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*ORIGIONAL RESEARCH ARTICLE*

# Prevalence of Intestinal Parasitic Infection and Associated Risk Factors Among Primary and Middle School Children in Zigem Town, Awi Zone, Northwest Ethiopia

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## Abstract

Intestinal parasitic infections are globally the greatest cause of illness and disease. They are linked to lack of sanitation, lack of access to safe water, poor hygiene and poverty. Though all age groups are affected, children are most affected. The objective of this study was to estimate the prevalence of intestinal parasitic infections and determine associated risk factors among Zigem Primary School children in Awi zone, Amhara region, Ethiopia. A cross sectional study was conducted from January-August, 2018. Participants were selected using systematic random sampling from classroom rosters. Direct-wet mount and formal-ether concentration was used for the diagnosis of stool samples. A questionnaire-items format was used to collect socio-demographic characters and possible risk factors. Data was analyzed using SPSS software version 20. Logistic regression was used to assess the strengths of possible risk factors. Out of the total of 576 school children, 178 (30.9%) were infected by one or more parasites. Entamoeba histolytica/dispar 80(13.9%), Ascaris lumbricoides 46 (8%), Hymenolepis nana 3 (0.5%), Giardia lamblia 4 (0.7%) and Hookworm infection 2 (0.3%) were identified. Male students i.e., 99 (17.2%; $p < 0.05$) were more infected than female students i.e., 79 (13.7%). Students with the age range of 11-14 years were more affected than other age categories ($p=0.024$). Family size, hand washing habit and latrine usage were associated risk factors for intestinal parasitic infections. The findings obtained from this study indicate the need for strengthening the control of intestinal parasitic infections. Hence, there should be a regular deworming program and health education to school children.

**Keywords:** Intestinal parasite; School children; Risk factors, Zigem

## Introduction

Intestinal parasites are organisms that live in the human intestine. Parasitic infections caused by intestinal helminths and protozoan parasites are among the most prevalent infections in humans worldwide and especially in developing countries (WHO, 2012). In the world, protozoan and helminth parasites are more common cause for gastrointestinal infection (Capello,2004). Globally, two billion individuals were infected with intestinal parasites; out of which majorities were children in resource-limited areas (WHO, 2002). Particularly in Sub-Saharan Africa, parasitic infections are the major public health problems causing morbidity and mortality (Brooker *et al*., 2006; Harhay *et al*., 2010).

Infections with intestinal parasites have been associated with stunting, physical weakness and low educational performance

of school children (Emile *et al*., 2013). Parasitic infections are governed by biological, environmental, socioeconomic and health systems of behavioral factors (WHO, 2006). Local conditions such as quality of domestic and village infrastructure; economic factors such as monthly income, employment, occupation and social factors such as education influence the risk of infection and disease transmission leading to morbidity and mortality (Workneh *et al*., 2014).These infections are more prevalent among the poor segments of the population and are closely associated with low household income, poor personal and environmental sanitation, and overcrowding, limited access to clean water, tropical climate and low altitude (Savioli *et al*., 2004).

Prevalence of intestinal helminths and protozoan parasites had been studied in different areas of the tropics and subtropics.

A number of studies focusing on intestinal parasites were done in different community -groups such as preschool children, schoolchildren, and in Ethiopian refugee camps. Regarding with these, interventions have been undertaken to minimize the burden (Samuel *et al*., 2017). But, it is not regularly implemented in schools and surrounding villages in Ethiopia including this study area. Still now there was no study done on the prevalence of intestinal parasitic infection and associated risk factors among Zigem primary school children. Therefore, the aim of this study was to estimate the prevalence of intestinal parasites and identify associated risk factors among primary school children in Zigem town.

## Materials And Methods

### *Study Setting*

The study was conducted at Zigem town which is located in Awi zone, Amhara Regional State, Ethiopia (Fig.1). The town isat a distance of 545km from Addis Ababa, 97 km from Injibara, the capital of Awi zone. The population of Zigem *woreda (*the lower administrative unit in Ethiopia*)* is estimated to be 106,886 of which 51,843 are males and 55,043 are females. The geographical coordinates of the site are 36° 25'18" longitude and 10°11'1" latitude and situated at an average altitude ranging from 1350-2100 meters above sea level with total area coverage of 202,300 hectare. Highest rainfall is recorded in July and August but the minimum in January and February. Mean annual rainfall in the area is 1650 mm. The average annual temperature varies and generally ranges from 18°C to 30°C (Zigem District Agricultural Office, 2016).

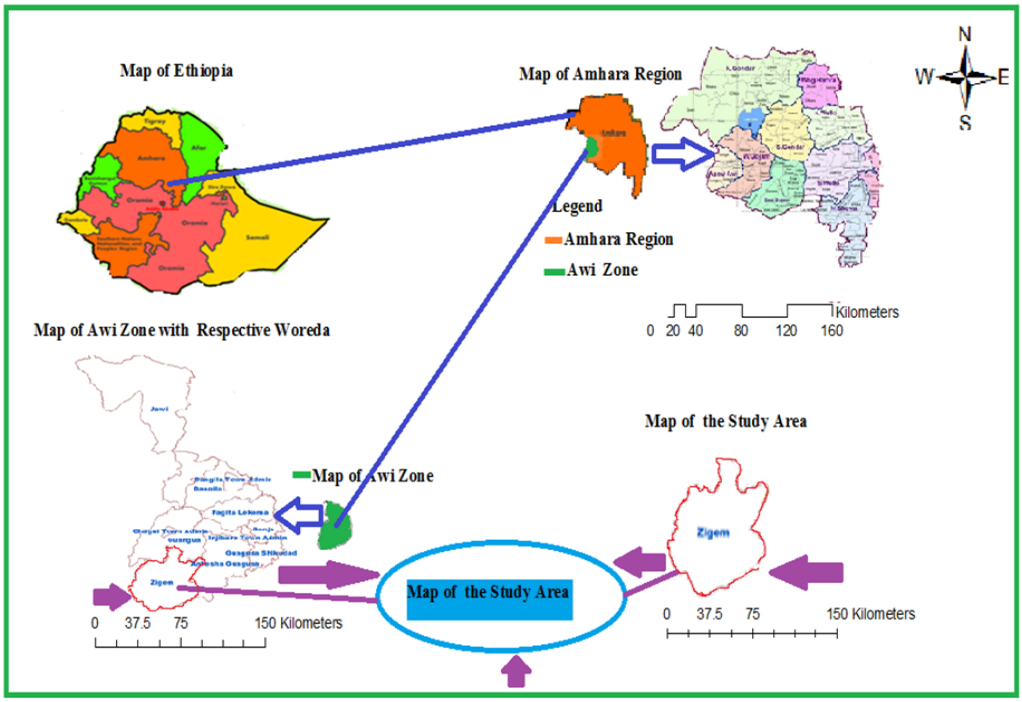


**Figure 1**. Map of study area

***Study Design, Period and Sample Size.***

School based cross sectional study was conducted in Zigem primary and middle school from January to August, 2018. The sample size of the study was determined by using single population proportion formula with the following assumptions: prevalence (p) of 50%, 95% confidence level, 5% margin of error, which gives 384 sample population (Daniel, 1999). To minimize errors that may cause by dropout or absentees during sample collection the samples was multiplied by 1.5 design effect and finally the sample size of the participant students of this study included was 576. The study sample was randomly selected from all children of Zigem primary & middle school children (n=2173).

Equal chance was given for to each grade level of each classroom and then 576 students were selected proportionally. The sample children were selected using stratified systematic random sampling by using class roster as sample frame. Then each stratified and randomly selected student included in this study are shown in Fig.2.

Zigem primary and middle school had 1073 (49.4 %) male and 1100 (50.6 %) female that total 2173 students. The school contained 37 total classes and equal chance was given to each of those classes based on age and sex groups to select study population. The selected students were instructed to bring approximately 3 g of stool samples. Stool specimens were checked for their label, quantity, and the procedures of collection.

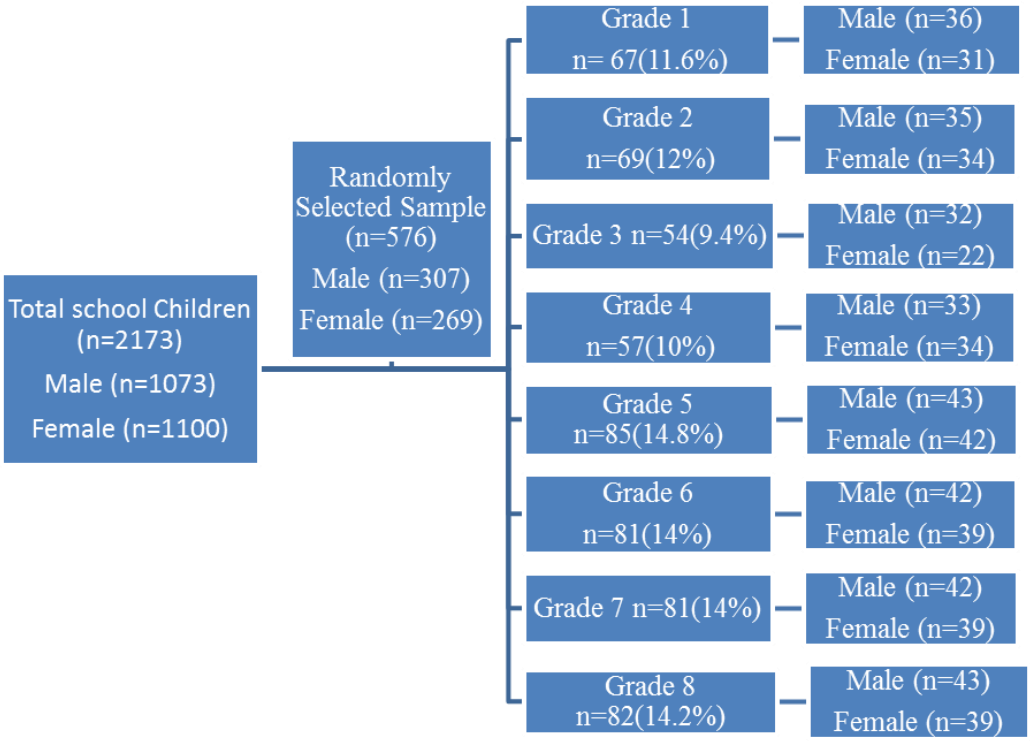


Figure 2. Stratification of study population proportion

***Data Collection and Processing***

*Questionnaire Survey*

In this study, for possible associated risk factors, structured- questionnaire was developed and information was collected from 576 primary school students by the principal investigator using local Amharic language.

*Base line Parasitological Survey*

The children were supplied plastic containers, water proof papers and applicator sticks and instructed to bring a sizable stool sample of their own. The sample was labeled with a unique identification number and immediately transported to Zigem Health center near the school. Direct wet mount parasitological examination was carried out in Zigem Health center laboratory before 30 minutes of stool collection. The remaining sample was preserved in10% formalin. Finally, the preserved stool specimen transported to University of Gondar department of Biology laboratory and formol-ether concentration technique parasitological examination was done by the principal investigator and experienced laboratory technician.

***Data Management and Analysis***

The collected data were entered in excel and was analyzed using SPSS software version 20 and descriptive statistics was used to report and present Socio-demographic and economic characteristics of the study participants. Trend of association between intestinal parasitic infections and age and sex were assessed using a Chi-square ($\chi^2$) and univariate and multivariate logistic regression (OR and 95% confidence interval (CI) was

with intestinal parasitic infections of primary school children of Zigem town. The association of intestinal parasitic infection and risk factor was assumed statistically significant at $p < 0.05$.

## Result

### *Socio-demographic characteristics of the study participants*

A total of 576 school children were selected for this study. All (100%) of them were included in the data analysis due to complete information given during fecal specimen collection and questionnaire interview. Among the study students, 307 (53.3%) were male and the remaining 269 (46.7%) were females. The students' age who participated in the study ranges from 7 to 20 years. The average age of the students involved in the study was 12.05 (SD ± 0.69). Students' grades included were from grades 1 to 8; 248(43.1%) were in grade 1-4 whereas 328 (56.9%) were in grades 5-8 (Table1)

**Table 1**. Sociodemographic characteristics of school children in Zigem Primary School, Zigem District, northwest Ethiopia, 2018.

| Variables | Categories | Frequency | Percentage |
|---|---|---|---|
| Sex | Male | 307 | 53.3 |
| | Female | 269 | 46.7 |
| Age | 7-10 | 166 | 28.8 |
| | 11-14 | 295 | 51.2 |
| | 15-20 | 115 | 19.9 |
| Grade | 1-4 | 248 | 43.1 |
| | 5-8 | 328 | 56.9 |
| Family size | 1-5 | 368 | 63.9 |
| | >6 | 208 | 36.1 |
| Monthly family income (ETB.) | <500 | 23 | 4.0 |
| | 500-1000 | 53 | 9.2 |
| | 1000-2000 | 262 | 45.5 |
| | >2000 | 238 | 41.3 |
| Parent education | Illiterate | 236 | 41.0 |
| | Primary school | 163 | 28.3 |
| | Secondary school | 92 | 16.0 |
| | Higher education | 85 | 14.8 |
| Latrine condition | Available | 120 | 20.8 |
| | Not available | 456 | 79.2 |
| Latrine usage | Not at all | 155 | 26.9 |
| | Sometimes | 294 | 51.0 |
| | Always | 127 | 22.0 |
| Type of Latrine | Field | 122 | 21.2 |
| | Private pit | 361 | 62.7 |
| | Public pit | 93 | 16.1 |
| Source of drinking water | Well/Borehole water | 277 | 48.1 |
| | River water | 4 | .7 |
| | Pipe/Bono water | 295 | 51.2 |

**Table 1**. Continued ...

| Variables | Categories | Frequency | Percentage |
|---|---|---|---|
| Storage of water container | Wide and open | 147 | 25.5 |
| | Narrow and closed | 429 | 74.5 |
| Treatment of drinking water | Not treated | 326 | 56.6 |
| | Boiling | 129 | 22.4 |
| | Treat with chemicals | 121 | 21.0 |
| Habit of washing hand before meal and after latrine usage | Yes | 423 | 73.4 |
| | No | 153 | 26.6 |
| Cleanness of finger nail (observed by investigator) | Not clean | 125 | 21.7 |
| | Clean | 451 | 78.3 |
| Consistency of shoe wearing | Not at all | 102 | 78.3 |
| | Sometimes | 102 | 17.7 |
| | Always | 337 | 58.5 |
| Contact with domestic animals | Yes | 327 | 43.2 |
| | No | 249 | 56.8 |
| Waste disposal | Open field | 219 | 38.0 |
| | Burry underground | 214 | 37.2 |
| | Burning | 143 | 24.8 |
| Eating raw meat and vegetables | Yes | 160 | 27.8 |
| | No | 416 | 72.2 |

**Note**: The percentage is calculated from the total examined (N = 576).

### *Prevalence of Intestinal Parasitic Infections*

*Prevalence of intestinal parasitic infection by species*

In this study 178 (30.9%) students were infected by different intestinal parasites. Five species of intestinal parasites were identified. From these, *E. histolytica/ dispar* 80 (13.9%) was the most abundant parasite followed by *Ascaris lumbricoides* 46 (8 %), *Giardia lamblia* 4 (0.7%), *Hymenolepis nana* 3 (0.5%) and hookworm 2 (0.3%).

Moreover, co-infections were observed with two or more parasites as follows; 4.2% *E. histolytica/dispar* and *A. lumbricoides;* 1.0% *A. lumbricoides* and Hookworm; 1.0% *A. lumbricoides* and *H. nana;* 0.2% *A. lumbricoides* and *G. lamblia;* 0.2% *E. histolytica/dispar* and *G. lamblia;* 0.3% *E. histolytica* and *H. nana* and 0.5% *E. histolytica*/dispar, *A. lumbricoides* and *G. lamblia* (Table 2).

**Table 1**. Continued ...

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Among the total infected school children, 99 (17.2%) were males and 79(13.7%) were females. However, the prevalence of *E. histolytica/dispar* 42(7.29 %) and *G. lamblia* 3(0.5 %) was slightly higher in females; in contrast males were more infected by *A. lumbricoides* 30(5.21%), *H. nana* 3(0.52 %) and hookworm 2 (0.35 %) than females, although the difference was not statistically significant ($p > 0.05$) (Table 3).

**Table 2**. Prevalence of different species of parasitic infection at Zigem primary school in Zigem District, Awi zone, Northwest Ethiopia, 2018.

| Parasite species | Negatives N (%) | Positives N (%) |
|---|---|---|
| *E. histolytica* | 496 (86.1) | 80 (13.9) |
| *G. lamblia* | 572 (99.3) | 4 (0..7) |
| *Lumbricoides* | 530 (92) | 46 (8) |
| *H. nana* | 573 (99.5) | 3 (0.5) |
| Hookworm infection | 574 (99.6) | 2 (0.3) |
| A. L+E.H | 552 (95.8) | 24 (4.2) |
| A. L+H.W | 570 (98.9) | 6 (1.0) |
| A. L+H.N | 570 (98.9) | 6 (1.0) |
| A. L+ G. L | 575 (99.8) | 1 (0.2) |
| G. L+ E.H | 575 (99.8) | 1 (0.2) |
| E.H+ H. N | 574 (99.6) | 2 (0.3) |
| A. L+E.H +G. L | 573 (99.5) | 3 (0.5) |
| **Overall infection** | **398 (60.1)** | **178 (30.9)** |

**Note**: A.L-*Ascaris lumbricoides*, E.H-*Entamoeba histolytica*, H.W-Hookworm, G.L-*Giardia lamblia*, H.N-*Hymenolepis nana.* The percentage is calculated from the total examined (N=576).

**Table 3**. Prevalence of parasitic infection among school children by sex at Zigem primary school, Northwest Ethiopia, 2018.

| | Intestinal Parasite infection by sex | | | | |
|---|---|---|---|---|---|
| **Parasite species** | Male N (%) | Female N (%) | Total N (%) | Chi-Square | P value |
| *E. histolytica/dispar* | 38(6.59) | 42(7.29) | 80(13.9) | 1.255 | 0.263 |
| *G. lamblia* | 1 (0.2) | 3 (0.5) | 4(0.7) | 1.296 | 0.255 |
| *A. lumbricoides* | 30 (5.2) | 16(2.8) | 46(8) | 2.853 | 0.091 |
| *H. nana* | 3 (0.5) | 0(0) | 3(0.5) | 2.642 | 0.104 |
| Hookworm | 2 (0.3) | 0(0) | 2(0.3) | 1.759 | 0.185 |
| A. L+E.H | 16 (2.8) | 8 (1.4) | 24 (4.2) | 1.798 | 0.18 |
| A. L+H.W | 4 (0.7) | 2 (0.3) | 6 (1) | 0.435 | 0.509 |
| A. L+H.N | 3 (0.5) | 3 (0.5) | 6 (1) | 0.310 | 0.577 |
| A. L+ G. L | 0 (0) | 1 (0.2) | 1 (0.2) | 1.143 | 0.285 |
| G. L+ E.H | 1 (0.2) | 0 (0) | 1 (0.2) | 1.143 | 0.285 |
| E.H+ H. N | 0 (0) | 2 (0.3) | 2 (0.3) | 1.143 | 0.285 |
| A. L+E.H +G. L | 1 (0.2) | 2 (0.3) | 3 (0.5) | 0.483 | 0.487 |
| **Overall infection** | **99 (17.2)** | **79 (13.7)** | **178 (30.9)** | **0.320** | **0.172** |

**Note**: A.L-*Ascaris lumbricoides*, E.H-*Entamoeba histolytica*, H.W-Hookworm, G.L-*Giardia lamblia*, H.N-*Hymenolepis nana.* The percentage is calculated from the total examined (N=576).

Among the total 178 intestinal parasite infected school children 37 (6.4%), 100 (17.4%) and 41 (7.1%) were in the age range of 7-10, 11-14 and 15-20 years, respectively (Table 4).

**Table 4**. Overall prevalence of intestinal parasitic infection by Age group at Zigem primary school, Northwest Ethiopia, 2018.

| | Parasite infected by age | | | | | |
|---|---|---|---|---|---|---|
| Parasite species | 7-10 N (%) | 11-14 N (%) | 15-20 N (%) | Total N (%) | Chi-square | (p value) |
| *E. histolytica* | 17(2.95) | 44(7.64) | 19(3.29) | 80(13.9) | 2.773 | .250 |
| *G. lamblia* | 1(0.2) | 3(0.5) | 0(0) | 4(0.7) | 1.270 | .530 |
| *A. lumbricoides* | 6(1) | 32(5.5) | 8 (1.4) | 46 (8) | 7.770 | .021 |
| *H. nana* | 1(0.2) | 2(0.3) | 0(0) | 3(0.5) | .764 | .682 |
| Hookworm infection | 1(0.2) | 1(0.2) | 0(0) | 2 (0.3) | 0.714 | .700 |
| A. L+E.H | 7 (1.2) | 10 (1.7) | 7 (1.2) | 24 (4.2) | 1.509 | 0.470 |
| A. L+H.W | 2 (0.3) | 2 (0.3) | 2 (0.35) | 6 (1) | 0.964 | 0.618 |
| A. L+H.N | 0 (0) | 4 (0.7) | 2 (0.3) | 6 (1) | 3.951 | 0.139 |
| A. L+ G. L | 0 (0) | 1 (0.2) | 0 (0) | 1 (0.2) | 0.954 | 0.621 |
| G. L+ E.H | 1(0.2) | 0 (0) | 0 (0) | 1 (0.2) | 2.474 | 0.29 |
| E.H+ H. N | 0 (0) | 1 (0.2) | 1 (0.2) | 2 (0.3) | 0.954 | 0.621 |
| A. L+E.H +G. L | 1 (0.2) | 0 (0) | 2 (0.3) | 3 (0.5) | 4.86 | 0.088 |
| **Overall infection** | **37 (6.4)** | **100 (17.4)** | **41 (7.1)** | **178 (30.9)** | **8.222** | **0.016** |

**Note**: A.L-*Ascaris lumbricoides*, E.H-*Entamoeba histolytica*, H.W-Hookworm, G.L-*Giardia lamblia*, H.N-*Hymenolepis nana.* The percentage is calculated from the total examined (N = 576)

*Association of Risk Factors with Intestinal Parasitic Infections*

Logistic regression analysis of socio-demographic variables is presented in Table 5. From the analysis, family size had shown significant association with prevalence of intestinal parasitic infections. Family size > 6 was nine times more exposed for intestinal parasitic infection, 9.048(CI: 5.813, 14.083) ($p$ = 0.000). Likewise, sex also showed significant association with the occurrence of intestinal parasitic infection. Males were 1.4 times more exposed for intestinal parasitic infection than females 1.411(CI.734, 2.712) (p = 0.032). Moreover, statistically significant high risk of intestinal parasitic infections was also observed in children aged 11-14 (Table 5).

**Table 5**. Univariate and multivariate logistic regression analysis of socio-demographic and economic factors with intestinal parasitic infections, 2018.

| Risk factors | Catego-ries | Intestinal Parasitic infection | | | |
|---|---|---|---|---|---|
| | | COR (CI 95%) | p value | AOR (CI 95%) | p value |
| Sex | Male | 1.411 (.734, 2.712) | 0.032 | 1.183 (.695, 2.013) | 0.535 |
| | Female | 1.00 | | 1.00 | |
| Age | 7-10 | 0.012 (0.002, .064) | 0.000 | 0.065 (.019, .222) | 0.000 |
| | 11-14 | 0.230 (0.097, 0.550) | 0.001 | 0.419 (.219, .800) | 0.008 |
| | >15 | 1.00 | | 1.00 | |
| Family size | 1-5 | 1.00 | | 1.00 | |
| | >6 | 3.793(1.691, 8.510) | 0.001 | 9.048(5.813, 14.083) | 0.000 |
| Monthly family income (ETB*) | <500 | 1.453(0.256, 8.260) | 0.673 | 3.038(1.106, 8.339) | 0.031 |
| | 500-1000 | 3.792(0.967,14.874) | 0.056 | 5.341(2.500, 11.409) | 0.000 |
| | 1000-2000 | 2.405(0.782, 7.396) | 0.126 | 3.462(2.048, 5.850) | 0.000 |
| | >2000 | 1.00 | | 1.00 | |

**Note**: COR = Crude odd ratio, ETB*(Ethiopian birr), AOR = Adjusted odd ratio, CI = Confidence interval for risk factors.

Logistic regression analysis of behavioral, hygienic practices and environmental sanitation is presented in Table 6. Unavailability of latrine, opened filed defecation, source of drinking water, storage type of drinking water, habit of washing hand before meal and after latrine, contact with domestic animals showed significant association with prevalence of intestinal parasite infections.

**Table 6**. Univariate and multivariate logistic regression analysis of behavioral, hygienic practices; 2018.

| Risk factors | Categories | Intestinal Parasitic infection | | | |
|---|---|---|---|---|---|
| | | COR (CI 95%) | P value | AOR (CI 95%) | p value |
| Latrine condition | Available | 1.00 | | 1.00 | |
| | Not available | 26.202 (2.886, 237.846) | 0.004 | 8.806 (1.573, 49.289) | 0.013 |
| Latrine usage | Not at all | 36.630 (5.160, 260.042) | 0.000 | 13.631 (3.053, 60.854) | 0.001 |
| | Sometimes | 35.393 (6.789, 184.514) | 0.000 | 15.345 (4.323, 54.467) | 0.000 |
| | Always | 1.00 | | 1.00 | |
| Type of Latrine | Field | .016(.000, .723) | 0.033 | 35.816 (4.217,304.164) | 0.001 |
| | Private pit | 12.278 (2.943,51.226) | 0.001 | 7.460 (2.554, 21.789) | 0.000 |
| | Public pit | 1.00 | | 1.00 | |
| Source of drinking water | Well/ Borehole water | 4.652 (1.472,14.699) | 0.009 | 2.451(1.274, 4.716) | 0.007 |
| | River water | 91.342 (3.891,2144.447) | 0.005 | 21.826 (1.995,238.730) | 0.012 |
| | Pipe/Bono water | 1.00 | | 1.00 | |
| Storage of water container | Wide and open | 38.396 (9.944,148.260) | 0.000 | 17.627 (7.073, 43.929) | 0.000 |
| | Narrow and closed | 1.00 | | 1.00 | |
| Habit of washing hand before meal and after latrine usage | Yes | 1.00 | | 1.00 | |
| | No | 3.813 (1.043,13.946) | 0.043 | 2.761 (1.104, 6.903) | 0.030 |
| Contact with domestic animals | Yes | 24.204 (3.020,193.954) | 0.003 | .751 (.256, 2.202) | 0.602 |
| | No | 1.00 | | 1.00 | |

**Note**: COR = Crude odd ratio, ETB*(Ethiopian birr), AOR = Adjusted odd ratio, CI = Confidence interval for risk factors.

However, waste disposal, the habit of eating raw meat and under cooked vegetables, treatment of drinking water, cleanness of finger nail and consistency of shoe wearing were not significantly associated with intestinal parasitic infection.

## Discussion

In the present study, five different intestinal parasites *E. histolytica/dispar, A. lumbricoides*, *H. nana, G. lamblia* and Hookworm were identified. *E. histolytica/ dispar* (13.9%) and *A. lumbricoides* (8.0%) were the predominant intestinal parasites while hookworm (0.3%) was the least parasites encountered. The observed overall prevalence of intestinal parasitic infection in the present study was 30.9%. This was comparable with the findings of Gelaw *et al*., 2013, in North Gondar (34.2%) and Adane *et al*., 2016, in Bahir Dar (31.5%). However, it disagrees with the reports of similar studies from Wukro town Tigray (60.7%) (Kidane *et al*., 2016), in Dagi primary school, North Mecha (77.9%) (Alamir *et al*., 2013), in Debre Elias Primary Schools, East Gojam (84.3%) (Workhen *et al*., 2014) and in Delgi school children, North Gondar (79.8%) (Ayalew *et al*., 2011). This variation might be differences in the study period, methodology employed for parasite examination and differences in socio-demographic conditions. On the other hand, the prevalence observed in this study was slightly higher than a study conducted in Babile, south eastern Ethiopia (27.2%) (Tulu *et al*., 2014). This variation might be due to the difference in living standard and variation in geographic condition.

In the present study, the prevalence of *E. histolytica/dispar* (13.9%) was higher than the study reported from Debre Elias, East Gojam (6.6%) (Workhen *et al*., 2014), in southern Ethiopia (8.2%) (Getachew and Argaw, 2017), in Babile, southeastern Ethiopia (5%) (Tulu *et al*., 2014) and in Adigrat, Northern Ethiopia (4.5%) (Senbeta, 2017). This variation might be in difference with habit of washing hands before meal and after latrine usage, eating uncooked vegetables, unclean storage of water container and source of drinking water. Conversely, the current study finding is lower than the study conducted in Homesha *Woreda*, west Ethiopia (14.17%) (Gebretsadik, 2016). This might be due to the difference in methodology employed for parasitological analysis and feeding habit.

The prevalence of hookworm (0.3%) infection in the present study was lower than other studies conducted in Debre Elias, East Gojam (71.2%) (Workhen *et al*., 2014), in Jimma town (15.9%) (Jejaw *et al*., 2014), in Homesha *Woreda*, west Ethiopia (10.12%) (Gebretsadik, 2016), and in southern Ethiopia (26.6%) (Getachew and Argaw, 2017).This might be due to shoe wearing habit and climate difference.

In the current study, the prevalence of *A. lumbricoides* (8.0%) was found to be lower than studies conducted in Gurage, southern central Ethiopia (9.6%) (Bireka *et al*., 2017) and Wondo Genet, south Ethiopia (84.3%) (Erko and Medhin, 2003). This variation might be due to the differences in study population size, socio-demographic conditions and environmental conditions and time of the study. In the present study, the prevalence of *A. lumbricoides* was higher in males 5.2% than females 2.8%. This is in line with the study conducted in two primary schools from North Gondar, northwest, Ethiopia (Mathewos *et al*., 2014) In contrast, a study conducted in Bahir Dar showed females were more affected than males (Hailegbrel, 2017). These differences in the prevalence of the specific parasites may be attributable to the difference in macro and micro environment.

In this study, statistically significant sex related difference in prevalence of intestinal parasite infection was not observed; but males (17.2%) were more affected by intestinal parasite infection than females (13.7%). This is in line with the study conducted in Homesha *Woreda*, Northwest Ethiopia (Gebretsadik, 2016). This might be due to males pass their time through playing activity outdoors and hygiene problem. In this study prevalence of intestinal parasitic infection in relation to sex is lower compared with other studies reported from Bahir Dar, 33.4% males and 32% females (Hailegebrel, 2017), and 50.7% males and 49.3% females in Zegie Peninsula, northwest Ethiopia (Abdi

*et al*., 2017). In contrast to the present study, a study conducted in Adigrat, Northern Ethiopia females (52.94%) were more infected than males (47.06%) (Senbeta, 2017). This might be due to females would actively involve in household activities and child care activities.

In this study, the highest prevalence of intestinal parasite infection was observed in children whose age range from 11 to 14 years (17.4%). This is in agreement with a study conducted in Delgi, North Gondar (Kidane et al., 2014) but higher compared with study conducted in Medebay Zana, Northwestern Tigray, Ethiopia, (13.5%) (Teshale et al., 2018).This variation could be due to active outdoor playing and environmental contamination.

This study also assessed the association of intestinal parasitic infection with possible potential risk factors. Univariate and multivariate regression analysis of sanitary and socio-demographic risk factors like family size, monthly family income, age of student, latrine condition, latrine usage, source of drinking water, storage of water container, habit of washing hands before meal and after latrine usage and contact with domestic animals are risk factors for intestinal parasite infection in the current study. Several studies have also identified a range of sanitary and socio-demographic risk factors with statistically significant association. Study conducted in North Gondar, Delgi, (Ayalew et al., 2011), in Zegie Peninsula, northwest Ethiopia [26], in Dona Berber primary school, Bahir Dar (Hailegebrel, 2017), in Tanzania (Speich et al., 2013), in Rwanda (Mupfasoni et al., 2009), in Nigeria (Asinobi et al., 2007) and in Western Turkey (Pinar et al., 2004) showed significant association of intestinal parasitic infection with sanitary and socio-demographic risk factors which is in agreement with the current study.

## Conclusion

The present study revealed that intestinal parasitic infection among students is an indicator for its public health importance. From the five total intestinal parasitic infections identified, E. histolytica/dispar and A. lumbricoides were the most abundant parasites among the study participants. Different sociodemographic factors like family size, family income, latrine condition, latrine usage, source of drinking water, water container for storage, and habit of none washing hand before meal and after latrine usage and contact with domestic animals were significantly associated factors with intestinal parasitic infection. Continuous health education, environmental sanitation and further epidemiological study is recommended.

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## Statement of ethical clearance

The proposal of the study was reviewed and approved by the ethical review committee of College of Natural and Computational science, University of Gondar. The purpose and importance of the study was explained to the school children, their parents and the school director of Zigem primary and middle school. Written consent was taken from the children parents or guardians and children had gave their assent. Students who were found positive for intestinal parasite were treated by health officer according to the treatment regimen.

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