BSC nurses and two laboratories technical, two BSC in environmental health supervisors were recruited and data collectors and supervisors were received 2 days of training on the study's objectives, the meanings of each question interviewed techniques, and standard procedures for measurements.

4.7. Study Variables

4.7.1. Dependent variables:

- Intestinal parasitic infections status.

4.7.2. Independent variable:

- **Socio-demographic characteristics related variable**: Sex, Age, Residence, Parental education, Parental occupation, Family size
- **Environmental related variable:** Water source, Availability of water & Soap, Toilet facility, Shower facility, Hand wash facility, Farming activity
- **Personal practice related variable:** Hand washing habit, wearing shoes, Finger nail status, Swimming, Eating raw /uncooked, Medical check-ups
- **Knowledge and Awareness related variable**: Information, Transmission, Prevention, Treatment, Contamination

4.8. Operational Definitions

School children: *Those* students who registered in shako primary school (Yeshitila *et al.*, 2020).

Shoes: any kind of shoes that are used by students not to walk on bare foot.

Intestinal parasitic infections (IPIs)*:* The participant was recorded positive for IPIs if the stool sample examined by microscopy becomes positive to cyst or trophozoite of any parasite (Hernández et al., 2019).

Washing hands at critical times: Washing hands after visiting the toilet, before a meal, after touching the bottom of the child, after touching animal pets, before food preparation.

Clean uniform: This is a protective cloth that is washed and used by the students (Kunwar et al., 2016).

Hygiene: The promotion of cleanliness to prevent the spread of disease (CDC, 2017a).

Finger nail status: Assessing school children of fingernails whether trimmed or untrimmed by observing (Emile et al., 2013).

Knowledge: Participants were asked to answer 10 knowledge questions about transmission and prevention methods of intestinal parasitic infection. Graded as having "Good knowledge" if they had answered correctly ($\geq$80%) 8–10 questions, medium if they had answered (50–70%) 5–7 questions, and< 5 questions as "Poor knowledge"

4.9. Data processing and Analysis procedure

Collected data were entered into epi data version 3.1 and exported to SPSS version 25 for further analysis. Descriptive statistics such as frequencies, mean, and range were carried out to observe the distribution of the study subjects in connection with variables under study. (e binary logistic regression analysis model was fitted after the cross-tabulation of each explanatory variable with the outcome variable and thereby checking the fulfilment of chi-square assumptions. Initially, bivariate analysis was carried out to select variables for multivariate analysis. Variables with a *p*-value <0.25 in the bivariate analysis were selected as candidates for the multivariable analysis and fitted into a logistic regression model. (*p*-value of ≤0.05 was considered statistically significant.

4.10. Data Quality Control

Data quality was ensured during tool development, data collection, entry cleaning, and analysis. Before data collection: An objective-based and standardized questionnaire and the instrument were prepared. The training was given to data collectors for two days on data collection methods, Pre-testing of questionnaire was undertaken on 5% of the study population out of study setting to check for any missing options, ambiguity, and clarity. before the main study was conducted to identify the potential problem of data collection tools and to check the consistency of the questionnaires.

The principal investigator was conduct spot-checking and review all the completed questionnaires to ensure completeness and consistency of collected information. Stool and ova sample collection and investigation were conducted according to standard procedures. Microscopic reading was made by the lab technician. During data collection at each selected student research team supervisors were supervised all steps of data collection including the interview and stool and ova specimen collection. Up on completion of data collection at each student, the PI was reviewed the entire data collection form to ensure completeness and accuracy.

4.11. Ethical Consideration

The study protocol, procedures, information sheet, and consent statement were approved by the Ethical review board (ERB) of Jimma University. (ERB000197/21). Participants, included in the study were informed about the study objectives and benefits. written informed consent was taken from the participants, and those who are willing to participate in the study were asked information regarding IPIs. Privacy and confidentiality of the interviews and information gathered were assured. Those who tested positive for the parasites were recommended for treatment.

4.12. Dissemination Plan

The finding of the thesis will be attached to Jimma university institute of health, Jimma university's research coordinated office, Jimma university department of Environmental Health Science and Technology, SNNPR Health Bureau, Zonal Health department, Sheko woreda administrator, and Woreda Health Office. Finally, study results will be sent to the respective scientific journals requesting for publication and presentation in scientific conferences

CHAPTER FIVE

5. RESULTS

5.1 Socio-demographic and economic characteristics of study participants

A total of 424 school children were involved in this study with a response rate of 99.5 %. Out of the total 422 study subjects, males make a majority 250(59.2%). Two hundred twenty eighty (54%) were aged ≤ 9 years. They were predominantly protestant 289 (68.5%) by religion and the majority of the respondent's residents 337(79.9%) were rural. Regarding House hold occupation and ethnicity 315 (74.6%) was farmer and 197(46.7 %%) were Sheko respectively (Table 1).

Table 2: Socio-demographic characteristics of school children in Sheko primary school, South-western part of Ethiopia, 2021 (n = 422).

Variable		**Frequency**	**Percentage (%)**
Sex	Male	250	59.2
	Female	172	40.8
Age	≤ 9	228	54.0
	10-14	176	41.7
	≥ 15	18	4.3
Ethnicity	Amhara	87	20.6
	Oromo	129	30.6
	Sheko	197	46.7
	Bench	9	2.1
Household head religion	Orthodox	74	17.5
	Muslim	45	10.7
	Protestant	289	68.5
	Other	14	3.3
Residence	Urban	85	20.1
	Rural	337	79.9
House hold occupation	Governmental employee	33	7.8
	Daily Laborer	38	9.0
	Merchant	19	4.5
	Farmer	315	74.6
	House wife	17	4.0

5.2 Participant's knowledge about intestinal parasite

Among the study participants, 93.1% of them have ever heard about the intestinal parasite, of which 55% of them got the information from health extension workers. Out of the total study participants, 91.5% know the source of the intestinal parasite, and 72.1% answer source of the intestinal parasite is contaminated food. Regarding the transmission of intestinal parasite 94.5% says it is transmitted and 83.6 % of them say that it is transmitted through ingestion of contaminated food and water. On the other hand, 93.6% and 100% of study participants answer intestinal parasite is preventable and treatable (Table 2).

Table 3: Knowledge about intestinal parasite among school children in Sheko primary school, Southwestern part of Ethiopia, 2021 (n = 422).

Variable		**Frequency**	**Percentage (%)**
Have you ever heard about intestinal parasite	Yes	393	93.1
	No	29	6.9
Source of information about intestinal parasite	Health extension worker	232	55.0
	Television or Radio	125	29.6
	Health facility	40	9.5
	School	25	5.9
Do you know the source of the intestinal parasite	Yes	386	91.5
	No	36	8.5
Source of intestinal parasite	Contaminated food	304	72.1
	Contaminated water	58	13.7
	Contaminated soil	60	14.2
Can intestinal parasites be transmitted	Yes	399	94.5
	No	23	5.5
How intestinal parasite transmitted	Fecal contamination	353	83.6
	Direct contact	69	16.4
Can some intestinal parasites have transmitted during bare foot movement?	Yes	144	34.1
	No	278	65.9
Can some intestinal parasite be transmitted during swimming	Yes	361	85.5
	No	61	14.5
Can intestinal parasite preventable	Yes	395	93.6
	No	27	6.4
How intestinal parasites could be	Keeping food and	319	75.6

prevented	water hygiene		
	Maintain Environmental sanitation	91	21.6
	Keeping personal hygiene	12	2.8
Can intestinal parasites be treatable	Yes	422	100

5.2. Environmental related factors

Most of the children, 300 (71%), used public tap water for drinking. 50 (12%) and 62 (17%) of the participants obtained water for domestic purposes from wells or streams and rain water respectively.

Two hundred fifty students (59 .2%) had latrines in their houses. Less than two-thirds, 397 (94.1%), of the children practiced hand washing before meals regularly while the remaining did so less frequently. 281 (66.6%) participants had the habit of finger nail trimmed. About 351 (83.2%) of the children wear shoes regularly.

Table 4 : personal and behavioral related factor of intestinal parasite among school children in Sheko primary school, in south-western part of Ethiopia, 2021 (n = 422).

Variable		**Frequency**	**Percentage (%)**
Toilet facility of the respondents	yes	250	59.2
	No	172	40.8
Hand washing before taking food	yes	397	94.1
	No	25	5.9
Hand washing after toilet	yes	282	66.8
	No	140	33.2
Finger nail status of the respondents	Trimmed	281	66.6
	untrimmed	141	33.4
Shoes wearing Habit	yes	351	83.2
	No	71	16.8

5.3 Prevalence of Intestinal Parasites among study participants

In the current study, among 422 students all have participated in the study, 134 (31.8%) were infected by one or more parasitic organisms (Table 4). The prevalence of intestinal parasitic infection was 67 (15.9%) both in female and male students. The rate of single, double, and triple parasitic infections was 91 (21.66%), 30 (7.15%) and13(3.03%), respectively (Table 4). Among these intestinal parasites, E. histolytica was the most prevalent 53(12.62%) followed by G. lamblia 38 (9.08%), Hookworm 20 (4.76%), S. mansoni 14 (3.33%), and Ascaris lumbricoides was one of the least identified parasites in the current study (Table 4).

In the current study, E. histolytica was the predominant parasite with a prevalence rate of 12.62% followed by S. mansoni and Hookworm. Ascaris lumbricoides were one of the least identified parasites in the current study (Table 4).

Table 4: Common intestinal parasite among School children in Sheko primary school, South-western part of Ethiopia, 2021 (n = 422).

Parasite species	**Parasite infected students by sex**		
	Female No. (%)	**Male No. (%)**	**Total No. (%**
E. histolytica	23(5.48)	30(7.14)	53(12.62)
G. lamblia	25(5.95)	13(3.09)	38(9.05)
Hookworm	8(1.9)	12(2.86)	20(4.76)
S. mansoni	8(1.91)	6(1.43)	14(3.33)
A. lumbricoides	3(0.71)	6(1.43)	9(2.14)
Single infection	23(5.46)	30(7.12)	53(12.58)
Double infection (G. lamblia and Hookworm)	27(6.41)	21(4.98)	48(11.39)
Triple infection (Hookworm, S. mansoni and A. lumbricoides)	17(4.03)	16(3.80)	33(7.83)
Over all infection	67 (15.9)	67(15.9)	134(31.8)

Prevalence of Intestinal Parasite

The prevalence of Intestinal Parasite among school children in Sheko primary school was 31.8%, (95% CI; 27.5-36.3).

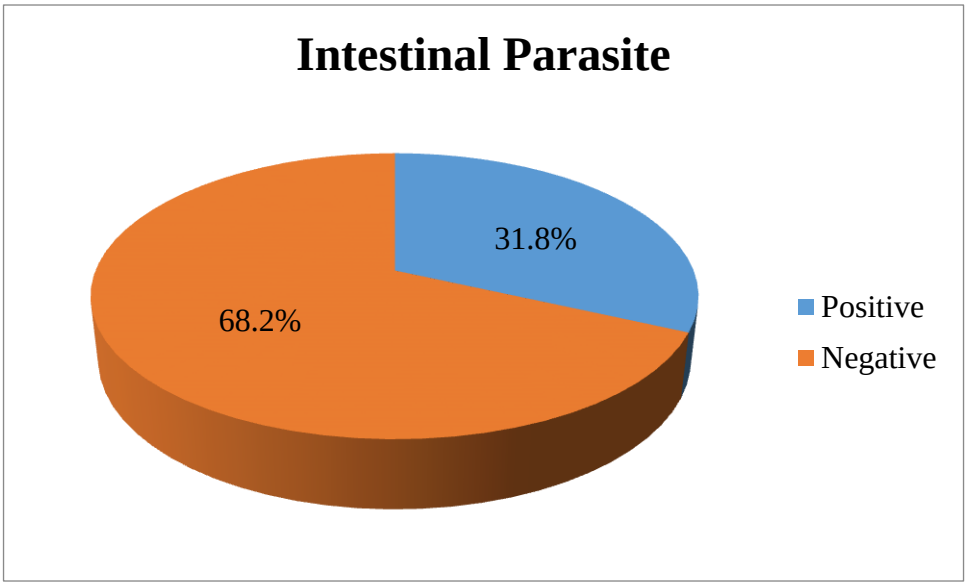


Figure 4: Prevalence of Intestinal Parasite among school children in Sheko primary school, South-western part of Ethiopia, 2021.

5.4 Factors associated with Intestinal Parasite

Those exposure variables with p-values < 0.25 were entered into multivariable logistic regression analysis. In bivariable logistic regression analysis, sex, age, the status of a finger nail, wearing shoes, having shower facility, hand washing after toilet, hand washing with soap, washing fruit and vegetable before eating, source of drinking water was having p-values < 0.25 so that entered into multivariable logistic regression analysis. However, in multivariable logistic regression sex, age, wearing shoes regularly, and washing hands with soap regularly were independent predictors of intestinal parasites. The likelihood of intestinal parasite was lower among female school children (AOR=0.60, 95% CI: 0.39-0.91) compared to male school children. Similarly, the odd of the intestinal parasite was lower among school children Wearing shoes regularly (AOR= 0.52, 95% CI: 0.28-0.97) than school children who didn't wear shoes regularly.

In the current study, the likelihood of intestinal parasites was higher among school children their age lies between ≤ 9years (AOR= 3.77, 95% CI: 1.26-11.30) and 10- 14years (AOR= 4.60, 95% CI: 1.51-13.98) compared to school children their age is greater than 15 years. Similarly, the odd of the intestinal parasite was higher among school children didn't wash their hand with soap regularly (AOR= 1.54, 95% CI: 0.93-2.54) than school children did wash their hand with soap regularly.

Table 6: Bivariable and Multivariable logistic regressio analysis result for factor associated with IPs among school children sheko primary school South-west, Ethiopia.

Characteristics		Frequency	percent (%)	COR (95%CI)	P-value
Sex	Male	250	59.2	1	1
	Female	172	40.8	1.74(1.15, 2.64)	**0.000***
Age	≤ 9 years	18	4.3	5.18(1.84, 14.58)	**0.039***
	10-14 years	228	54	4.25(1.53, 11.76)	**0.015***
	≥15years	176	41.7	1	**1**
Finger nail	Untrimmed	146	34.6	1	1
	Trimmed	276	65.4	1.13 (0.74,1.74)	0.146
Wearing shoes	No	70	16.6	1	1
	Yes	352	83.4	0.70(0.39, 1.26)	**0.041***
Having shower	Yes	94	22.3	1	1
	No	328	77.7	1.37(0.85, 2.22)	0.169
Hand washing after toilet	No	140	33.2	1	1
	Yes	282	66.8	1.37 (0.89, 2.11)	0.165
Hand washing with soap	Yes	104	24.6	1	1
	No	318	75.4	1.33 (0.84,2.12)	**0.009***

Washing fruit and vegetable before eating	No	147	34.8	1	1
	Yes	275	65.2	1.35(0.88, 2.07)	0.210
Source of drinking water	Tap water	146	34.6	1	1
	Non tap water	276	654.	0.77(0.49, 1.19)	0.217

P-value of *< 0.05, COR=Crude Odds Ratio, P-value of *< 0.25AOR= Adjusted Odds Ratio.

Table 7: Multivariate logistic regression analysis result for factors associated with IPs among school children in Sheko primary school South-west.

Variables	Categories	Frequency	Present (%)	COR (95%CI)	AOR (95% CI)	P-Value
Sex	Male	250	59.2	1	1	1
	Female	172	40.8	1.74(1.15, 2.64)	0.60(0.39, 0.91)	**0.017***
Age	≤ 9 years	18	4.3	1	4.60(1.51, 13.98)	**0.007***
	10-14 years	228	54	4.25(1.53, 11.76)	3.77(1.26, 11.30)	**0.018***
	≥15years	176	41.7	5.18(1.84, 14.58)	1	**1**
Wearing shoes	No	70	16.6	1	1	1
	Yes	352	83.4	0.70(0.39, 1.26)	0.52(0.28, 0.97)	**0.041***
Hand washing with soap	Yes	104	24.6	1	1	1
	No	318	75.4	1.33 (0.84,2.12)	1.54(0.93, 2.54)	**0.009***

P-value of *< 0.05, COR=Crude Odds Ratio, AOR= Adjusted Odds Ratio.

CHAPTER SIX

6. Discussion

This study has tried to assess the prevalence and associated factors of intestinal parasites among schoolchildren. Accordingly, the prevalence of intestinal parasites was found to be 31.8%, (95% CI; 27.5-36.3). The prevalence found in this study is higher than study conducted in Sebeya primary school (29.9%), (Dessie et al., 2017), Harbu Town (21.5%) (Gebretsadik et al., 2020), and Shashamane town 19.7% of Ethiopia (Sahiledengle et al., 2020). This variation could be due to geographical settings differences, sanitation facility coverage, accessibility of safe water, and personal hygiene dissimilarity (Damtie et al., 2021).

In the current study, age had a significant association with intestinal parasites among school children, where children their age lie between ≤ 9 years and 10-14 years were three and four times more likely to had an intestinal parasite in comparison with children their age were greater than ≥15 years respectively. This is supported by the study conducted in Merawi Town and Jawi town (Damtie et al., 2021) & (Sitotaw et al., 2019). Young children have the habit of inserting into their mouth whatever they got, which makes them to susceptible the intestinal parasite. On the contrary, age had no significant association with the intestinal parasite in the study conducted Sasiga District (Sitotaw and Shiferaw, 2020), Harbu Town (Gebretsadik et al., 2020), and Shashamane town. (Sahiledengle et al., 2020).

Based on current finding washing hand with soap regularly had a significant association with intestinal parasite among school children, where children didn't wash their hand with soap regularly were one time more likely to had an intestinal parasite in comparison with children washing their hand with soap regularly. This is supported by the study conducted by Sebeya (Dessie et al., 2017). Washing hand frequently is one the simplest and effective means of infection prevention which is also true for protection from the intestinal parasite (Dessie et al., 2017).

In this study, the intestinal parasite had a significant association with sex, where female children were less likely to had an intestinal parasite in comparison with male children. This is supported by the study conducted Harbu Town (Gebretsadik et al., 2020). Unlike the current finding, research work in Sasiga District (Sitotaw and Shiferaw, 2020) and Shashamane town did not show a significant association between sexes with an intestinal parasite (Sahiledengle et al., 2020). This might be due to

in comparison with female school children male children usually play outdoors and engage in outdoor activities like playing football, which may predispose them to higher risks of IPI.

According to this study, wearing shoes had a significant association with an intestinal parasite, where children wearing shoes regularly were less likely to had an intestinal parasite in comparison with children who didn't wear shoes regularly. This is supported by the study conducted Sasiga primary school (Sitotaw and Shiferaw, 2020), Merawi elementary school (Damtie et al., 2021), Jawi primary school, (Sitotaw et al., 2019), and Shashamane primary school (Sahiledengle et al., 2020). Unlike the current finding, research work in Harbu primary school town did not show a significant association between wearing shoes with the intestinal parasite (Gebretsadik et al., 2020). The possible explanation could be due to lack of protective shoes is a known risk factor to increase the chance of getting hookworm and other infections.

6.1. Strengths and limitations of the study

6.1. Strengths

- ✓ Standardized tools which were tested for their validity according to the Ethiopian context were employed to assess intestinal parasites.
- ✓ Those children who had intestinal parasites were linked with health facilities to get needed treatment.
- ✓ Having a high response rate.

6.2. Limitations

- ✓ Because of the cross-sectional study design establishing a tentative relationship between intestinal parasite significant associated factors with co-variate is impossible.
- ✓ In addition, due to the cross-sectional study design was used; it doesn't allow inferring the causation.
- ✓ Social–desirability bias was likely for self–reported responses.

CHAPTER SEVEN

7. Conclusion and Recommendation

7.1 Conclusion

According to this study Sheko primary school were highly infected with an intestinal parasite, indicating that intestinal parasite is still public health problem in the study area. In the current study, E. histolytica was the predominant parasite followed by S. mansoni and Hookworm. In currently in this study, the most important risk factors for these found to be sex, age, wearing shoes regularly, and washing hands with soap regularly was associated with IPIs among shako primary school independent predictors of intestinal parasite.

7.2 Recommendation

For students

- They were recommended to improve their hygiene practice and shoes wearing habit
- Those who were infected should get treatment and follow their medical status and those who were not infected should improve their hygiene practice.

For FMOH

- AS per WHO guideline recommends periodic drug treatment, should be given once year when prevalence of STH Infection in the study population is over 20%

For Woreda

- They should continuously supervise the students and establish personal hygiene rule and posted it on easily visible site.
- They were encouraged to conduct regular evaluation of students for their health status including screening for the prevalence of intestinal parasite in their school compound.
- Health education program should be strength on mode transmit ion of intestinal parasite and focusing water sanitation and hygiene (WaSH) practice to prevent acquisition of re-infestation with and spread of intestinal parasite infections.

For Researcher:

- Further studies should be conducted by researchers to indicate the impact of intestinal parasites disease arise from students and the environment including, finger nails, hands, Fruit and vegetables.

. References

Abera, A., Nibret, 2014a. Prevalence of gastrointestinal helminthic infections and associated risk factors among schoolchildren in Tilili town, northwest Ethiopia. Asian Pac J Trop Med. 2014;7(7):525–30.

Abera, A., Nibret, E., 2014b. Prevalence of gastrointestinal helminthic infections and associated risk factors among schoolchildren in Tilili town, northwest Ethiopia. Asian Pac J Trop Med. 2014;7(7):525–30.

Abuse, A., Sied, M., 2014. "Assessments of the prevalence of intestinal parasitic infection and associated risk factors among primary schoolchildren in Chencha town southern Ethiopia," BMC Public Health, vol. 14, no. 166, pp. 47–58, 2014.

Ahmed, A.A.M., Afifi, A.A., Malik, E.M., Adam, I., 2010. "Intestinal protozoa and intestinal helminthic infections among schoolchildren in Central Sudan," Asian Pacific Journal of Tropical Medicine, vol. 3, no. 4, pp. 292-293, 2010.

Ajayi, M.B., Sani, A.H., SMC, E., Afocha, E.E., Adesesan, A.A., 2017. "Intestinal parasitic infection and body mass index among school children in Oshodi lagos Nigeria," Advances in Cytology & Pathology, vol. 2, no. 2, pp. 44–49, 2017.

Ali, Y., 2016. Intestinal parasitic Infections among School-age Children In Mekaneselam Health Center, Borena, Northeast Ethiopia.

Assefa, T., Tasew, H., Wondafrash, B., Beker, J., 2015. Assessment-of-bacterial-hand-contamination-and-associated-factors-among-food-handlers-working-in-the-student-cafeterias-of-jimma-main-campus-jimma-south-west-ethiopia-2376-0214-1000345.pdf.

Becker, S., Liwanag, H., Snyde, J., Akogun, O., 2018. Toward the 2020 goal of soil-transmitted helminthiasis control and elimination.

Belete, Y., Kassa, T., Baye, M., 2021. Prevalence of intestinal parasite infections and associated risk factors among patients of Jimma health center requested for stool examination, Jimma, Ethiopia.

Bintsis, T., 2017a. Foodborne pathogens. http://www.aimspress.com/journal/microbiology.

Bintsis, T., 2017b. Foodborne pathogens.

Birke, W., Zawide, F., 2019. Transforming Research Results in Food Safety to Community Actions-A Call for Action to Advance Food Safety in Ethiopia EER5-14013070.

CDC, C., 2018. Surveillance for Foodborne Disease Outbreaks - United States, 2009–2015.

CDC, C., 2017a. FOOD-BORNE DISEASES AND FOOD SAFETY, Monthly Newsletter of National Centre for Disease Control Directorate General of Health Services.

CDC, C., 2017b. Centres for Disease Control and Prevention, 2016b. National Centre for Emerging and Zoonotic Infectious Diseases (NCEZID). Division of Foodborne, Waterborne, and Environmental Diseases. https://www.cdc.gov/ncezid/dfwed/edeb/index.html. (Accessed 19 July 2017).

Chelkeba, L., Mekonnen, Z., Alemu, Y., Emana, D., 2020. Epidemiology of intestinal parasitic infections in preschool and school-aged Ethiopian children: a systematic review and meta-analysis.BMC Public Health. 2020;20(1):117. doi:10.1186/s12889-020-8222-y.

Chiyangi, H., Muma, J.B., Malama, J., Manyahi, J., Abade, A., Kwenda, G., Matee, M.I., 2017. Identification and antimicrobial resistance patterns of bacterial enteropathogens from children aged 0–59 months at the University Teaching Hospital, Lusaka, Zambia: 2017a prospective cross-sectional study. BMC Infect. Dis. 17 (1), 117.

Damtie, D., Sitotaw, B., Menkir, S., Kerisew, B., Hussien, K., 2021. Human Intestinal Parasitic Infections: Prevalence and Associated Risk Factors among Elementary School Children in Merawi Town, Northwest Ethiopia.

Dessie, A., Gebrehiwot, T., Kiros, B., Wami, S., Chercos, D., 2017. Intestinal parasitic infections and determinant factors among school-age children in Sebeya primary school. northern Ethiopia: a cross-sectional study, 2017.

Doyle, M.E., 2003. Foodborne Parasites A Review of the Scientific Literature Review. medoyle@wisc.edu http://fri.wisc.edu/docs/pdf/parasites.pdf.

ECDC, E., 2015. European Food Safety A, EuropeanCentre for Disease P, Control. The European Union summary report on trendsand sources of zoonoses, zoonotic agents and food-borne outbreaks in 2014. EFSA Journal 2015;13:4329-n/a.

EFSA, E., 2016. EFSA (European Food Safety Authority) and ECDC (European Centre for Disease revention and Control) (2016) The European Union summary report on trends and sources of zoonoses, zoonotic agents and food-borne outbreaks in 2015. EFSA J 14: 4634–4865.

Efstratiou, A., Ongerth, J.E., Karanis, P., 2017. "Waterborne transmission of protozoan parasites: review of worldwide outbreaks-an update 2011–2016," Water Research, vol. 114, pp. 14–22, 2017.

Emile, N., Bosco, N., Karine, B., 2013. Prevalence of intestinal parasitic infections and associated risk factors among Kigali Institute of Education students in Kigali, Rwanda.

Enrique, C., Cruz, A., 2017. Intestinal protozoal diseases. 2017. https :// e medicine. medsc ape.com/artic le/99928 2-overview.

Erismann, S., Diagbouga, S., Odermatt, T., 2016. "Prevalence of intestinal parasitic infections and associated risk factors among schoolchildren in the Plateau Central and CentreOuest regions of Burkina Faso, "Parasites & Vectors, vol. 9, no. 1, p. 554, 2016.

G. Ross, A., Papier, K., Luceres-Catubig, R., N. Chau, T., T. Inobaya, M., 2017. Poverty, Dietary Intake, Intestinal Parasites, and Nutritional Status among School-Age Children in the Rural Philippines.

Gadisa, E., Jote, K., 2019. Prevalence and factors associated with intestinal parasitic infection among underfive children in and around Haro DumalTown, Bale Zone, Ethiopia.

Gebretsadik, D., Tesfaye, M., Adamu, A., Zewde, G., 2020. Prevalence of Intestinal Parasitic Infection and Its Associated Factors Among School Children in Two Primary Schools in Harbu Town, North East Ethiopia: Cross-Sectional Study.

Gebrie, A., Alebel, A., 2020. A systematic review and meta-analysis of the prevalence and predictors of anemia among children in Ethiopia.

GHS, F., CJ, W., 2017. Quality and standards of hospital food service; a critical analysis and suggestions for improvements.

Gizaw, Z., Addisu, A., Dagne, H., 2019. Effects of water, sanitation and hygiene (WASH) education on childhood intestinal parasitic infections in rural Dembiya, northwest Ethiopia: an uncontrolled before-and-after intervention study. Environ Health Prev Med. 2019;24(1):16. doi:10.1186/s12199-019-0774-z.

Gupta, R., Rayamajhee, B., P. Sherchan, S., Rai, G., Mukhiya, R., Khanal, B., Rai, S., 2020. Prevalence of intestinal parasitosis and associated risk factors among school children of Saptari district, Nepal: a cross-sectional study.

Hailegebriel, T., 2017. Prevalence of intestinal parasitic infections and associated risk factors among students at Dona Berber primary school, Bahir Dar, Ethiopia.

Hernández, P.C., Morales, L., Chaparro-Olaya, J., Sarmiento, D., Sánchez, L.K., 2019. Intestinal parasitic infections and associated factors in children of three rural schools in Colombia. A cross-sectional study.

Hokelek, M., Lutwick, L., Cua, A., 2017. Nematode infections. 2017. https://emedicine.medsc ape.com/artic le/22401 1-overview.

Hotez, P.J., Basáñez, M.G., Alvarado, M., 2014. "The global burden of disease study 2010: interpretation and implications for the neglected tropical diseases,"PLoS Neglected Tropical Diseases, vol. 8, no. 7, article e2865, 2014.

Humphries, R.M., Linscott, A.J., 2015. Laboratory diagnosis of bacterial gastroenteritis. Clin. Microbiol. Rev. 28 (1), 3–31.

Kunwar, R., Acharya, L., Kark, S., 2016. Trends in prevalence of soil-transmitted helminth and major intestinal protozoan infections among school-aged children in Nepal.

Meena, M., Swapnil, P., Barupal, T., Sharma, K., 2019. A Review on Infectious Pathogens and Mode of Transmission.

Naing, L., Winn, T., Rusli, B., 2006. "Practical issues in calculating the sample size for prevalence studies,"Archives of Orofacial Sciences, vol. 1, pp. 9–14, 2006.

Newell, D.G., Koopmans, M., Verhoef, L., Duizer, E., Scheutz, F., Kruse, H., Threfall, J., 2010. Food-borne diseases—The challenges of 20 years ago still persist while new ones continue to emerge.

OGUNYEMI, A.K., BURAIMOH, O.M., ONUORAH, N.O., EZEUGWU, S.M.C., ODETUNDE, S.K., OLUMUYIWA, E.O., 2015. Bacteria associated with contamination of ready-to-eat (RTE) cooked rice in Lagos-Nigeria.

Ojha, S.C., Jaide, C., Jinawath, N., Rotjanapan, P., Baral, P., 2014. "Geohelminths: public health significance," The Journal of Infection in Developing Countries, vol. 8, no. 1, pp. 005–016, 2014.

Omrani, V., Fallahi, S., Rostami, A., Siyadatpanah, A., Barzgarpour, G., Mehravar, S., 2015. Prevalence of intestinal parasite infections and associated clinical symptoms among patients with end-stagerenal disease under going hemo dialysis. Infection 2015, 43(5): 537–544. https://doi.org/10.1007/s15010-015-0778-6 PMID: 25869822.

Osman, M., Safadi, D. el, Cian, A., 2016. "Prevalence and risk factors for intestinal protozoan infections with Cryptosporidium, Giardia, Blastocystis and Dientamoeba among Schoolchildren in Tripoli, Lebanon,"Public Library of Science Neglected Tropical Diseases, vol. 10, no. 3, article e0004496, 2016.

Pullan, R., Smith, J., Jasrasaria, R., Brooker, S., 2014. Global numbers of infection and disease burden of soil transmitted helminth infections in 2010. Parasit Vectors. 2014;7:37.

Raj Tiwari, B., Chaudhary, R., Adhikari, N., Jayaswal, S., Poudel, T., Rijal, K., 2013. Prevalence of Intestinal Parasitic Infections among School Children of Dadeldhura District, Nepal.

Reta, M., Lemma, M., Gemeda, A., Lemlem, G., 2017. Food handling practice and associated factors among food handlers working in food establishments in Woldia town, Northeast Ethiopia.

Rivero, M., De Angelo, C., Nuñez, P., Salas, M., Motta, C., Chiaretta, A., 2017. Environmental and socio-demographic individual, family and neighbourhood factors associated with children intestinal parasitoses at Iguazú, in the subtropical northern border of Argentina. PLoS Negl Trop Dis. 2017;11(11): e0006098. pmid:29155829.

Sahiledengle, B., Beker, S., Girum, Y., Haji, G., Merewo, S., Anberbir, W., 2020. Prevalence and risk factors of intestinal parasites among primary school children in Shashamane town, southern Ethiopia.

Sitotaw, B., Gebeyaw, Y., Mekonnen, H., 2020. Prevalence and associated risk factors of intestinal parasitic infections among primary school children at Bure town, north-west Ethiopia.

Sitotaw, B., Mekuriaw, H., Damtie, D., 2019. Prevalence of intestinal parasitic infections and associated risk factors among Jawi primary school children, Jawi town, northwest Ethiopia.

Sitotaw, B., Shiferaw, W., 2020. Prevalence of Intestinal Parasitic Infections and Associated Risk Factors among the FirstCycle Primary Schoolchildren in Sasiga District, Southwest Ethiopia.

Tefera, E., Belay, T., Mekonnen, S., 2017. Prevalence and intensity of soil transmitted helminths among school children of Mendera Elementary School, Jimma, Southwest Ethiopia. The Pan African Medical Journal. 2017;27:88.

Tegen, D., Damtie, D., Hailegebriel, T., 2020. Prevalence and Associated Risk Factors of Human Intestinal Protozoan Parasitic Infections in Ethiopia: A Systematic Review and Meta-Analysis.

Vandeputte, E., 2014. ASSESSMENT_OF_FOOD SAFETY HANDLING PRACTICES AT FARMERS' MARKETS IN RHODE ISLAND.

WASH, 2016. Water, Sanitation and Hygiene (WASH) Ethiopia, 2016.

Weerakoon, K.G., Gordon, C.A., Williams, G.M., 2018. "Coparasitism of intestinal protozoa and Schistosoma japonicum in a rural community in the Philippines,"Infectious Diseases of Poverty, vol. 7, no. 1, 2018.

Weninger, S., Wagendorf, J., Mille, T., Bullinger, K., Well, L., Brosz, T., Pritschet, B., 2012. Foodborne Outbreak Investigation Manual.

WHO, 2020. WHO. Soil–transmitted helminth infections. 2020.

WHO, who, 2011. WHO (2011) Evaluating household water treatment options: Health-based targets and microbiological performance specifications. Geneva, Switzerland.

WHO, W., 2017a. Organization WH: World Health Report. Conquering Suffering Enriching Humanity. Geneva: WHO; 1997. Available from: apps who int/book orders/ MDI book PDF/Book/12401997 pdf [Accessed on 22 July 2017].

WHO, W., 2017b. WHO. Integrating neglected tropical diseases into global health and development: fourth WHO report on neglected tropical diseases. Geneva: World Health Organization; 2017. Licence: CC BY-NC-SA 3.0 IGO.

WHO, W., 2015. WHO ESTIMATES OFTHE GLOBAL BURDEN OF FOODBORNE DISEASES: foodborne disease burden epidemiology reference group 2007-2015.

WHO, W., 2010. WHO. Working to overcome the global impact of neglected tropical diseases: first WHO report on neglected tropical diseases. Geneva: WHO; 2010.

WHO, W., 2000. WHO. Basic laboratory method in medical parasitology. Geneva: WHO; 2000.

WHO,UNICEF & USAID, W., UNICE& USAID, 2015. Improving nutrition outcomes with better water, sanitation and hygiene: practical solutions for policies and programmes. WHO_UNICEF_USAID_Nov2015.

Workneh, T., Esmael, E., Ayichiluhm, M., 2014. Prevalence of intestinal parasitic infections and associated factors among Debre Elias primary school. East Gojjam zone Amhara region, north-West Ethiopia. J Bacteriol Parasitol. 2014; 5(181):11.

Worku, A., 2017. Prevalence of Helicobacter pylori and intestinal parasite and their associated risk factors among school children at Selam Fire Elementary School in Akaki Kality, Addis Ababa, Ethiopia.

Yang, D., Yang, Y., Wang, Y., 2018. “Prevalence and risk factors of Ascaris lumbricoides, Trichuris trichiura and Cryptosporid ium infections in elementary school children in Southwestern China: a school-based cross-sectional study,” International Journal of Environmental Research and Public Health, vol. 15, no. 9, 2018.

Yazew, T., 2020. Review of Barriers to Food Safety Management in Hospitality Industries of Ethiopia: The Impacts and Prevention.

Yeshitila, Y., Zewde, H., Mekene, T., Manilal, A., Lakew, S., Teshome, A., 2020. Prevalence and Associated Risk Factors of Intestinal Parasites among Schoolchildren from Two Primary Schools in Rama Town, Northern Ethiopia.

Zhu, L., Chen, X., Liu, Z., Li, S., W., Yu, W., 2016. Characteristics of bacterial pathogens associated with acute diarrhea in children under 5 years of age: 2016 a hospital based cross-sectional study. BMC Infect. Dis. 16 (1), 253.

Annex I: Information sheet

Title of research: A cross-sectional study of the prevalence of intestinal parasite infection and associated factors among Sheko primary school children in the southern west part of Ethiopia.

Name of principal investigator: ----------

Name of organization: Jimma university college public health Department of Environmental health science and technology

Purpose of the study: This study aims to determine prevalence of intestinal parasite infection and determinant factors among Sheko primary school children in southern west part of Ethiopia. If you are willing to participate in this study you are expected to answer some questions and give stool specimens.

Procedures: In order to undertake the aforementioned study, some question related with topic and stool sample are taken for laboratory investigation. Permission were processed from the Jimma university and Sheko woreda administrators. hence, you are expected to give required samples and information related with the study.

Risk associated with the study: There is no risk associated with participating in this study. you never waste time except the time required to give some information and specimen.

Confidentiality of your information: The result of laboratory finding will be kept confidential and could only accessed by the researcher and responsible body. There is no personal information to be attached to your data.

Right to refusal or withdrawal: Participant has the full right to refuse from participating and to withdrawal at any step in this research. If you have any question you may contact the following individuals. Based on above information I agree to participate in the research

Signature: ---------- date----------

Name of data collector---------- signature----------

Remember: If you have any question you can ask the principal investigator

Annex II. STANDARD OPERATING PROCEDURES (SOP) FOR STOOL EXAMINATION

A. DIRECT WET MOUNT METHOD

1. A drop of fresh normal saline will be placed on the slide and mixed with small amount of stool specimen using a piece of stick.

2. The smooth preparation will be covered with cover glass.

3. The entire saline preparation will be examined systematically using 10x and 40x objective

B. Standard operational procedure for the Formal-Ether concentration technique

1. using a stick, emulsify about 1g (pea size) of faces in about 4ml of 10% formal water. Add more 3-4ml formal water

2. Mix well by shaking and sieve into another tube made of glass or polypropylene

3. Add 3-4ml of ether (anaesthetic). Stopper tube and mix for 1 min

4. Loosen the stopper (there is pressure inside tube)

5. Centrifuge immediately at 750-1000g (~ 3000rpm) for 1 min

6. using a stick loosen the layer of faecal debris from the side of the tube and discard the supernatant, the sediment remains

7. Allow the fluid from the side of the tube to drain to the bottom. Tap the bottom tube to re suspend and mix sediment

8. Transfer a small portion of the sediment to a slide and cover it

9. Examine the preparation first with 10X and then 40X objective

Annex III. observation checklist

S.no	Question	Response option	Remark
1	Does the student wear uniform	1.yes 2.no	
2	Does the student wear mouth mask	1.yes 2.no	
3	Are finger nail trimmed and clean	1.yes 2.no	
4	Does the student uniform clean	1.yes 2.no	
5	Discharging from nose, eye, ear and cough during visit	1.yes 2.no	
6	Do you have regular medical check-up see if evidence	1.yes 2.no	
7	Are you separate from student when you are ill like as Quarantine	1.yes 2.no	
8	School have deworming program	1.yes 2.no	
9	School have sanitation campaign program	1.yes 2.no	
10	School have hand washing facilities with clean water and soap	1.yes 2.no	
11	School toilet have slab cove and clean floor	1.yes 2.no	

Annex IV. Eligibility questionnaire

S.no	Question	Answer
1	In the last 2 to 3 weeks, did you have any of the following sign and symptoms? A. Diarrhoea (bloody or not) B. Fever C. Abdominal pain	1. yes 2.no
2	Are you taking antibiotic/anti helminthic drug?	1.yes 2.no
3	If yes for the above question, when?	----------

Questionnaire for the eligible **Code----------**

Part 1. Participants socio-demographic			
S/N	Question	Response option	Remark
1	Sex of respondent	1. male 2. female	
2	Age of respondent (in years)	1. ‹9 2.10-14 3. › 15	
3	Nationality	1.Amhara 2. Oromo 3. Sheko 4. Bench 5. Other	
4	household head's Religion	1. Orthodox 2. Muslim 3. Protestant 4. Other	
5	Income status	1. <500 2.501-1500 3.1501-5000 4.>5000	
6	household head's education	1. Illiterate 2. Elementary 3. High school & above	
7	household head's occupation	1. Government employee 2.NGO employ 3. Daily labor 4. Merchant 5. Farmer 6. House wife 7. Other	
8	Residence	1.urban 2. rural	
Part 2. personal hygiene practice of students			
9	Finger nail status	1.trimmed 2. untrimmed	
10	Do you share writing materials?	1. yes 2.no	
11	Do you wear clean uniform during learning?	1. yes 2.no	
12	Do you cover mouth with tissue paper /mask during learning?	1. yes 2.no	
13	Do you have shoes wearing habit?	1. yes 2.no	

14	Do you have shower facility at home?	1. yes 2.no	
15	Do you wash hands after using the toilet?	1. yes 2.no	
16	Do you wash hand before taking any food?	1. yes 2.no	
17	If the above Q is yes, do you wash your hands with soap?	1. yes 2.no	
18	Have you ever received/learn any health information about water, sanitation or hygiene?	1. yes 2.no	
19	Do you wash fruits and vegetables before eating?	1. yes 2.no	
20	If the above Q is yes, where do you get your health information about water, sanitation or hygiene?	1. HEW 2. HW 3. Religious leader 4. Radio or TV 5. religious leader 6. others--	
21	Do you wash your cloths in the river?	1. yes 2.no	
Part 3. Environmental related factor			
22	Where does Your family get water for domestic use?	1.stream/river 2.tape water 3.bore hole 4. rain water	Multiple answer is possible
23	Do you carry out farming activity like, weeding and digging on the farms?	1. yes 2.no	
24	Do you have toilet facility?	1. yes 2.no	
25	If your answer for Q 25 is yes, what type of toilets do you use while at home?	1.pit latrine 2. Flush toilet 3.VIP 4. other specify (----)	
26	Do you have separate hand washing facility?	1. yes 2.no	
27	If your water source is other than tap water, do you treat it?	1.yes 2.no	
28	Where do you mostly obtain your fruit and vegetables?	1.farm 2. market 3. both	
Part 4 knowledge related question			
29	Have you ever heard about intestinal parasite?	1. yes 2.no	
30	Do you know the sources of intestinal parasite?	1. yes 2.no	
31	If the above answer is yes to Q 30 above what are sources of intestinal parasite?	1.contaminated food 2.contaminated water	

		3. contaminated soil 4.other specify (----------)	
32	Can intestinal parasites be transmitted?	1. yes 2.no	
33	If yes to Q33above, how could it be transmitted?	1.direct contact 2. sexual contact 3.fecal contamination 4. other specify	
34	Can some intestinal parasite be transmitted during bare foot movement?	1. yes 2.no	
35	Can some intestinal parasite be transmitted during swimming?	1. yes 2.no	
36	Can intestinal parasites preventable?	1. yes 2.no	
37	If your answer is yes, do you know how intestinal parasites could be prevented?	1.personal hygiene 2.drinking alcohol3..food hygiene 4.enviromental sanitation 5.eatingcookedfood/vegetables 6.other specify------	
38	Do they have treatment?	1.yes 2.no	
39	Do you think intestinal parasite cause fatal disease?	1. yes 2.no	

Part 5. participants laboratory data		stool	ova
Parasites isolated from stool/ova	A. lumbrcoid		
	T. trichuria		
	E. histolica/dispare		
	S. stercolaris		
	Hook worm species		
	G. lamblia		
	H. nana		
	Taenia species		
	Mixed		
	Other specify		
Status of intestinal parasite	1.posative 2.Negative		

Annex V. Shows assessment of annual intestinal parasite laboratory diagnosis in bench sheko zone sheko woreda health office plan and achievement from 2004-2012 EC

s.no	Year	Annual plan	No of person tested	No of person positive	%
1	2004	3500	3461	1246	36
2	2005	4877	4586	1330	29
3	2006	4500	3757	1240	33
4	2007	4000	3666	1100	30
5	2008	3555	2964	1008	34
6	2009	3666	3406	988	29
7	2010	3200	3009	933	31
8	2011	4233	4003	1241	35
9	2012	2788	1943	622	32

According to the above table the prevalence of parasitic infection of sheko woreda 5 years' report is nearly similar to the result of the study findings.

APPROVAL SHEET

As thesis research advisors, we hereby certify that we have read and evaluated this thesis prepared under our guidance by Netsanet Girma entitled as "prevalence of intestinal parasitic infection and associated factors among school children in sheko primary school, south-west Ethiopia". We recommended that it could be submitted as fulfilling the thesis requirement.

Advisors:

Dr. Abebe Beyene (PhD, Associate Professor**)**

Date _____ Signature _____

Mr. Wondwossen Birke (MSc, PhD candidate)

Date _____ Signature _____

Department Head

Name _____signature _____ date_____

As member of the board of examiners of the MSc. thesis open defence examination, we certify that we have read and evaluated the thesis prepared by Netsanet Girma and examined the candidate. We recommend that the thesis be accepted as fulfilling the thesis requirement for the degree of Master of Science in Environmental Science and Technology.

_____	_____	_____
Internal Examiner	Signature	Date
_____	_____	_____
External Examiner	Signature	Date

Declaration

This thesis work on; prevalence of intestinal parasitic infection and associated factors among school children in sheko primary school, south-west Ethiopia, is my original thesis work, has not been presented for a degree in this or other university and that all sources of materials used for this have been acknowledged.

Name: Mr. Netsanet Girma (BSc)