PREVALENCE OF INTESTINAL PARASITIC INFECTIONS AND ASSOCIATED FACTORS AMONG SCHOOL AGE CHILDREN IN URBAN AND OPEN DEFECATION FREE RURAL KEBELES, AT DEDO WOREDA, SOUTH WEST ETHIOPIA: A COMPARATIVE CROSS SECTIONAL STUDY

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Abstract

Introduction: -*Intestinal parasitic infections have been a major public health burdens in low and middle income countries which is most common in rural communities, particularly school age children are among at high risk group in developing countries including Ethiopia. Open defecation is one of the major predisposing factors for intestinal parasitic infections. In Ethiopia, the government is committed to decrease open defecation by integrating with health extension program packages and declaring kebeles free of open defecation as a strategy of improving sanitation to decrease infection of intestinal parasites.*

Objective:-*The objective of this study was to determine the prevalence of intestinal parasite infections and associated factors among school age children in urban and open defecation free rural kebele Dedo District, South-west Ethiopia*

Methods: -*Community based comparative cross-sectional study was conducted in Dedo Woreda from July 15 to August 15, 2021. A total of 607 school age children were involved in the study. The school age children's were selected using systematic random sampling method. Stool samples were collected using stool cups and processed by formo- ether concentration technique and wet mount was used for detection of protozoan trophozoites. Prevalence and associated factors were computed with descriptive statistics and bivariate and multivariate regression. Variables with a P-value < 0.05 were considered as statically significant.*

Results: -*Overall, 305 urban and 302 open defecation free rural school age children were investigated and 32.1% of them (30.2% of the urban and 34.1% of the open defecation free rural kebeles) were found to be harboring at least one species of intestinal parasite. In both groups unprotected water source (AOR=2.55, P=0.001 and AOR=3.6,P=0.001), latrine with not hand washing facility (AOR=2.28, P=0.008 and AOR=4.65,P <0.001) not hand washing before having food (AOR=4.6,P<0.001 and AOR=2.32,P=0.025), and latrine not available (AOR=5; P=<0.001and AOR=4.65, P=.02) were significantly associated with IPIs in urban and rural open defecation free kebeles respectively.*

Conclusion:-.*The prevalence of intestinal parasite infection was moderate in the study area with slightly higher in open defecation free kebeles than urban.*

Recommendations*:* - *Therefore application of community-led total sanitation and hygiene coupled with close follow-up and monitoring was necessary. Additionally continuous community awareness should be strengthened on prevention and control of intestinal parasite infections.*

Key words*: Prevalence, Intestinal parasites, School age children, Open defecation free, Dedo*

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Abbreviations and acronyms

CLTS:	Community Led Total Sanitation
CLTSH:	Community Led Total Sanitation and Hygiene
HH:	House Hold
HEP:	Health Extension Program
HIV:	Human Immunodeficiency Virus
IPIs:	Intestinal Parasite Infections
IP:	Intestinal Parasites
IRB:	Institutional Review Board
MDA:	Mass Drug Administration
ODF:	Open Defecation Free
SAC:	School Age Children
SDGs:	Sustainable Development Goals
SPSS:	Statistical Package for Social Sciences
STHs:	Soil Transmitted Helminthes
WHO:	World Health Organization

Chapter one

Introduction

1.1Background

Intestinal parasitic infections(IPIs) are endemic in rural and urban, among children in developing countries, which is caused by both intestinal helminthes and protozoan parasite(1). Intestinal parasitic infections are the major health problems in school children between the ages of 5 and 15 years suffer the highest infection rate and parasitic burden(2). Thus the main helminthes that infect people are *Ascaris lumbricoides (A.lumbricoides), Trichuris trichiura (T.trichiura),* hookworms,*Strongyloides stercoralis (S. stercoralis), Schistosoma mansoni(S.mansoni)* and *Hymenolepsis nana (H.nana)*(3), while the main pathogenic intestinal protozoa are *Entamoeba histolytica/dispar (E.histolytica/dispar), Giardia intestinalis (G.ntestinalis), Cryptosporidium species*(4).

Intestinal parasites are usually transmitted directly by ingestion of infective stage from contaminated water, food, soil, or by direct skin penetration with infective stage and having close contact to infected animals or person-to-person contact are also possible routes of transmission (5). In the case of protozoan parasites, after ingestion by an appropriate host, the cysts of parasitic protozoan transform into trophozoites which exhibit an active metabolism and are usually motile for most intestinal protozoa(6), and most protozoan parasites are an asexual reproduction which consist cysts stage and trophozoites stage(7). Helminthes are reproduced sexually and produce eggs, which are passed in human stools and deposited in the external environment (soil and water bodies) passing through some developmental stage which in turn infect human(8).

There are various factors that associated with the prevalence of intestinal parasitic infection, which includes lack of safe drinking water, poor environmental sanitation, lack education and poor socioeconomic status(9). Open defecation of human excreta in fields, bushes, forests, ditches, streets, canals rather than use of toilet is the main causes of intestinal parasitic infections(10).

There are strategies to control helminthes infection , which, includes regular administration of anthelmintic drugs, however, rapid re-infection occurs in areas where hygiene, access to clean water and sanitation are inadequate(11)**.** Increasing access to basic sanitation and hand washing with soaps is among the mechanisms to prevent IPIs(12), while eliminating open defecation is the main prevention mechanism of IPIs(13).

Sustainable Development Goals (SDGs) of WHO which "Ensure availability and sustainable management of water and sanitation for all" are working to eliminating open defecation world wide by 2030(14). From this community-led total sanitation (CLTS) is an innovative approach for mobilizing communities to build their own toilets and stop open defecation(15). Community-led total sanitation not only focuses on the construction of latrines, but also on local knowledge, attitude, practice, and beliefs related to hygiene and defecation behavior(16). Factors contributing to open defecation especially in rural villages includes habit, nomadic cultural lifestyles and poor design of public toilets, absence and non-functionality of latrines; available open space and poor understanding of health and hygiene factors(17)**.**

In Ethiopia, the government is committed to decrease open defecation by integrating with health extension program (HEP) packages and CLTS by increasing the number of open defecation free rural kebeles(18). Thus the performance in reducing open defecation in Ethiopia from 2000 to 2016 was 82% to 32% which contributed significantly for the improvement of the health status of under-five children (reduced mortality from 166/ 1,000 live births to 67)(19). The current challenges encountered while implementing open defecation free(ODF) kebele programs are mainly related to inconsistency of performance, substandard infrastructure, data inconsistency and lack of institutional coordination and integration(19).

In the study area there are urban and rural health extension program which is component of sustainable development goals like CLTS, which mainly focused on rural kebeles to build their house hold latrine and communal latrine to eliminate open defecation and decrease transmission of intestinal parasitic infection which implemented since 2016 in the study area. Therefore it is very important to determine the importance of this program whether it has impact on transmission of intestinal parasitic infection between rural ODF kebeles by comparing with urban kebeles that have already their own latrine.

1.2. Statement of the problem

Intestinal parasitic diseases affect more than 1 billion people in marginalized and poor communities, particularly in low-income regions, such as most African, Southeast Asian, and Latin American countries(20). The prevalence of IPIs was ordinarily high in Sub-Saharan Africa countries, and the incidence of IPIs is 25% in developed countries, but its incidence can range up to 95% in developing countries which was caused by both protozoa and helminthes(21).

According to WHO report of 2019 among 20 diseases included in the WHO list of neglected tropical diseases, soil transmitted helminthes(STHs); (*A. lumbricoides*, hookworms, and *T. trichiura*) are the most prevalent and greater than 1 billion people infected (22). Among the protozoans, *E. histolytica/dispar* infects 500 million individuals per year, causing disease in 50 million(23). In Africa, more than 173 million people are infected with *A. lumbricoides* while 198 million and 162 million people are infected with *H.worms* and *T. trichiura*, respectively(6). Whereas waterborne protozoan disease causes of 4 billion cases of diarrhea and the death of 1.6 million people per year(24).

School aged children(SAC) were highly infected with *hookworms, A. lumbricoides, T. trichiura,* and water born protozoans parasites like *E. histolytica/dispar* and *G. intestinalis*(25). School aged children are the most commonly affected groups of the populations due to their typical hand-mouth activity, water contamination and their immature immune system(26). Their behavioral activities are also associated with the high prevalence of IPIs compared to adults (27).

In Ethiopia, like other developing countries, intestinal parasites are among major public health problems and the most predominant causes of outpatient morbidity(28). Soil transmitted helminthes for example are widely distributed in the country with 81 million people living in endemic areas: 9.1 million preschool children, 25.3 million schoolchildren, and 44.6 million adults (29). The distribution and prevalence of various species of intestinal parasites differ from region to region because of several environmental, social and geographical factor (30). Ethiopia

contributes to the highest–burden of IPIs and accounts for 8% of the global burden of STHs infections (28).

Parasitic infections are regarded as serious public health problem and responsible for iron deficiency anemia, growth retardation and physical and mental health problems among children (31). Estimated 400 million schoolchildren, intestinal parasitic infections with helminthes can have adverse effects on physical and mental development, especially in poorly nourished communities, it leads to nutritional depletion, poor immunity in children mucosal loss and lymphatic leakage and local hemorrhage(32). Helminth infected individuals could also be susceptible for other infections such as malaria and HIV(33). Similarly , *G. intestinalis*, a frequent causative agent of diarrhea, can also result in mal absorption in children and even retarded growth and approximately affects a population of 200 million worldwide (23). Growing evidence also show that poor sanitation and IPIs are associated with stunting, poor cognitive development, low educational outcomes at schools and low productivity in adult life (34).

The main reasons for the high prevalence of parasite infections in tropical and subtropical countries including Ethiopia were inadequate toilet facilities(open defecation practice) especially in rural areas (35). Open defecation remains the predominant norm and poses one of the biggest public health problem in developing countries; which results in a fecal load of 200,000 metric tons per day which finds its way into soil and water bodies(36). Infected human excreta can contain several harmful organisms that are associated with a number of health problems, which one gram of infected human excreta can contain 106 pathogenic viruses, 106–108 bacterial pathogens, 103 protozoan cysts and 10–104 helminth eggs(10).

The Joint Monitoring Program for Water Supply and Sanitation estimates that 2.3 billion people globally lack access to basic sanitation (use of improved sanitation facilities that are not shared with other households) and that 892 million people practice open defecation(37). Open defecation is largely a rural phenomenon, most widely practiced in Southern Asian and Sub-Saharan Africa in which in Sub-Saharan Africa, 45% of the population uses either shared or unimproved toilets and an estimated 25% practice open defecation(18). In Ethiopia open defecation practicing population decreased from 79% in 1990 to 22% in 2017(19).

A five years (2013-2017) retrospective data from Sheki Health center laboratory, Dedo District,3021 stool samples from two urban kebeles (sheger and sherif) and 1098 from two rural kebles (Bilo adicho and kete kedida) were requested for intestinal parasite diagnoses and 807 (26.7%) and 289(38.3) positive for IPIs in urban and rural respectively before ODF announcement.(Unpublished).

Know there are kebeles which launched open defecation free in the district's rural kebeles which may reduce the transmission of IPIs and the urban considered as ODF in which compare the prevalence of IPIs among school age children to evaluate the effect of open defecation free IPIs in the kebeles. Therefore the objective of this study was to determine the prevalence of IPIs and associated factors among school age children in urban and rural that declared open defecation free.

1.3. Significance of study

The impact of open defecation free intervention to ward IPIs among school age children is given minimal attention in public health research. This made the magnitude and factors associated with IPIs mainly unexplored in the study area. Revealing the IPI of this school age children helps to design effective intervention modalities. This study helps to apparatus towards achievement of national targets concerning on open defecation may reducing the transmission of IPIs among school age children. Making rural kebeles free open defecation is very crucial for IPI reducing among school age children. Ignoring school age children in researches concerning the prevalence of intestinal parasitic infections and associated factors will result in failure of elimination activities as they remain source of infection for the wider community. In addition, this study helps to carry out targeted interventions by considering identified associated factors to prevent intestinal parasitic infections and consequent morbidities. Furthermore, findings of this study could be used as a reference and a baseline data for upcoming studies. Finally, this research is of great importance to reconsider the national intervention programs against IPIs to be more inclusive of this group of children.

Chapter two

Literature review

Several studies have been conducted on IPI in different countries mainly focusing on SAC. The same is true in Ethiopia also, documented high prevalence of IPI in SAC. Some of the available literatures on the global and Ethiopia burden of IPI, epidemiology and factors associated with acquisition of IPI in SAC are reviewed as follows.

2.1. Global burdens of intestinal parasites among urban and rural SAC

Study done in Indian among school age children in rural and urban kebeles showed that *E.coli* 25.3%, *G. lamblia* 17.9%, *E. histolytica/dispar* 4.2% for rural whereas *E. coli* 26%, *A. lumbricoides* 21%, *G.lamblia* 14%, *T. trichiura* 8% for urban SAC(38). Study conducted in Colombia, among urban versus rural kebles reported prevalence of intestinal parasites indicated that 62.5% *G. intestinalis*, 19.4% *Cryptosporidium species*, 19.4% *A. lumbricoides*, and 5.6% *T. trichiura* in an urban and 68% *G. intestinalis*, 20% *E. histolytica/dispar*, 50% *A. lumbricoides*, 46% *T. trichiura* and 2% *S. stercoralis* in rural areas. Polyparasitism was higher in rural 58% compared to urban 25% (39).

Similarly study done on primary schoolchildren in rural areas of Nakhon Si Thammarat, Thailand showed that the overall prevalence of intestinal parasites was 16%, Hookworms 10.7%, *Blastocystis hominis* 3.3%, *G. lamblia* 1.6%, *E. vermicularis* 0.3% and *T. trichiura* 0.3% (40). Similarly study done among school children in rural area of Vizianagaram showed that the overall prevalence of intestinal parasite was 55.6% .*E. histolytica/dispar* and *G. lamblia* were the commonest parasites isolated each 37.7%, followed by *H.nana* 11.6%, Hookworms 8.7% and *S.tercolaris* 4.3% (41).

Study done in rural Ecuadorian children showed that over all prevalence of IPIs was 90%. The most common parasitic species identified were *A. lumbricoides* 39.7 %, *G. lamblia* 25.2 %, *T. trichiura* 19.7 %, *E. histolytica/dispar* 18.5 % and *Ancylostoma duodenale* 1.7 %(42). Also study done at urban slum of Karachi, Pakistan showed that the overall prevalence of the IPIs was estimated at 52.8%. About 43% of samples contained a single parasite and 10% contained

multiple parasites. *G. lamblia* was the most common IP 28.9% followed by *A. lumbricoides* 16.5%, *H. nana* 0.9% and *E. coli* 2.3 %(43).

Findings from Nigeria on school children showed that the prevalence of intestinal parasite was 24.5%, IPs is widely distributed and infection usually varies according to immunity, region, age and poor sanitation. E. *histolytica/dispar* was the most common intestinal parasites encountered in the study area 58.2%, while *G.lamblia* was the least common(10.9%)(28)**.** Similarly study done among rural and urban schoolchildren in south–western Nigeria show that the prevalence of intestinal helminthes was 30.0% of them 36.1% of the rural and 24.3% of the urban were found to be harboring at least one species of intestinal helminthes(32)**.**

Another study done at rural and urban school-aged children in Nigeria showed that the overall prevalence of infection among the rural and urban children was 80.9% and 51.4% respectively. Hookworms (55.9% versus 24.9%), *A. lumbricoides* (30.5% versus 16.8%), *T. trichiura* (4.1% versus 5.4%), *G.lamblia* (3.2% versus. 2.2%) and *E. histolytica/dispar* (0.9% versus 4.3%) was rural and urban children respectively (6)**.** Also study done among rural and sub urban people in Gwagwada Nigeria show that the overall intestinal parasites prevalence of rural and sub urban pupils was 67.2%, with the sub urban having a prevalence of 70.8% and rural prevalence was 58.9%, *A. lumbricoid* (37 and 29.8%), *T. trichuiris* (4.1 and 4.7%),Hookworm (9.6 and 5.3%) and *Taenia species.(*32.9 and 11.1%) in rural and sub urban respectively(3)**.**

2.2. Intestinal parasites infection in Ethiopia among urban and rural SAC

Study done in two primary schools in Harbu town, north east Ethiopia showed that the overall prevalence of IP was 21.5% were found with one or more IPs. From these, *E. histolytica/dispar* was the most 8.3% detected parasite followed by *H. nana* 4.8%, *S. mansoni* 4.8% and *G. lambelia* 1%, where urban and rural IP prevalence was 24.4% and 17.1% respectively(44).

Findings among school age children in Ethiopia show that prevalence of intestinal helminths was 51.5% (rural 68.3%, urban 36.2%). Hookworms, S *mansoni* and *S. stercoralis* were more prevalent in rural schools, whereas *H. nana* was higher in urban schools(43). Another study conducted among urban and rural kebeles of prevalence of IP study done in Sasiga District on

primary schoolchildren, show that the overall prevalence of IPIs among the children was 62.4%, where rural and urban IPI was (76.4%) and (49.8) respectively. Single, double, and triple infections were 49.9%, 10.7%, and 1.83%, respectively. *A. lumbricoides* 22.7% and hookworms 20.6% were the most prevalent parasites, followed by *E. histolytica/dispar* 8.1%, *T. trichiura* 7.6%, *G. intestinalis* 6.5% and *H. nana* 5.7%(45).

Results from Gurage Zone showed that the overall prevalence of intestinal parasitosis was 42.1%. Protozoa infections 59.5% were more prevalent than STHs infections 40.5%. The predominant parasites were *G. lamblia* 47.7% followed by *A. lumbricoides*18.9%, and *E.histolytica/dispar* 11.8%(46)**.** Similar Study done among primary school a child in Shashamane town shows that, the overall prevalence intestinal parasite infection was 19.7%. *H. nana* 36.2%, *A. lumbricoides* 24.1%, *E. histolytica/dispar* 12.1%, *G. lamblia* 12.1%, *Tinea species* 12.1%, and *E. vermicularis* 3.4% were identified. (25)**.**

Also findings from northwest Ethiopia among children living with and without open defecation practices showed that the prevalence of helminthic infections in ODF declared and open defecation practice kebeles accounted for 32.8% and 41.7% respectively. Hookworms was the most common STH infections in both ODF declared (27.5%) and ODP (31.3%) kebeles (47).

Another study conducted in Jimma town show that the overall prevalence of IP 83% had one or more intestinal parasitic infections. *T. trichiura, A. lumbricoides* and S.*mansoni* were detected in single infection in 16.4%, 5.8% and 1.5% of the infected study subjects, respectively. Polyparasitism was found in 56.7% of the total examined. The prevalence of *amoebiasis* and giardiasis in the study was 3.1% and 3.6%, respectively (43).

.The prevalence of childhood intestinal parasitic infections was higher among households with no members whose education level is secondary and above(48)**.** Also study done at Jimma town among school children of Mendera elementary school showed that 48.4% were positive for at least one intestinal parasite. The most prevalent parasites were *A. lumbricoides* 23.6% and *T. trichiura* 23.1% (49)**.**

2.3. Factors contribute to IPI distribution

Study done in Turkey among school age children showed that prevalence of IP due to socio economic and environmental factors affect the distribution of IPIs. Eastern part has low socio economics than Western parts, thus the prevalence of IP was 31.8% of this 43.5% *E. vermicularis* 21% *G. intestinalis*, 0.03% *A. lumbricoides* for Eastern part and 22.4% of this 16% *E. vermicularis* 11.9% *G. intestinalis* for Western part(31). The same study shows that individuals who have improper toilet facilities are more infected by STH, evidence from Eastern Turkey children eating contaminated vegetables from the garden was infected more with *A. lumbricoides* 44.7%,*T. trichiura*11.7% while proper toilet users were 12.2% and 6.6% for *A. lumbricoides* and *T. trichiura* respectively(31).

Findings from Vietnam lack of access to improved sanitation and not receiving deworming within the past 12 months were associated with higher infection risk of IPI. This shows hookworm and *T. trichiura* were the predominant helminthes species 25 % and 5 %, respectively for per-urban and urban (50).

Results from Pawi Special District in Benishangul-Gumuz among children show that the prevalence of *G. lamblia* and *Cryptosporidium parvum* was associated with the source of drinking water with more cases of giardiasis detected in study participants using water from unprotected 28.3% water sources than those using the "protected" 3.7% water(26)**.**Study done among school-aged children in Sigmo primary school showed that latrine usage , habit of hand washing before meal, and habit of hand washing after toilet were predictor of STH infections, the overall prevalence of STH was 41.7%. *A. lumbricoides* was the predominant parasite 19.8% followed by *T. trichiura* 15.6% (51)**.**

2.4. Conceptual framework

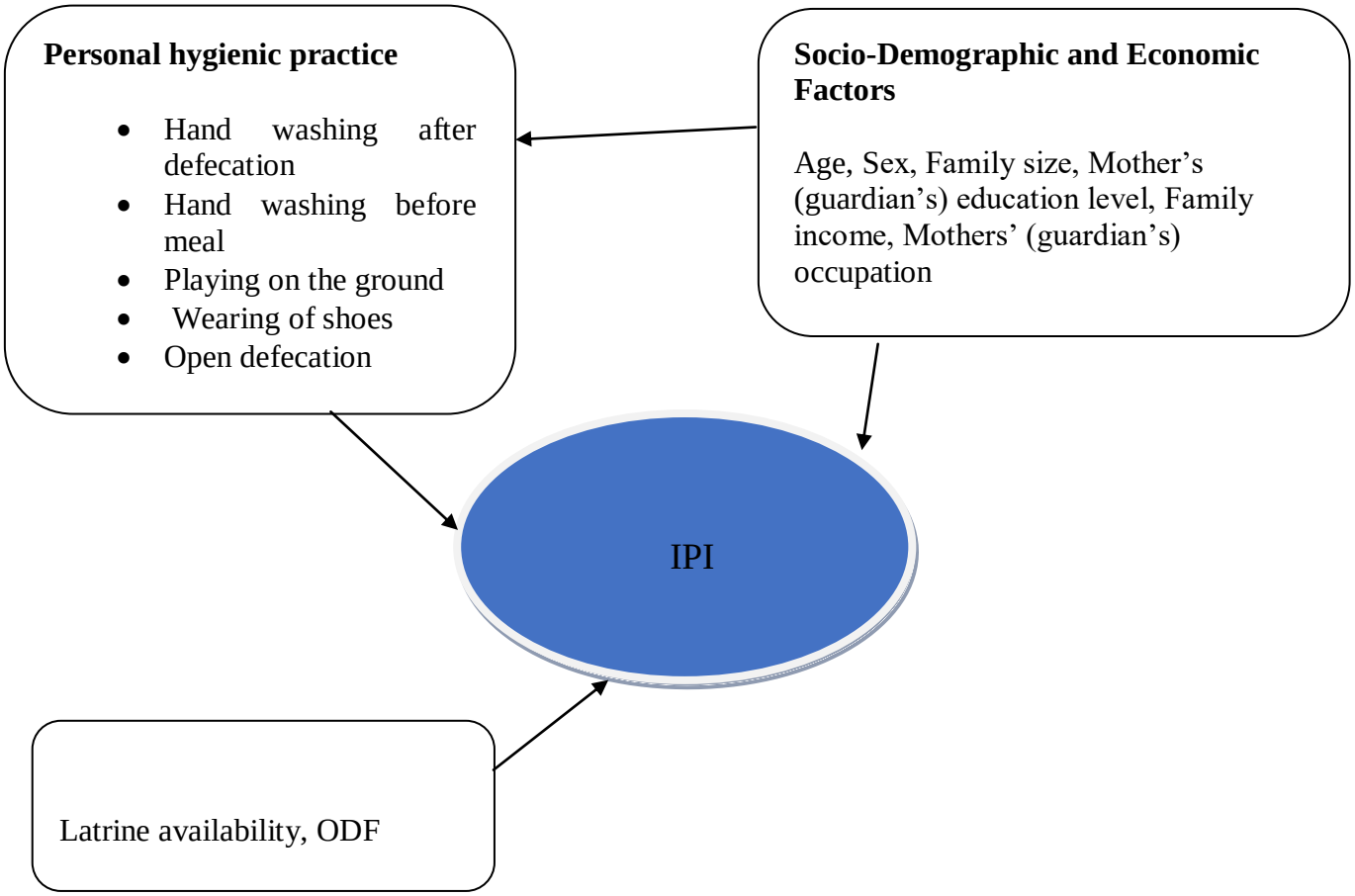

Figure 1. Conceptual framework for factors associated with IPIs developed after reviewing relevant literatures

Chapter three

Objective

3.1. General objective

To determine the prevalence of intestinal parasitic infections and associated factors among SAC in ODF declared rural kebele and urban kebeles, Dedo Woreda, south west Ethiopia from July to August 2021.

3.2. Specific objectives

- To determine prevalence of IPIs among urban and ODF rural kebele school age children in Dedo Woreda.
- To compare the prevalence of intestinal parasite infections among urban and ODF rural kebeles school age children, in Dedo Woreda.
- To assess associated risk factors with IPI among urban and ODF rural kebeles school age children, in Dedo Woreda.

Chapter four:-Methods and materials

4.1. Study area

The study was conducted in Dedo Woreda which is one of the Woredas' found in Jimma Zone Oromia regional state, south west Ethiopia. It is 374km away from capital city of the country and 20 km away from Jimma town. It's boundaries in South by the Gojeb River which separates it from the SNNP Region, in the West by Seka, in the North by Kersa, and on the East by Mencho Woreda. Topographically, Dedo Woreda is mountainous with an altitude ranging between 880 and 2400 meter above sea level and rain fall ranging from 1800 to 3000mm. Agro-ecologically; it consists of 18% highlands, 48% midlands and 34% lowlands. The population of the district is estimated to be 290,000 (National Census, 2007) and 62,516HHs. The Woreda have 1 primary hospital, 6 health center and 36 health posts, 2 secondary school and around 30 primary schools . For administrative purpose the Woreda is divided into 36 kebeles, in which 2 kebles(1595HHs) were urban and 34 were rural, of this rural kebele 6 kebeles(4769HHs) were ODF declared. The total HHs in urban and rural ODF keble for source of population was 4367, whereas urban (sheger 798 HHs and sherif HHs1376) and rural ODF (Bilo Adicho 797 HHs and keta kedida 1396 HHs), and total HHs having SAC in urban (sheger 558 HHs and sherif HHs1010) and rural ODF (Bilo Adicho 526 HH and keta kedida 1034HH), then total HHs having SAC are 3128.

4.2. Study period

The study was conducted from July 15 to August 15, 2021among SAC in ODF declared rural Keble and urban Keble, Dedo Woreda, south west Ethiopia.

4.3. Study design

Community based comparative cross-sectional study was conducted at Dedo Woreda, South west Ethiopia.

4.4. Population

4.4.1. Source population

The source of population was all school age children who are resident in study kebeles.

4.4.2. Study population

The study populations were SAC in selected HHs in the study area (Sheger , Sherif, Bilo adicho and Keta kedida)

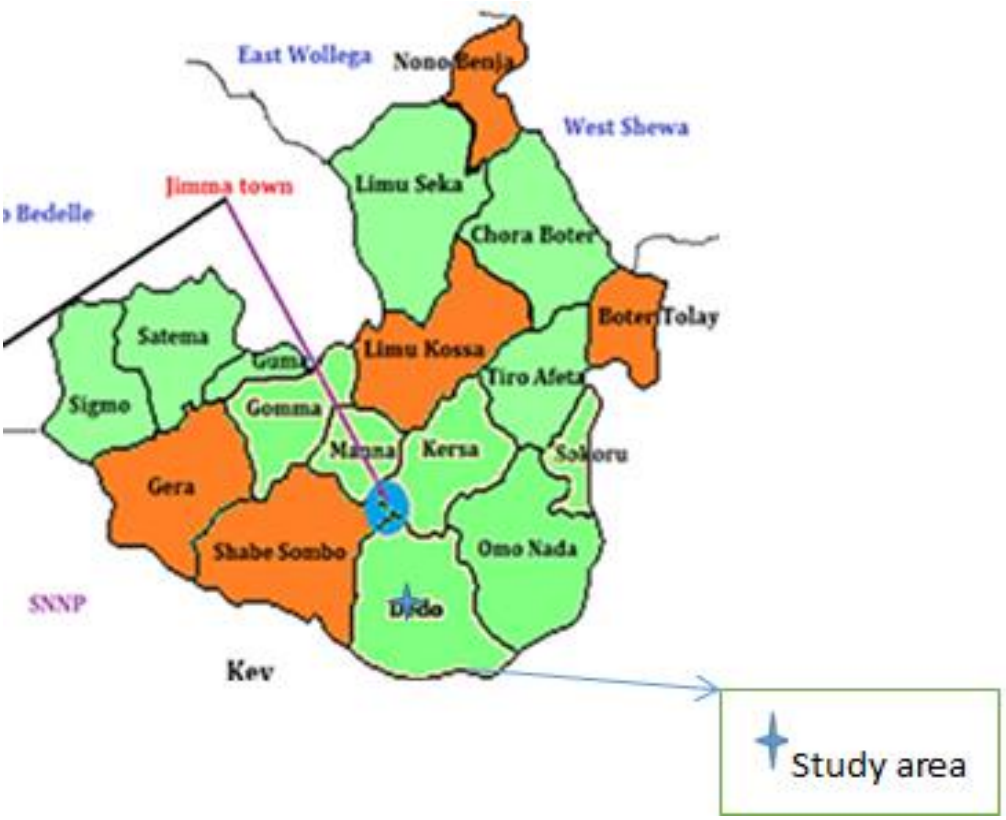

Figure 2 . Map of the study site

4.5. Inclusion and exclusion criteria

4.5.1. Inclusion criteria

Children which residing in the study area during the time of the study and aged 5-14 years

4.5.2. Exclusion criteria

Children who took anti-helminthic drug or treated with anti-protozoa drug within one month prior to data collection.

Children who had diarrhea at the time of sampling.

4.6. Sample size determination and sampling technique

4.6.1. Sample size determination

Sample size was determined by using double population proportion formula, at 95% confidence interval and 80% power .The proportion is taken at urban P1(45%) and rural P2(56.4%), prevalence of intestinal parasites among school age children which was conducted among Jawi primary school children, Adgrat town (52).

$n = (Z_{\alpha/2}+Z_{\beta})^2 * (p_1 (1-p_1) + p_2 (1-p_2)) / (p_1-p_2)^2$

$n= (1.96+0.84)^2*((0.45(1-0.45) +0.564(1-0.564))/ (0.45-0.564)^2$

$n=7.84x ((0.45(1-0.45) +0.564(1-0.564))/ (0.45-0.564)^2$

$n=\underline{7.84 x (0.246+0.248)/}0.013$

n=**298**

Since source population is less than 10,000, (that is urban 2174 HHs and rural 2193HHs), we have used the finite population correction formula and then 10% non-response rate was added.

To apply a finite population correction to the sample size calculation for comparing two proportions above, we include $f_1= (N_1-n)/ (N_1-1)$ and $f_2= (N_2-n)/ (N_2-1)$ in the formula as follows.

$n = (Z_{\alpha/2}+Z_{\beta})^2 * (f_1*p_1 (1-p_1) +f_2*p_2 (1-p_2)) / (p_1-p_2)^2$, first we calculate for finite population

$f1= (N_1-n)/ (N_1-1)$, (2174-298)/ (2174-1) =**0.86**

$f2= (N_2-n)/ (N_2-1)$, (2193-298)/ (2193-1) =**0.864**

Then, $n= (Z_{\alpha/2}+Z_{\beta})^2 *((f_1*(p_1 (1-p_1) +f_2*(p_2 (1-p_2)) / (p_1-p_2)^2$

$n = 7.84 \text{ x } ((0.86\text{x}0.25) + (0.865\text{x}0.25))/0.012$

n=280 +10%=**308**

Where

n = the maximum possible sample size

$Z_{\alpha/2}$ =the critical value of the normal distribution at $\alpha/2$ for a confidence level of 95%= (1.96)

Z_{β} = the critical value of the normal distribution at β for a power of 80% = (0.84)

p1= proportions for urban

p_2 = proportions for rural

f1= finite population correction for urban

f2= finite population correction for rural

N1= population sizes for urban

N2= population sizes for rural

Using 10% contingency, the sample size for each group was 308. The ratio between ODF declared rural and urban kebele was 1:1. Then, the total sample size will be 616.

4.6.2. Sampling technique

A stratified sampling technique was used to stratify into ODF declared rural kebles and urban kebeles. Two kebeles were selected randomly form ODF, whereas urban has only two kebeles, therefore both were considered as it is. Screening of households having SAC was identified from the list of family folder at health posts. The study participants in each kebele were proportionally allocated based on the population of households which have SAC. A systematic random sampling technique was used to select the study participants. If there were two or more children in the same household, only one child was selected by the lottery method to participate in the study (Fig 3).

K (urban- sheger) =Total number of HHs having SAC in sheger kebele=558=5
Sample size calculated in sheger kebele 110

K (urban –sheriff) = Total number of HHs having SAC in sherif kebele=1010=5
Sample size calculated in sherif kebele 198

K (rural ODF-Bilo Adicho)= Total number of HHs having SAC in Bilo Adicho kebele=526=5
Sample size calculated in Bilo Adicho kebele 104

K(rural ODF-Keta Kedida)= Total number of HHs having SAC in Keta Kedida kebele=1034=5
Sample size calculated in Keta Kedida kebele 204

Therefore every 5th HHs interval, the study participant was selected until a total of sample recruited in each kebele attained.

4.6.3. Sampling technique tree

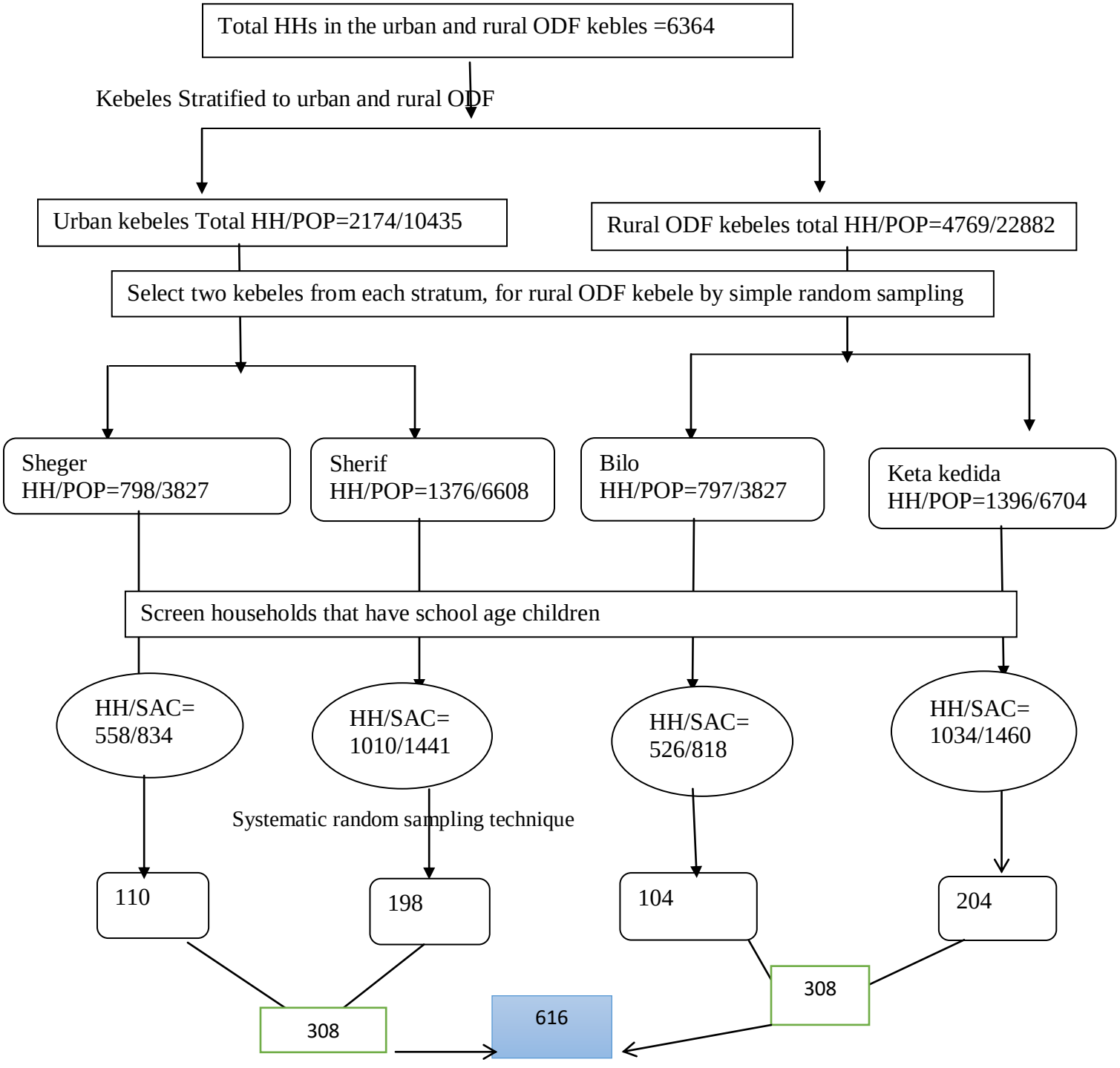

Figure 3. Participant flowchart showing participant selection

Compliance of participants

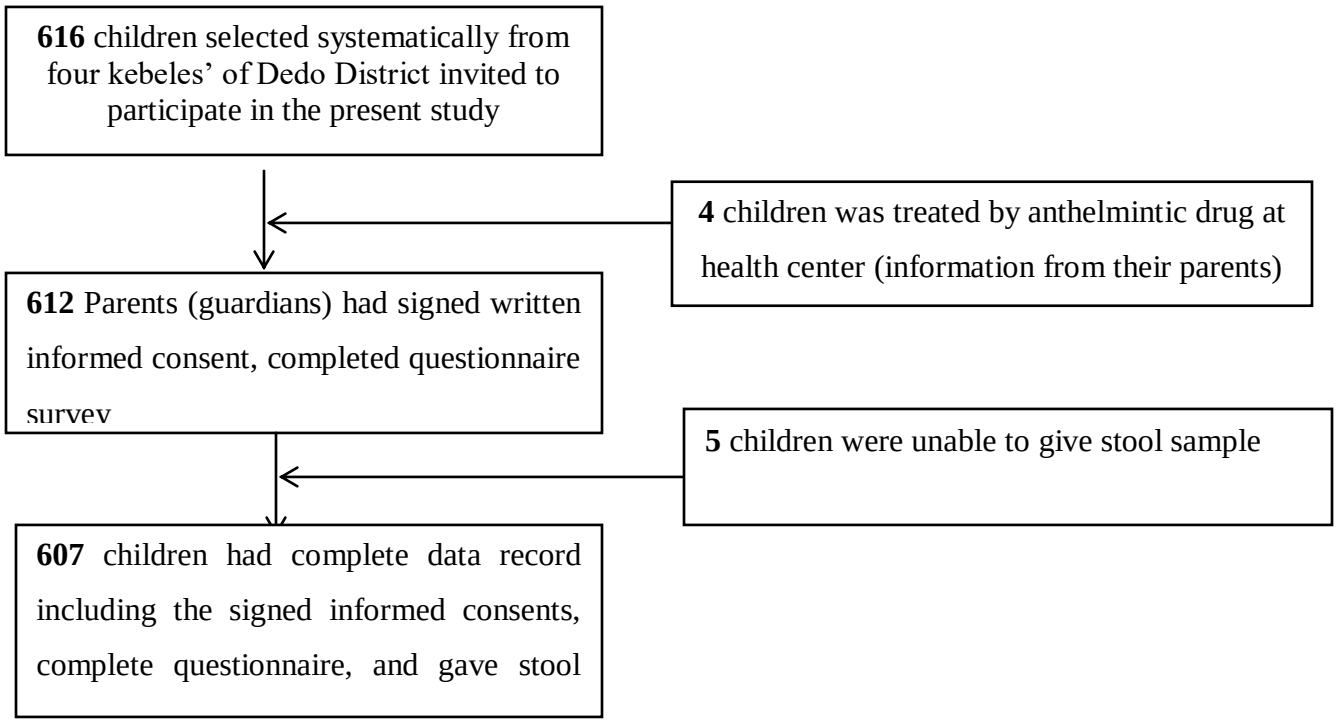

Figure 4. Flow chart of the participants and compliance

4.7. Data collection

4.7.1. Socio-demographic characteristics and associated risk factors data

House-to-house visits were done to collect data. Ask mother's (guardian's) when their children was available at home. Semi-structured questionnaire having both closed and open ended questions were used to gather information on socio-demographic characteristics and risk factors related to IP infections in SAC. The questionnaire was initially prepared in English and then translated in to local language Afan Oromo and translated back into English to check its

consistency by the principal investigator. The socio-demographic data and other related data such as age, sex, family size, family income, mother's (guardian's) educational level, and mother's (guardian's) occupation. Moreover, questionnaire related to associated risk factors of IP infections among SAC included; habit of hands nail biting, finger trimming status , habit of washing hands after defecation, habit of washing hands before meal, habit of playing with soil, availability of latrine at household, types of latrine and main source of water for drinking. The data was collected by health extension workers and nurses.

4.7.2. Laboratory diagnosis

For parasitological analysis, fresh stool samples were collected from each SAC. After providing adequate instruction each SAC was provided with a uniquely labeled stool cup, applicator stick and soft tissue paper (for cleaning) to bring about 5-10 gram fresh stool sample of their own. At the time of collection, date of sampling, the name of the participant, age, and sex was recorded for each study participants in a recording format. Stool samples were preserved in 10% formalin before transported to the health center laboratory. Formol-ether concentration techniques was used to detect the presence of parasite eggs, cyst of intestinal protozoa parasites and direct microscopy was done by mixing a small amount of the specimen in 0.9% sodium chloride solution (using direct wet mount) for intestinal protozoa trophozoite following the standard operational procedures(53).

4.8. Study variables

4.8.1. Dependent variable

- IP infections

4.8.2. Independent variables

- Sex
- Age
- Family size

- Family Income
- Mothers' (guardians') occupation
- Mothers' (guardians') educational level
- shoes wearing habit
- Thumb sucking/for low age groups
- Hands washing habit after defecation
- Hands washing habit before meal
- Habit of playing on the ground
- Availability of a latrine at household
- Open defecation habit
- Main source of drinking water

4.9. Ethical clearance

Ethical approval and letter of permission was obtained from the Institutional Review Board (IRB) of Jimma University institute health research and postgraduate office (Ref. No.IHRPG1/798/21). Permission was sought from Dedo district health office. Prior to data collection, written consent/ assent was obtained from each study participant (guardian/parents), and only individuals and households willing to participate in the study was included in the study. Confidentiality of information obtained from each participant was kept with the represent of code of identity. All individuals with confirmed IPIs were linked with the health center as per standard treatment guide line of Federal Minster of Health (53).

4.10. Data management and analysis

The questionnaire was checked for completeness, coded and entered into Epi-Data version 3.1 and exported into SPSS version 25 statistical packages and finally data was analyzed and presented by tables, charts and graphs. Bivariate logistic regression was used to see the associations between IP infections with independent variables and those variables with P- value ≤0.25 was used as candidates for multiple logistic regressions to check independent predictors for intestinal parasitic infections. Multiple logistic regressions were used to measure the

strengths of association between the prevalence of intestinal parasitic infection and associated factors using adjusted odds ratio and those variables with P -value less than 0.05 was considered statistically significant association with IPIs.

4.11. Data quality control

All data collectors were trained by principal investigator before data collection and pretest was performed at Seka Woreda to validate the data collection instrument before conducting the study. During data collection, kebeles were coded and supervision was performed during the fieldwork for data completeness during data collection. Each questionnaire was checked for completeness before leaving each study participant's house. Completeness of all filled questionnaires was reviewed at the end of the day by the supervisor. The reliability of the laboratory was assured by implementing quality control measures during the pre-analytical, analytical, and post analytical steps. All materials, equipment, and procedures were adequately controlled. Each stool cup was properly labeled with their identification key. To minimize bias slide was examined by two laboratory personnel independently. From all of the slides, 10% of each positive and negative slide was randomly selected and reexamined, and the discordant results were crosschecked by the principal investigator.

4.12. Operational definitions

Open defecation:-Open defecation is the human practice of defecating in fields, bushes, forests, ditches, streets, canals rather than into a toilet.

Open defecation free:-Open defecation free is a term used to describe either community that has eliminated the practice of open defecation or households which no longer defecate on the open field.

School age children: -the age of children that expected to develop physically, emotionally and mental ability of the children with ages 5 to 14 years live in the community.

Chapter Five

Results

5.1 Socio-demographic characteristics of study participants

A total of six hundred seven (305 urban and 302 ODF rural kebeles) were involved in this study with 98.5% of response rate. The age of the study participants ranged from 5 to 14 years with mean age of 9.36, standard deviation (SD) 2.5 and the median was 9. More than half (51.2%) of study participants were male. The age-group distribution showed that (53.8%) and (46.2%) were in the age group of 5-9 and 10-14 years respectively for urban, while (52%) and (48%) were in range of 5-9 and 10-14 respectively for rural ODF kebeles. The educational status of most children (74%) were 1–4 class of these (72.1%) urban and (76.8%) in ODF rural kebele. Majority of SAC mother or guardian occupation were house wife (61%), of them (55.7%) urban and (66.6%) rural ODF kebeles. Also majority (49.1%) of literacy level of mother or guardian was primary education, of them (43.9%) urban and (54.3%) of ODF rural kebele (Table1).

Majority of (67.7%) family size were greater than five, of these (67.9%) urban and (67.5%) rural ODF kebeles and almost half (46.8%) of the children were from families with estimated monthly income less than 1000 Ethiopian Birr, of them (40.3%) urban and 53.3%) rural ODF kebele.

5.2 Prevalence of intestinal parasitic infection

The overall prevalence of at least one intestinal parasite infection among study participants were 32.1 %(195/607). The prevalence of intestinal parasites among urban kebele was 30.2% (92/305) whereas among ODF rural kebeles was 34.1 %(103/302). Over all nine intestinal parasite species were detected, of which the most detected was *A. lumbricoides* 8.2%(50/607), followed by *E. histolytica/dispar* 7.2%(44/607) and *G. lamblia* 5.8%(35/607), hook worms 4.3 % (26/607), *T. Trichiura* 3.6% (22/607), *H.nana* 2.6 % (16/607), *E.vermicularis* 2.3% (14/607), S. *stercoralis* 1.5% (9/607) and *Teania species* accounts 1.5% (9/607) are also detected (Table 2)

Table 1: Socio-demographic characteristics of school-age children in urban and ODF declared kebeles at Dedo district, South West Ethiopia, 2021 (n = 607)

Variable	Category	Urban		rural ODF kebele		Total	.
		No (%)	Pos for IPI (%)	No (%)	Pos for IPI (%)	No (%)	Pos for IPI (%)
Urban kebele	Sheger	108(35.4)	38(35.2)				
	Sherifi	197(64.6)	54(27.4)				
ODF rural kebele	Bilo adicho			104(34.4)	40(38.5)		
	Keta kedida			198(65.6)	63(31.8)		
Sex	Male	156(51.1)	49(31.4)	155(51.3)	64(41.3)	311(51.2)	113(36.3)
	Female	149(48.9)	43(28.9)	147(48.7)	39(26.5)	296(48.8)	82(27.7)
Age group (year)	5-9	164(53.8)	57(34.7)	157(52)	64(40.8)	321(52.9)	121(37.7)
	10-14	141(46.2)	35(24.8)	145(48)	39(27)	286(47.1)	74(25.9)
Family size	≤5	98(31.2)	30(30.6)	98(32.5)	26(26.5)	196(32.3)	56(28.6)
	>5	207(67.9)	62(30.0)	204(67.5)	77(37.3)	411(67.7)	139(33.8)
Family income	<1000	123(40.3)	56(45.5)	161(53.3)	65(40.4)	284(46.8)	121(42.6)
	1000-2000	100(32.8)	23(23)	89(29.5)	24(27)	189(31.1)	47(24.9)
	>2000	82(26.9)	13(15.9)	52(17.2)	14(26.9)	134(22.1)	27(20.1)
Educational status of Mother or guardian	No formal education	73(23.9)	27(37)	75(24.8)	34(45.3)	148(24.4)	61(41.2)
	Primary	134(43.9)	47(35.1)	164(54.3)	57(34.8)	298(49.1)	104(34.9)
	Secondary	71(23.3)	17(23.9)	53(17.5)	11(20.8)	124(20.4)	28(22.6)
	High level	27(8.9)	1(3.7)	10(3.3)	1(10)	37(6.1)	2(5.4)
Mother or guardian occupation	Farmer	54(17.7)	11(20.4)	82(27.2)	26(31.7)	136(22.4)	37(27.2)
	Merchant	55(18)	15(27.3)	16(5.3)	3(18.8)	71(11.7)	18(25.4)
	Employ	11(3.6)	1(9.1)	2(0.7)	0	13(2.1)	1(7.7)
	House wife	170(55.7)	61(35.9)	201(66.6)	74(36.8)	371(61.1)	135(36.4)
	Student	5(1.60)	1(20)	0	0	5(0.8)	1(20)
	Daily labor	10(3.3)	3(30)	1(0.3)	0	11(1.8)	3(27.3)
Educational status of child	Not enrolled	9(3)	4(44.4)	22(7.3)	14(63.6)	31(5.1)	18(58.1)
	Kindergarten	37(12.1)	8(21.6)	26(8.6)	7(26.9)	63(10.4)	15(23.8)
	1-4	220(72.1)	74(33.6)	232(76.8)	75(32.3)	452(74.5)	149(33)
	5-8	39(12.8)	6(15.4)	22(7.3)	7(31.8)	61(10)	13(21.3)
Total		305(100)	92(30.2)	302(100)	103(34.1)	607(100)	195(32.1)

Key: - : %=percent, ODF=open defecation free, Pos- positive, n-number of sample, No=number

From the total intestinal helminthes infections, *A. lumbricoides* and hookworms accounted for (34.4%). *A. lumbricoides* was the most common helminthes infections in both urban (25%) and ODF rural (20.7%) kebeles, while the least encountered were *S. stercoralis* (3%) and *Teania species* (4.2%) urban and rural ODF kebles respectively(Table 2).

From intestinal protozoan infection *E. histolytica/dispar* and *G. lamblia* accounted for (35.7%). *E. histolytica/dispar* was the most common protozoan infection in both urban (20%) and ODF rural (19.8%) kebeles. Single infection, double infection and triple infections were found with infection rates of (90.2%), (8.7%) and (1.1%) respectively for urban, while (86.4%), (9.7) and (3.9%) respectively for rural ODF kebeles (Table 2, 3 and 4).

The increased occurrence of intestinal parasite infections in ODF declare rural kebeles were among age group of 5-9 (40.8%), (41.3%) among males study participants,(63.6%) of infected SAC were those not enrolled in school, (45.3%) of infected SAC were their mother or guardian have no formal education and (36.8%) mother or guardian occupation that house wife (Table 1). Similarly the increased prevalence of intestinal parasite infections in urban (34.7%) was also recorded in the 5-9 age-group, (31.4%) in males, (44.4%) in children not enrolled in school,(37%) their mother or guardian have no formal education and (35.9%) mother or guardian occupation that house wife(Table 1).

The Prevalence of intestinal parasitic infections in relation to independent factors, that do not have latrine (67% versus 76.5%), used un protected drinking water (42.3% versus50%), latrine with not hand washing facilities (38% versus 55%), child plying with soil (50% versus 60%) and do not have hand washing before having food (60% versus 58%) were for urban and ODF rural kebeles respectively (Figure 5).

5.3 Hygienic related characteristics of the study participants

The latrine coverage in urban and ODF rural kebeles were 90.2% and 94.4% respectively (data from Sheki health center). Regarding source of drinking water 51.1% and 44.7% households in urban and ODF rural were used protected water source respectively. Similarly, latrine with hand washing facility was 53.8% and 60% in urban and rural ODF kebeles respectively.

About 2% of urban children were used river water for drinking while 8 .3% of ODF rural kebeles used for drinking. 83.3% of children used always latrine in urban while 56.5% always used latrine in ODF rural kebeles and always hand washing before having food in urban was 84.6% while 54.9% in ODF rural kebeles. Similarly, 27.5% of children were played with soil in ODF rural kebeles, when 20.3% of children played with soil in urban residents (Table 5).

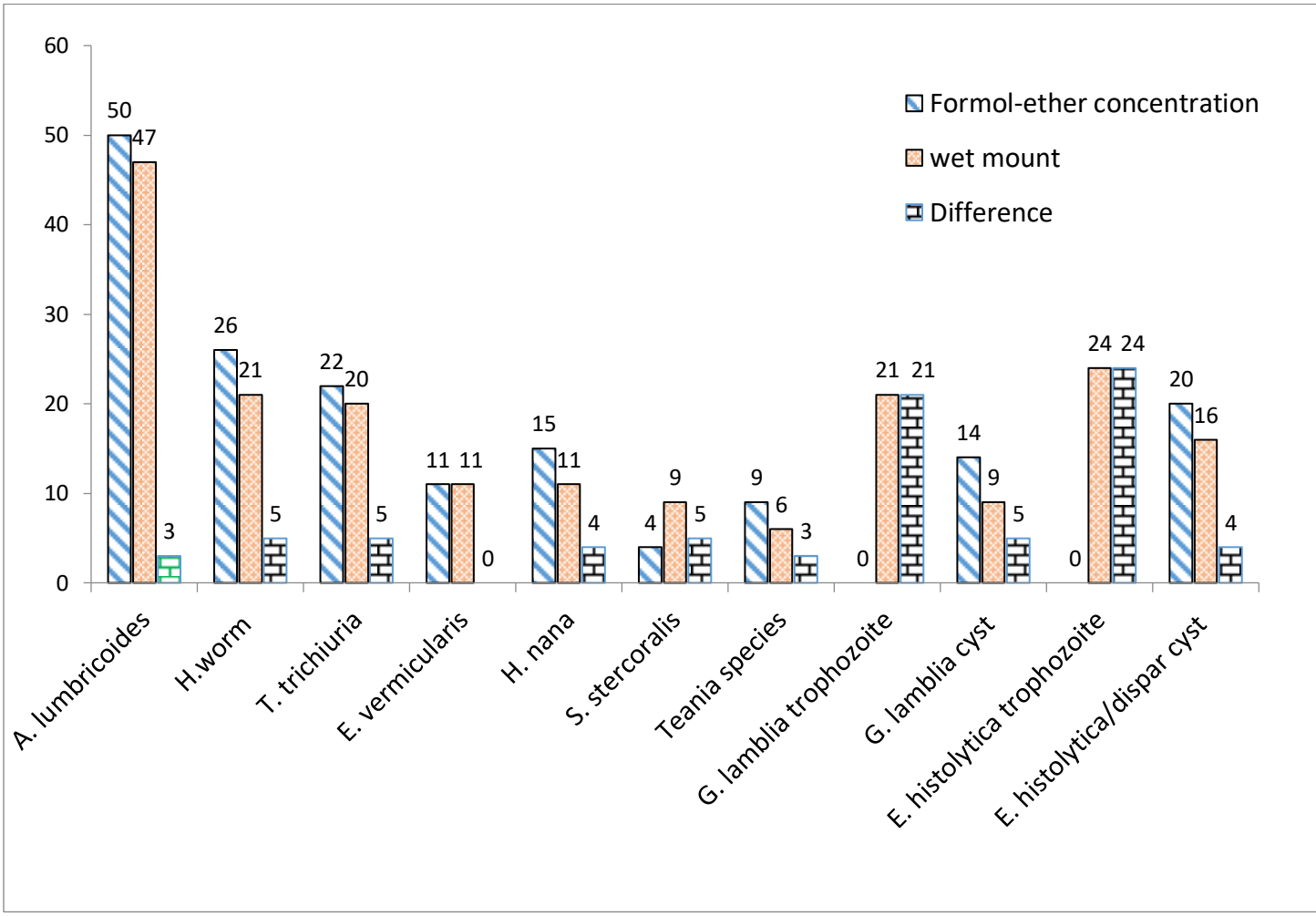

Figure 5 Laboratory diagnosis of IP with formol ether concentration techniques and wet mount methods and their differences

Table2: Prevalence of intestinal parasitic infection among urban and ODF kebles school age children in Dedo district, South West Ethiopia, 2021

Species of intestinal parasitic infection	SAC infected in urban, No (%)	SAC infected in ODF rural kebles, No (%)	Total, No (%)
Ascaris lumbricoides	25(25)	25(20.7)	50(22.6)
Hook worms	11(11)	15(12.3)	26(11.8)
Trichuris trichiuria	14(14)	8(6.6)	22(9.9)
Enterobius vermicularis	4(4)	7(5.8)	11(5)
Hymenolepsis nana	4(4)	11(9.1)	15(6.8)
Strongyloides stercoralis	3(3)	6(5)	9(4.1)
Teania species	4(4)	5(4.2)	9(4.1)
Gardia lamblia	15(15)	20(16.5)	35(15.8)
Entamoeba histolytica/dispar	20(20)	24(19.8)	44(19.9)
Total	100(100)	121(100)	221(100)

Key: IPs=intestinal parasites, No=number, %=percent, ODF=open defecation free

Table3: Types of intestinal parasite infections identified among urban and ODF kebeles school age children in Dedo district, South West Ethiopia, 2021

Types of infection	Urban infected SAC, No (%)	Rural ODF infected SAC, No (%)	Total, No (%)
Single infection	83(90.2)	89(86.4)	172(88.2)
Double infection	8(8.7)	10(9.7)	18(9.2)
Triple Infection	1(1.1)	4(3.9)	5(2.6)
Total	92(100)	103(100)	195(100)

Key: SAC=school age children, No= number, %= percent, ODF =open defecation free

Table 4: Multiple intestinal parasite infections identified among urban and rural ODF kebles school age children in Dedo district, South West Ethiopia, 2021

Urban multiple infections	Frequency	Rural ODF multiple infections	Frequency
A. lumbricoides+ E. histolytica/dispar	2	*A. lumbricoides + T. trichiura*	1
T. trichiura+ G. lamblia	2	*Hookworms+ E. histolytica/dispar*	1
E. vermicularis+ G. lamblia	1	*A. lumbricoides + E. histolytica/dispar*	1
T. Trichiura+ E. histolytica/dispar	1	*teania species + G. lamblia*	2
A. lumbricoides+ H.nana	1	*S. stercoralis + E. histolytica/dispar*	1
S. stercoralis+ E. histolytica/dispar	1	*Hookworm + T. trichiura*	1
Hookworm + T. trichiura + E. histolytica/dispar	1	*A. lumbricoides + G. lamblia*	1
		E. histolytica + G. lamblia	2
		A. lumbricoides + Hookworms + E. histolytica/dispar	1
		A. lumbricoides +teania species + E. histolytica/dispar	1
		Hookworm + H.nana + E. histolytica/dispar	1
		A. lumbricoides + E. histolytica/dispar + G. lamblia	1

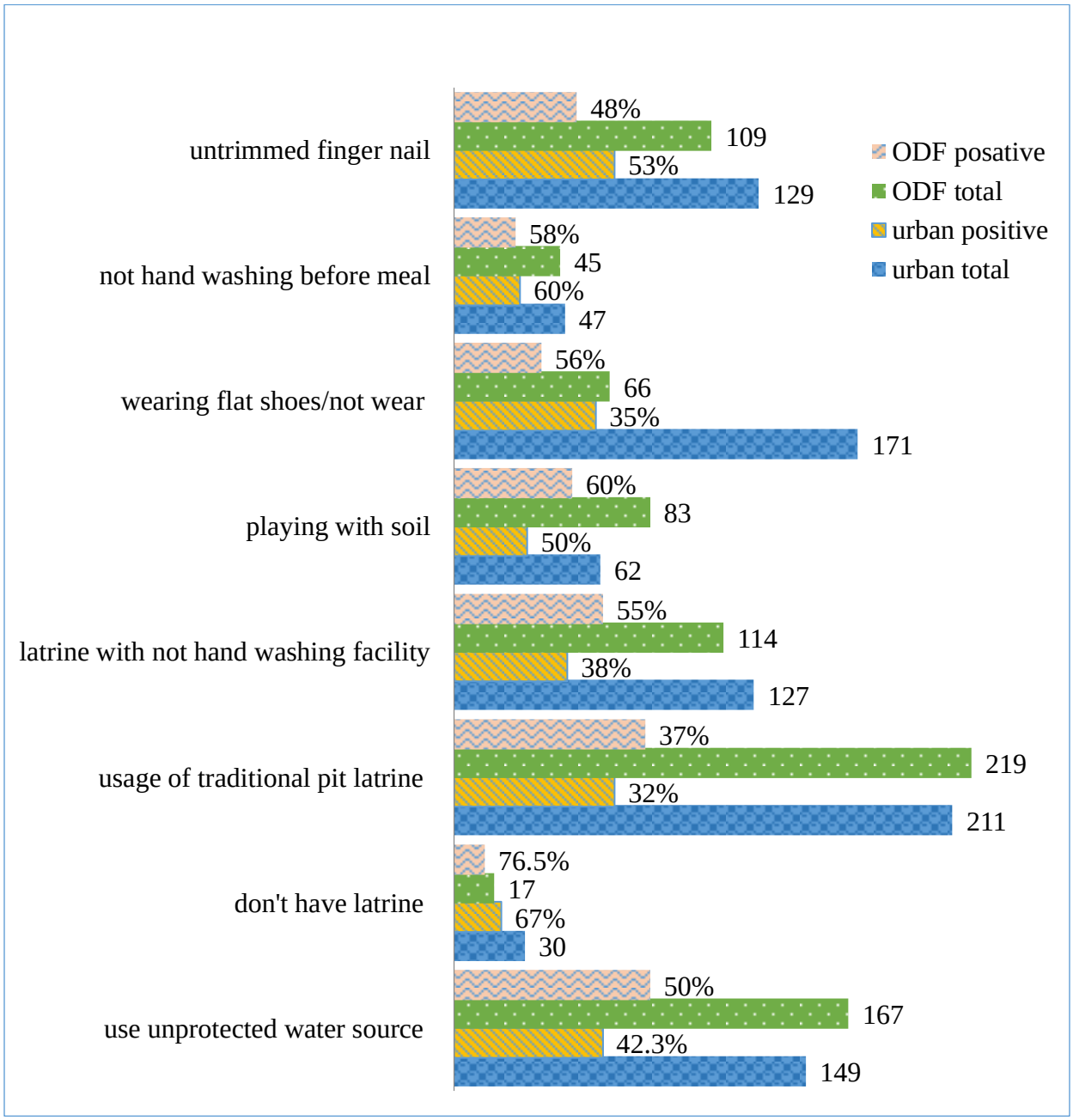

Figure 6. Prevalence of intestinal parasitic infections in relation to independent risk factors among school-age children in urban and ODF rural kebeles, Dedo district, South West Ethiopia, 2021

5.4 Factors associated with intestinal parasite infections in urban kebeles.

Bivariate and multivariate logistic regression was used to assess factors associated with IPIs. Majority of independent variables showed significant association on the bivariate logistic regression. After taking the independent variables to the multivariate logistic regression, some variable showed significant association with, source of water for drinking, availability of latrine, latrine with hand washing facility, hand washing before having food, family income status of fingernails and cleanliness of finger nail at the time of data collection (Table 5).

The multivariate logistic regression model revealed that children who did not wash their hand before having food were 4.56 times more exposed to IPIs than children who had hand washing before having food (AOR = 4.56; 95% CI: 2.321-8.96, P<0.001). Likewise, children playing with soil were 3.17times more exposed to IPIs than children who could not play with soil (AOR = 3.17, 95% CI: 1.1-9.27, P=0.035). Also those used unprotected source of drinking water was 2.55 times more exposed to IPI than those used protected drinking water (AOR=2.55, 95% CI:1.46-4.474,P=0.001).Similarly those not have latrine were 5.071 times more infected with IPI than that have latrine (AOR = 5.071, 95% CI: 2.21-11.65,P<0.001)and latrine with not hand washing facility were 2.28 times more exposed to IPIs (AOR=2.28; 95% CI: 1.24-4.18, P=0.008)(Table 5).

5.5 Factors associated with intestinal parasite infections in ODF rural kebeles

Multivariate logistic analysis on ODF rural kebeles also showed that, prevalence of IPIs children those used drinking water from the river was about 3 times (AOR=2.99; 95% CI: 1.04-8.56,P=0.042) more infected than those used other source, those used unprotected source of drinking water was 3.67 times (AOR=3.67; 95%CI: 1.9.8-6.8,P<0.001) more infected than that used protected water source, also multivariate logistic analysis showed that children not wearing shoes were 2.54 times more exposed than children who wore their shoes (AOR = 2.54; 95%CI: 1.34-4.82,P=0.004). Similarly, prevalence of IPIs were observed higher in children with untrimmed hands fingernail 2 times (AOR= 2; 95% CI: 1.15-3.48, P=0.014) infected compared

to trimmed participants. In the same way, children playing with soil were 4.18 times more exposed than children who did not play with soil (AOR = 4.18; 95%CI:2.34-7.46,P<0.001)(Table 5).

Moreover, IPIs were significantly associated with hands washing habit after defecation with higher infection seen for infrequently hands washing habit after defecation 8 times (AOR=8; 95%CI: 2.617-28, P<0.001). In addition, not washing hands before having food was 2.32 times more exposed than children wash their hands before having food (AOR= 2.32; 95% CI:1.11-4.84,P=0.025) and latrine with not hand washing facility were 4.65 times more exposed to IPIs (AOR=4.65; 95% CI: 2.6-8.3, P <0.001). The prevalence of intestinal parasite infection was no significant association between children living in urban and ODF rural kebeles with (AOR=1.2; 95%CI: 0.852-1.69, P=0.299 (Table 5).

Table 5: Bivariate and Multivariate logistic regression analyses of factors associated with intestinal parasite infections among school-age children in urban and ODF rural kebeles, Dedo district, south west Ethiopia, 2021 (n = 607)

Independent variable			No	IPI,No(%)	OR (95% CI)	P-value	AOR (95% CI)	P-value
Sex	Urban	Male	156	49(31.4)	1.13(0.692-1.842)	0.628		
		Female	149	43(28.9)	1			
	Rural ODF	Male	155	64(41.3)	1.948(1.198-3.12)	0.007*	1.38(0.73-2.62)	0.31
		Female	147	39(26.5)	1			
Age group(year)	Urban	5-9	164	57(34.7)	1.6(0.979-2.65)	0.06*	1.23(0.61-2.47)	0.231
		10-14	141	35(24.6)	1			
	Rural ODF	5-9	157	64(40.8)	1.87(1.15-3.04)	0.02*	1.19(0.546-1.8)	0.132
		10-14	145	39(27)	1			
Family size	Urban	≤ 5	98	30(30.6)	1			
		>5	207	62(30)	0.969(0.575-1.63)	0.907		
	Rural ODF	≤ 5	98	26(26.5)	1			
		>5	204	77(37.7)	1.98(0.99-2.85)	0.055*	1.92(0.96-3.83)	0.066
Family income	Urban	<1000	123	56(45.5)	4.44(2.224-8.85)	<0.001*	3.43(1.51-7.79)	0.003
		1000-2000	100	23(23)	1.585(0.746-3.37)	0.231*	1.27(0.56-2.86)	0.57
		>2000	82	13(15.9)	1			
	Rural ODF	<1000	161	65(40.4)	1.84(0.92-3.6)	0.083*	0.63(0.29-1.34)	0.238
		1000-200	89	24(27)	1(0.46-2.17)	0.996		
		>2000	52	14(26.9)	1			
Mother or guardian	Urban	No FE	73	27(37)	15.261(1.96-8.9)	0.009*	8.388(1-70.34)	0.052
		Primary	134	47(35.1)	14.046(1.85-10.8)	0.011*	7.66(0.95-61.8)	0.056
		Secondary	71	17(23.9)	8.19(1.033-64.89)	0.047*	6.88(0.85-55.8)	0.71
		High level	27	1(3.7)	1			

literacy	Rural	No FE	75	34(45.3)	7.463(0.9-61.89)	0.063*	0.54(0.25-1.16)	0.112
	ODF	Primary	164	57(34.8)	4.79(0.59-38.8)	0.142*	0.47(0.17-1.32)	0.15
		Secondary	53	11(20.8)	2.357(0.269)	0.439		
		High level	10	1(10)	1			
Water source protected	Urban	Yes	156	29(18.6)	1			
		No	149	63(42.3)	3.208(1.911-5.38)	<0.001*	2.55(1.46-4.47)	0.001
	Rural ODF	Yes	135	20(14.8)	1			
		No	167	83(49.7)	5.68(3.23-9.98)	<0.001*	3.67(1.9.8-6.8)	<0.001
Water source for drinking	Urban	Borehole	55	9(16.4)	1			
		Stream	200	60(30)	2.19(1.01-4.758)	0.048*	1.59(0.66-3.82)	0.3
		Well	44	21(47.7)	4.67(1.8511.7.98)	0.001*	2.4(0.83-6.93)	0.11
		River	6	2(33.3)	2.56(0.405-16.17)	0.318		
	Rural ODF	Borehole	56	13(23.2)	1			
		Stream	175	59(33.7)	1.682(0.84-3.37)	0.142*	1.41(0.22-1.31)	0.312
		Well	46	15(32.6)	1.6(0.67-3.84)	0.292		
		River	25	16(64)	5.88(2.11-16.4)	0.001*	2.99(1.04-8.56)	0.042
Latrine availability	Urban	Yes	275	72(26.2)	1			
		No	30	20(66.7)	5.64(2.52-12.616)	<0.001*	5.071(2.2-11.64	<0.001
	Rural ODF	Yes	285	90(31.6)	1			
		No	17	13(76.5)	7.04(2.234-22.2)	0.001*	4.65(1.28-16.9)	0.02
Latrine with HWF	Urban	Yes	148	24(16.2)	1			
		No	127	48(37.8)	3.14(1.783-5.526)	<0.001*	2.28(1.24-4.18)	0.008
	ODF rural	Yes	171	327(15.8)	1			
		No	114	63(55.3)	6.59(3.792-11.45)	<0.001*	4.65(2.61-8.3)	<0.001
Child wearing shoes	Urban	Yes	247	65(26.3)	1			
		No	58	27(46.6)	2.439(1.354-4.39)	0.003*	1.75(0.92-3.35)	0.09
	ODF rural	Yes	236	66(28)	1			
		No	66	37(56.1)	3.286(1.87-5.77)	0.000*	2.54(1.34-4.82)	0.004
Status of	Urban	Cover foot	76	5(6.6)	1			
		Flat shoes	171	60(35.1)	7.676(2.94-20.04)	<0.001*	7.2(0.904-58.8)	0.05

shoes	ODF rural	Cover foot	70	7(10%)	1			
		Flat shoes	166	59(35.5)	4.96(2.14-11.53)	0.000*	1.25(0.4-3.92)	0.702
Hand wash after defcat.	Urban	Yes	230	56(24.3)	1			
		No	75	36(48)	2.868(1.665-4.94)	<0.001*	1.34(0.69-2.58)	0.388
	ODF rural	Yes	229	67(29.3)	1			
		No	73	36(49.3)	2.39(1.39-4.1)	0.002*	1.18(0.62-2.28)	0.614
Hand washig before meal	Urban	Yes	258	64(24.8)	1			
		No	47	28(59.8)	4.467(2.338-8.53)	<0.001*	4.56(2.32-8.96)	<0.001
	ODF urban	Yes	257	77(30)	1			
		No	45	26(57.8)	3.2(1.67-6.12)	0.000*	2.32(1.11-4.84)	0.025
Child play with soil	Urban	Yes	62	31(50)	2.984(1.677-5.31)	0.000*	3.17(1.1-9.27)	0.035
		No	243	61(25.1)	1			
	ODF rural	Yes	83	50(60.2)	4.75(2.77-8.123)	0.000*	4.18(2.34-7.46)	<0.001
		No	219	53(24.2)	1			
Status of finger nail	Urban	Trimmed	176	24(13.6)	1			
		Untrimmed	129	68(52.7)	7.06(4.065-12.26)	<0.001*	6.25(1.45-4.47)	<0.001
	ODF rural	Trimmed	193	51(26.4)	1			
		Untrimmed	109	52(47.7)	2.54(1.55-4.16)	0.000*	2.(1.15-3.48)	0.014
Cleanliness of finger nail	Urban	Clean	171	21(12.3)	1			
		Not clean	134	71(53)	8.05(4.558-14.22)	<0.001*	5.9(2.19-16.11)	<0.001
	ODF rural	Clean	186	48(25.8)	1			
		Not clean	116	55(47.4	2.59(1.59-4.23)	0.000*	1.38(0.313-6.1)	0.67
Wash vegetables	Urban	Always	56	6(10.7)	1			
		Sometimes	202	69(34.2)	4.32(1.76-10.584)	0.001*	1.53(0.37-6.44)	0.56
	ODF rural	Always	57	8(14)	1			
		sometimes	194	73(37.6)	3.75(1.68-8.35)	0.001*	2.23(0.68-7.25)	0.188
Group		Urban	305	92(30.2)	1			
		Rural ODF	302	103(34.1)	1.2(0.852-1.69)	0.299		

Key: HWF –hand washing facility , OR-odd ratio, CI- confidence interval, AOR- adjusted odd ratio,* potential candidates for multivariate, FE-formal education

Chapter Six

Discussion

In the present study the overall prevalence of IPIs among study participants was (32.1 %). The prevalence of IPIs among urban kebele was (30.2%) where as in ODF rural kebele was (34.1%). *A. lumbricoides* was the most common helminthes infections in both urban (25%) and ODF rural (20.7%) kebeles, while the least encountered were *S. stercoralis* (3%) and *Teania species* (4.2%) urban and rural ODF kebeles respectively.

From intestinal protozoan infection *E. histolytica/dispar* was the most common protozoan infection in both urban (20%) and ODF rural (19.8%) kebeles. Single infection, double infection and triple infections were found with infection rates of (90.2%), (8.7%) and (1.1%) respectively for urban, while (86.4%), (9.7) and (3.9%) respectively for rural ODF kebeles. Unprotected water source, unavailability of latrine, latrine without hand washing facility, not washing hand before having food, playing with soil and untrimmed fingernail were independent predictors for IPIs in both groups.

Our present study was lower than those previous findings from Nigeria (67.4%) of them (51.4%) urban and (80.9%) rural (54), finding from Indian showed that (54.7%) urban and (62%) rural (38), finding from Colombia showed (97.2%) urban and (90%) rural (55), Kanchee puram district of Tamil Nadu (63.6%) of them (52.6%) urban and (47.4%) rural (56), rural Ecuadorian children (90%) (57), rural areas of district Pakistan (82%) (58), children in an urban Slum of Karachi was (52.8%) (59). Diagnostic methods, age variation, family education may be correlated with the discrepancy.

Also lower than many study done in different parts of Ethiopia, findings in Sanja District, Northwest Ethiopia (52.9%) from these (47.8%) urban and (57.4%) rural (60), Sasiga District, Southwest Ethiopia (62.4%) of them (49.8%) urban and (76.4%) rural (45), Boricha district South Ethiopia urban (48.7%) (61), Jawi, Northern Ethiopia (57.88%) of them (45%) urban and (56.4%) rural (52), Dawudo school children , Dessie, (66.5%) (62), Dera District, Northwest Ethiopia (62.3%) (63). The variation might be due to this study used only wet mount method to

assess the status of protozoan trophozoites, this method was less sensitive and delayed of same specimens supporting the above statement that the prevalence might be more than the stated.

In contrary, the present study was higher than previous findings reported from southwestern Iran (16.0%) of them (9.8%) rural areas and (6.2%) urban areas (5),Iran (28 %) which was (29.3%) rural and (26.2%) urban (64), rural area of southern Thailand (16%) (40), school children in Accra, Ghana(15%)(65),central India (7.56%) (66). This difference may be due to environmental and personal hygiene condition and source of drinking water.

Also the present study was higher than those findings reported from different parts of Ethiopia such as Yadot school children, South Eastern Ethiopia (26.2%) (67), rural Dembiya (25.8%) (68), Shashamane, Southern Ethiopia(19.7%) (25), Harbu, North East Ethiopia (21.5%) of them urban (24.6%) and rural (17%) (2), Yadot school children, South Eastern Ethiopia (26.2%) (67), Bahir Dar, northwest Ethiopia (24.4%) (69). Study period, sample size, geographic and socioeconomic difference may be contribute for this variation

Our finding was in line with study reported from abroad, such us south–western Nigeria (30%) of which (36.1%) of the rural and (26.3%) of the urban (32), a western Turkey (31.8%) of them (27.9%) urban and (36.9%) rural (31), among school children of Saptari district, Nepal (33%) of them urban (30%) and rural (36.7%) (70), rural area school children of Lokhim (30.92%) (71)**.**

Similarly studies reported from different parts of Ethiopia showed, almost similar with present study, such as Birbir district, South Ethiopia (27.1%) in which (27.7%) urban and (37.5%) rural(72), Glomekeda district, northern Ethiopia (29.9%) (73), school-age children in Ethiopia (29.9%), University of Gondar community School (34.2%) (74)**.**

In this study the prevalence of intestinal parasite infections were no significant association between children living in urban and ODF rural kebeles with (AOR: 1.2; 95%CI: 0.852-1.69,*P*= 0.299). The present result was supported by a study carried out in Gwagaweda Nigeria showed that there were no significance associations between urban and rural residents (P=0.23) (3).This might be due to implementation of community lid total sanitation and hygiene on urban and rural, then similar influence on prevalence of IPI.

Our finding was contradicted with the findings in south–western Nigeria with the prevalence of infection significantly higher among the rural SAC than among the urban (X^2=53.44; P =0.001)(32), study done in Vietnam showed that rural was 5.8 times (AOR: 5.8, P=0.02) infected than urban (50) and study among schoolchildren in Ethiopia showed rural was 6.23 times infected (AOR:6.23, P<0.001) than urban (43). The difference might be due to at present study area there were almost equal application of health extension packages and community lid total sanitation at both rural ODF and urban kebeles and also latrine coverage was almost similar.

In the current study, unprotected water source was 2.55 (AOR=2.55, 95% CI:1.46-4.474,P=0.001) and 3.67 (AOR=3.67; 95%CI: 1.9.8-6.8,P<0.001) times infected in urban and rural ODF kebeles respectively than those used protected water source, this was strengthened with findings from Sanja ,Northwest Ethiopia with (AOR: 3.92 and AOR: 4.7) times infected in urban and rural respectively (60), findings from Dona Berber primary school with (AOR = 2.51, P=0.0131) times infected (69) and abroad Maiyama, Kebbi State, Nigeria (AOR : 6.59, P = .04) and (AOR:4.12, P=0.021) times infected in urban and rural respectively(28). This justification can be might be drinking of not protected water source was more exposed to water born parasites like *E.histolytica/dispar* and *G. lamblia* when drink water contaminated by cysts.

Our finding showed that latrine with not hand washing facility was 2.28 (AOR: 2.28; 95% CI 1.24-4.18, P=0.008) times infected in urban and 4.65(AOR=4.65; 95% CI: 2.6-8.3, P <0.001) times infected in rural than latrine with hand washing facility. This finding was strengthened with findings in walaita sodo Southern Ethiopia (AOR : 2.68) times, abroad Maiyama, Kebbi State, Nigeria (AOR:11.409, P= .0007) (28) and not hand washing before having food 4.56 (AOR=4.6;95% CI: 2.32-8.96, P<0.001) and 2.32(AOR=2.32; 95% CI: 1.11-4.84, P=0.025)times urban and rural respectively. These finding was supported with findings from Chencha , Southern Ethiopia (P<0.001)(75)and abroad Saptari district, Nepal(P<0.001)(70). This can be justified that awareness of way of transmission of IP and effective personal hygiene were impact on intestinal parasite infections.

Bare foot 5.2 (AOR: 5.2;95% CI: 3.4-6.3, P <0.021) and 3.54(AOR: 3.54;95% CI: 1.22-5.312, P <0.0043) times more infected with hook worm for urban and rural ODF respectively than wearing cover shoes, play with soil 4.12 (AOR: 4.12;95% CI: 1.44-6.32, P <0.004) and

3.23(AOR:3.23;95% CI: 2.11-4.3, P <0.021) times more infected with *A.lumbricoid* among urban and ODF rural kebeles respectively. The possible justification might be that children living in our study area played with soil and mud, drilled holes in the soil, and played volleyball and football, which lead to parasitic infections. This result was similar with the previous study conducted in different area of Ethiopia Woreta, Northwest Ethiopia(AOR: 3.41)(76), Dona Berber primary school, Bahir Dar (AOR: 14.13(69), Jawi town, North West Ethiopia (AOR: 3 95%CI = 1.3, 7.3, P = 0.02)(52) and abroad Vietnam(AOR:4.34)(50)and Central India (AOR: 8.89)(38).

Limitations of the study

Intestinal parasite infection statuses of most children were determined by a single stool specimen who could underestimate the prevalence of the measure. Some stool samples were delayed for detection of morphology of protozoan trophozoite without appropriate preservative like polyvinyl-alcohol

Chapter Seven

7.1. Conclusion

The prevalence of intestinal parasitic infections was moderate among the study area with slight higher comparatively in ODF rural kebeles. *A.lumbricoides* was the most common helminthes infections in both urban and ODF rural kebeles while *E. histolytica/dispar* was the most common protozoan infection in both urban and ODF rural kebeles. In both groups latrine unavailability, latrine with no hand washing facility, not washing hand before having food, playing with soil and untrimmed hand finger nail were associated with IPIs. Not cleaned finger nail, wearing flat shoe was associated with IPI in urban while not wearing shoes, using river water for drinking was associated with IPIs in rural ODF declared kebeles.

7.2. Recommendation

Therefore, upgrading traditional pit latrine and application of community-led total sanitation and hygiene (CLTSH) coupled with close follow-up and monitoring, make sustains ODF environment free of IPIs; proper awareness creations aiming to change the attitude and practice of the community should be strengthened in the study area. On the other hand, further studies should be conducted to address factors other than factors addressed by this study.

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Annexes

Annex–I: Laboratory investigation procedures

A. Formol-ether concentration technique

1. Using a stick, emulsify an estimated 1g of faeces in about 4ml of 10% formol water contained in a screw –cap bottle or tube.

2. Add further 3-4ml of 10% formol water, cap the bottle and mix well by shaking.

3. Sieve the emulsified faeces, collecting the sieved suspension in a beaker.

4. Transfer the suspension to a conical tube and add 3-4 ml of diethyl ether.

5. Stopper the tube and mix for 1 minute.

6. with a piece of wrapped around the top of the tube, loosen the stopper.

7. Centrifuge immediately at 3000 rpm for 1 minute.

8. Using a stick, loosen the layer of faecal debris from the side of the tube and invert the tube to discard the ether, fecal debris and formol water.

9. Return the tube to its upright position and allow the fluid from the side of the tube to drain to the bottom. Tap the bottom of the tube to re-suspend and mix the sediment.

10. Transfer the sediment to the slide, and cover with cover glass.

11. Examine the preparation microscopically using the 10x objective with the condenser closed sufficiently to give good contrast. Use 40X objectives to examine cysts.

Intestinal protozoa trophozoite:-For microscopy stool sample was divided into two portions. Direct microscopy was done by mixing a small amount of the specimen in 0.9% sodium chloride solution (wet mount).

Annex–II: Information sheet (English version)

Title of the research project: A community based comparative cross-sectional study of intestinal parasite infections and associated factors among school age children in urban and rural ODF declared kebele , Dedo district , Southwest Ethiopia

Name of the Organization: Jimma University, Institute of Health, Faculty of Health Sciences, School of Medical Laboratory Sciences

Purpose of the study: The aim of this study is to compare the prevalence and assess associated risk factors among school age children among urban and rural ODF declared kebele, Dedo district

Procedures: In order to undertake this study, questions related with the topic stool sample willtake for laboratory investigation. Permission was processed from the Jimma University to Dedo health office.

Risk and/or Discomfort: There is no any possible risk.

Benefit of the study: Study results will able to create awareness among policy makers to strengthen/integrate existing programs that take actions on intestinal parasites. Based on laboratory result the participants get treatment.

Confidentiality: The information given by participants and laboratory results are kept confidential. Any information about the participants that are collected from the study are stored in a file that are not bear a name on it, but only a number code assigned to it instead.

Right to Refusal or Withdraw: Participant wills the full right to refuse from participating and to withdraw at any step in this research. If you have any question you may contact the following individuals.

Investigator: - Melese Hailu Phone: 0911537703, e mail:melesehailu9@gmail.com

Advisors:-Mr.Mitiku Bajiro phone: 0917809566, e mail:mitikubajiro2008@yahoo.com

:-Mrs. Serkadis Debalke phone: 0934275821, email:serkadis2000@yahoo.com

Annex–II: Odeeffanoo (Afaan Oromoo)

Mata duree qarannoo: Tattamsa'iinsa fi wantoota raammoo garaa nama dhukubsaniif sababa ta'an daa'imman umirii baruumissaa keessa jiran gandoota udaan irraa bilisa ta'aniif gandoota magalaa malalaa wal bira qabuu,Aanaa Deeddoo.

Maqaa qorataa: Mallasa Hayiluu, Phone: 0911537703, e mail:melesehailu9@gmail.com

Maqaagorsootaa:

1. Mittikuu Baajiroo, phone: 0917809566, email:mitikubajiro2008@yahoo.com
2. Sarkaadis Dabaalqee, phone: 0934275821, e mail:serkadis2000@yahoo.com

Maqaa dhabatichaa: Univarsitii Jimmaa, Inistituutii fayyaa, Faakalitii saayinsii fayyaa, Mana baruumsa saayinsii laaboratorii meedikaala

Kaayyoo qorannoo: Tattamsa'iinsa fi wantoota raammoo garaa nama dhukubsaniif sababa ta'an daa'imman umirii baruumissaa keessa jiran gandoota udaan irraa bilisa ta'aniif gandoota magalaa wal bira qabuu.

Faayidaa qorannoo:qarannoo kana irraa kalattidhan kan irratti hirmatan fayyadamoota yennaa ta'an al-kallattidhanis Aanichi fi qooda fudhattonni waa'ee tattamsa'iinsa raamolee jiran irratti odeeffannoo argachuu danda'an

Iccitti : Odeeffanoon nama irratti hirmaate fi firiin laaboratorii icittin qabama akasumas koodii dhaan wanta adda ba'uuf maqaan irratti hin baraa'u.

Mirga diduu fi addan kutuu: hirmaatan mirga guutu irratti hirmaachu fi yeroo barbaadetti adda kutuu danda'a.

Annex–III: consent form (English Version

I _____,here by giving my consent for me or my child to participate in the mentioned study. I understand that this study will be used to know the prevalence of intestinal parasites among school age children. I also trust that at the end of study, the results will be shared with the concerned body, Jimma university institute of health science, DedoWeredahealth office and to the local health facilities.

Your child's name _____

Parent's name _____ Signature _____ Date _____

Name of data collector _____signature _____date _____

Name of principal investigator_____Signature _____ Date _____

Thank you for your participation

Annex–III: uunkaa"consent" (Afan Oromo Version)

Ani obboo/ addee_____,anis ta,ee daa'imni koo qorannoo kana irratti hirmaachuuf waligaluu koo malttoo kootin nan mirkaneessa. Qoranicha waa'ee tatamsa'iinsa raamlee garaa nama dhukubsan daa'iman umirii baruumsakeessa ji ran irratti qoranoon geggeefamaa jiru hubannoo ga'aa argadheejira. Bu'aan qoranoo kanaas dhuma irratti qaama ilaaltuuf jechunis dhabata fayyaa yunivaristy Jimmaa, waajjira Eegums Fayyaa Anaa Deedo fi dhabilee fayyaa nanawa kana jiranif aakka tamsasamu nan amana.

Maqaa hirmata/ttuu _____ mallattoo _____ guyyaa _____

Maqaa nama saamuda sassaabee_____ mallattoo _____ guyyaa _____

Maqaa qorataa_____ mallattoo _____ guyyaa _____

Qoranicha irratti wan hirmataniif galatoomaa

Annex–IV: English version assent for child (<18 years of age of study participant)

You are being asked to give a stool sample that will be examined for intestinal parasites. You do not have to do this if you do not want to do, but there is no danger in doing so.

Do you agree to give your stool sample for intestinal parasite examination?

Yes---------- No----------

Child's name----------

Child's signature----------

Name of the person obtaining assent----------

Signature of the person obtaining assent----------

Witness name_____ Signature---------- date_____

Annex–IV:Afaan oromoo version assent form((Hirmatotaumiriiwaggaa18 gadita'aniif)

Amma kan si gaafachaa jirru saamuda booli guddaa qorannoo raammolee garaa nama dhukubsan qorachuuf nu gargaaru akka nu kenituuf. Kennus kennuu dhisuus ni dandeessa garuu keennuu keetiin wantti midhamtu tokkolleen hinjiru. Saamuda boolii guddaa nu kennuuf waligalteerta?

Eeyyee_____lakki_____

Maqaa da'imaa _____ Mallattoo _____ Maqaa nama gaafatee _____ mallattoo_____ Ragaa _____ mallattoo _____ guyyaa_____

Annex–IV: Questionnaire (English Version)

If you agree to participate in this study, I have started my questions by asking general identification point. The interview takes about 15 minutes.

S. NO	Questioners	Responses	Remark
100	**Section I:Socio Demographic characteristics**		
	Kebele	1. Sheger 2. Sherifi 3.bilo adicho 4, Keta kedida	
	Zone number	_____	
	House number	_____	
101	Ethnicity	1 oromo 2 dawuro 2 amahara 3 kefa 4. Yem 5 others	
102	Age of the child	____years 1. 5-9 2. 10-14	
103	Sex	1. Male 2. Female	
104	Resident	1. Urban 2.Rural	
105	Religion	1. 1. Muslim 2. Orthodox 3.porotestant 4. Others	
106	Family size	1. ≤5 2. >5	
107	Family income per month	____ETB1. <1000 2.1000-2000 3.>2000	
108	Mothers' (Guardians') highest level of schooling have ever attended	1. No formal education 2. Primary 3. Secondary 4. High level	
109	Mothers' (Guardians') occupation	1. Farmer 2. Merchant 3. Employed 4. House wife 5. Student 6. Daily laborer 7. Others specify_____	
1110	Grade level of children	1. Not enrolled 2. KG 3. 0-4 4. 5-8	

200	**Section II: factors associated for intestinal parasite infections**		
201	Source of water for drinking?	1. Pipe 2.Borehole 3. Stream 4. Well 5. River 6. specify_____	**More than one answer**
202	Is source of water protected	1. Yes 2. No	
203	Is there any water treatment practice	1. Yes 2. No	**If No, jump to Q. No. 205**
204	If yes, ways of treatment	1. Boiling 2. Aqua tab 3. Chlorine 4. Other specify _____	**More than one answer**
205	Do you have latrine?	1. Yes 2. No	**If No., jump to question No.211**
206	If yes, what types of latrine?	1. Pit latrine with slab 2. VIP 3. Traditional Pit Latrine 4. Water Flash	
207	Latrine with hand washing facility	1. Yes 2. No	
208	Latrine hole covered	1. Yes 2. No	
209	Do you use latrine for defecation	1. Yes 2. No	
210	If yes, how often?	1. Always 2.sometimes	
211	If No Q 205, where you defecation	1. At public latrine 2. open field 3.others	
212	Solid waste disposal method	1 Burning 2. Pit 3. Open field	**More than one answer**
213	Does the child wearing shoes?	1. Yes 2. No	**If No., jump to Q No. 215**
214	If yes to No 213, status of shoes	1. Covering all of the foot 2. flat shoes	
215	Does the child wash his/her hand after	1. Yes 2. No	**If No., jump to Q No. 217**

	defecation		
216	If Yes to No.215, how often?	1. Always 2.sometimes	
217	Does the child wash his/her hand before eating food?	1. Yes 2. No	**If No., jump to Q No. 219**
218	If yes to No.217, haw often?	1. Always 2.sometimes	
219	Does the child play with the soil?	1. Yes 2. No	**If No., jump to Q No. 221**
220	If yes to No.219, how often?	1. Always 2.sometimes	
221	Does the child have nail biting or/ thump sucking habit?	1. Yes 2. No	**If No., jump to Q No. 223**
222	If yes to No.221, how often?	1. Always 2.sometimes 3. Never	
223	Status of finger nails	1. Trimmed 2. Not trimmed	**Observe**
224	Cleanliness of fingernails	1. Clean 2. Not clean	**Observe**
225	Domestic animal living with human at home	1. Yes 2. No, if yes specify _____	
226	Does habit of washing vegetable before eating	1. Yes 2. No	
227	If yes to No.226, haw often?	1. Sometimes 2. Always	
228	Practice of Swimming	1. Yes 2. No	
300	**Section III : Health service and knowledge related factors**		
301	Have you ever heard of intestinal worms?	1. Yes 2. No	
302	If Q 301 Yes, from where did you hear aboutthem	1. from my family 2.from health extension workers 3.from Radio 4. from TV 5.others	**More than one answer**
303	Do you know ways of	Yes 2. No	**If No, finish**

	transmission of intestinal parasites?		
304a	Intestinal parasites can be transmitted by not keeping personal hygiene	1. Yes 2. No	
305b	Intestinal parasites can be transmitted by eating contaminated food	1. Yes 2. No	
306c	Intestinal parasites can be transmitted by drinking contaminated water	1. Yes 2. No	
307d	Intestinal parasites can be transmitted by not wearing protective shoes	1. Yes 2. No	
308e	Intestinal parasites can be transmitted by swimming in unprotected water bodies	1. Yes 2. No	
400	**Laboratory results of stool examinations for intestinal parasites**		
401	Parasitic infection status	1. Positive 2.negative	
402	Is there polyparasitism?	1. Yes 2. No	
403	What parasites are recovered from the stool?	List 1_____ 2_____ 3_____ 4_____ 5_____ 6_____	

Annex–IV: Questionnaire (Afan Oromo Version)

Lakk.	Gaafileewwan	Deebii	Yaada
100	**Kutaa I:- haalahawwaasa –diinagdee**		
101	Codii	_____	
102	Umirrii daa'imaa	Waggaa _____	
103	Saala	1. Dhiira 2. Dhalaa	
104	Iddoo jireenyaa	1. Magalaa 2.baadiyyaa	
105	Amantaa	1. Musliima 2.ortodoxii 3.porotestantii 4. Katolikii 5.kan biro	
106	Baayina maatti	1. <=5 2. >5	
107	Galii ji'aan qarshii	_____ETB	
108	Sadarkaa baruumsa haadha YKN nama guddisee	1. baruumsa kallattii kan hin baranne 2. Sadarkaa 1ffaa 1 – 8 3. Sadarkaa 2ffaa 9 - 12 4. 12+	
109	Hojjii haadha ykn nama guddisee	1. Qoteebulaa 2. Daldalaa 3. Hojjetaa moottummaa 4. Haadha manaa 5. Barataa 6. kan biro	
1110	Sadarkaa baruumsa daa'imaa	1. KG 2. 0-4 2. 5-8 3. Kan hin baranne	
200	**KutaaII:sababootadhukkubbii raamolee garaa fiduun wal qabata**		
201	Madda bishaan dhugaatii ?	1. laga 2.boonbaa 3. Burqaa 4. Boolla 5. Kan biro , ibsi _____	
202	Mali bishaan ittin yaalamu jira	1. Eeyyen 2. Mitti	Miti yoo ta,e lakk. 203 darbi
203	Eeyyen yoo ta'e mala isaa	1. Danfisuu 2. Aqua tab 3. Chlorine 4. Kan biroo _____	
204	Mana fincaanii qabduu	1. eeyyen 2. Mitti	
205	Eeyyen yoo ta,e gosa isaa	1. Pit latrine with slab 2. VIP 3. Traditional Pit Latrine 4. Water Flash	
206	Mana fincaanii buula,uuf	1. Eeyyen 2. Mitti	

	nifayyadamtuu		
207	Eeyyen yoo ta,e yeroo kami	1. Yeroo hunda 2. Darbee darbee	
208	Abbummaa mana fincaanii	1. Kophaatti 2. Waliin 3. Kan ummataa	
209	Keddoo qabaa	1. Eeyyen 2. Mitti	
210	Mini fincanii wantoota harka dhiqannaa qabaa	1. Eeyyen 2. Mitti	
211	Haala balfi itti maqfamu	1gubuudhan 2. Boollatti 3. Badheeretti	
212	Daa'imman kophee keewatu	1.eeyyen 2. Mitti	Miti yoo ta,e lakk.213 darbi
213	Lakk 13 eeyyen yoo ta'e yeroo kami	1. yeroo hundaa 2.darbee darbee	
214	Daa'iman erga boola'anii booda harka ni dhqatuu ?	1. eeyyen 2. Mitti	Miti yoo ta,e lakk.215 darbi
215	Lakk2 214 eeyyen yoo ta'e yeroo kami?	1. yeroo hundaa 2.darbee darbee	
216	Daa'iman nyaata dura harka isaanii ni dhqatuu	1. eeyyen 2. Mitti	Miti yoo ta,e lakk.217 darbi
217	Lakk 216 eeyyen yoo ta'e yeroo kami?	1. yeroo hundaa 2.darbee darbee	
218	Does the child play with the soil?	1. eeyyen 2. Mitti	Miti yoo ta,e lakk.219 darbi
219	Lakk 218 eeyyen yoo ta'e yeroo kami?	1. yeroo hundaa 2.darbee darbee	
220	Daa'imani barmaatilee quba hodhuu qabuu	1. eeyyen 2. Mitti	Miti yoo ta,e lakk.221 darbi
221	Lakk 220 eeyyen yoo ta'e yeroo kami?	1. yeroo hundaa 2.darbee darbee	
222	Haala qeensa qubaa	1. kan qarame 2. Kan hin qaramin	Ilaaludhaan

223	Qulqullina qeenssa qubaa	2. Qulqulludha 2.mitti	Ilaaludhaan
224	Beenladootni mana keessa jiruu?	1. eeyyen 2. Mitti , adda baasi-------	
225	Fuduraaf gudura osoo hin nyaatin dura ni miicama	1. eeyyen 2. Mitti	
226	Lakk 225 eeyyen yoo ta'e yeroo kami?	1. yeroo hundaa 2.darbee darbee	
227	Bishaan ni daakituu	1. eeyyen 2. Mitti	
300	**Section III : Health service and knowledge related factors**		
301	Waa'ee raamoo garaa beektaa	1. Eeyyen 2.miti	
302	Lakk.301 eeyyen yoo ta'e eessa ageesse	1. mmatti 2.HEF 3.from Radio 4. from TV	
303	Karaa raammon daddarbu beektuu	1. Eeyyen 2. Mitti	Mitti yoo ta,e dhume
304	Qulqullina ofii eegu dhiisurraa	1.eeyyen 2. Mitti	
305	Nyaata faalame nyaachun	1. eeyyen 2. Mitti	
306	Bishaan faalame dhuguun	1.eeyyen 2.mitti	
307	Kophee keewachuu dhabuun	1. eyyen 2. Mitti	
308	Bishaan daakun	1. eeyyen 2. Mitti	

Annex-V Laboratory results compiling table

Study Code number_____Sex_____Age _____Address_____

Microscopic Examinations of stool

Intestinal parasite seen_____

Name of Laboratory Technologist _____Signature _____Date ___/ ____/ _____

Checklist for data collection for the prevalence of intestinal parasitosis

S/N	Age	Sex	Kebele	Code	AL	TT	HW	EV	SS	HN	TS	SM	EH	GL	Negativ

Annex-VI: Declaration

I the undersigned, declare that this thesis was my own work and has never been presented for any degree or other purposes at Jimma University or any other institution of higher learning. I also declare that, when other people work has been used, it has been carefully acknowledged and referenced following the requirements. Therefore, I agree to accept responsibility for the scientific, ethical and technical conduct of the research project and for the provision of required progress reports as per the terms and conditions of the Institute of Health in effect at the time of grant is forwarded as the result of this application.

Name of the student: Melese Hailu

Signature: _____ Date: _____/_____/_____

This thesis has been approved by the supervision of university advisors:

1. Name of 1st advisor: Mitiku Bajiro (MSc, Ass.professor)

Signature: _____ Date: _____/_____/_____

2. Name of 2nd advisor: Serkadis Debalke (MSc, Ass. professor)

Signature: _____ Date: _____/_____/_____

Examiner: _____Signature_____Date ___/_____/_____