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Research Article

# Prevalence of Intestinal Helminths and Associated Risk Factors among Primary School Children in Gedeo Zone, Southern Ethiopia

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## ABSTRACT

**Background:** Intestinal helminths infection mainly occurs in the tropics and sub-tropics and affects the health status of school children by causing anemia, malnutrition and also restrictions in physical and cognitive development. This study aimed to access the prevalence of intestinal helminths and associated risk factors among primary school children in Gedeo Zone, Southern Ethiopia.

**Methods:** A cross-sectional study was conducted from February to April 2020. Stool samples were collected and processed by using Wet Mount (WM) and Formol-Ether Concentration (FEC) techniques. The Pearson's chi-square and multivariate analysis was performed to verify the association between helminths and associated risk factors.

**Results:** A total of 413 school children were participated. The mean age ± SD of the study participants was 10.7 ± 2.64 years. The overall prevalence of intestinal helminths was 27.3%. Ascaris lumbricoids was the most prevalent intestinal helminths 77(18.6%) followed by *Trichuris trichiura* 9(2.2%) and Hook worm 15(3.6%). Poor hand washing practice before meal (AOR=0.46; 95% CI:0.232-0.915; P=0.027), drinking water from river (AOR=1.01; 95% CI:0.004-2.600; P=0.000), living in rural area (AOR=0.63; 95% CI:0.397-0.915; P=0.052) and poor toilet use habit (AOR=0.45; 95% CI:0.114-0.520; P=0.000) were factors significantly associated with intestinal parasite infections.

**Conclusion:** The prevalence of intestinal helminths was high in the study area, 114(27.3%). Therefore, intervention measures including periodic school-based deworming programmes needed to improve the health of school children.

**Keywords:** Hepatitis B; Surface antigen; Immunochromatogarphic assay; Seroprevalence

## INTRODUCTION

Intestinal helminths infections are major health problem that affect the health status of pre-school and school children [1]. According to the 2020 WHO report, more than 1.5 billion people (24% of the world's population) infected by helminths in worldwide [2]. Over 267 million preschool-age children and 568 million school-age children live in areas where helminths infection are intensively transmitted [3]. The common three intestinal helminths, named Soil Transmitted Helminths (STH), cause the most common parasitic infections worldwide. About 819 million people are infected with *Ascaris lumbricoides* , 465 million with *Trichuris trichiura*, and 439 million with hookworms [4]. *Strongyloides stercoralis*, *Hymenolepis nana* and *Schistosoma mansoni* are also intestinal helminths affects the health status [5].

Intestinal helminths infections are widely distributed in the tropical and subtropical areas of sub-Saharan Africa [6]. The main reasons for their high prevalence associated with increasing population density, poverty, contaminated food and water, poor environmental sanitation, poor health service providers, having an inadequate supply of drugs and lack of adequate and proper awareness of the transmission mechanisms, inadequate toilet facilities, inadequacy and lack of safe water supply [7].

Intestinal helminths infection linked with intestinal bleeding, abdominal pain, intestinal obstruction, malabsorption, nutrient deficiency malnutrition, anemia and school absenteeism [8] resulting in restrictions in physical and cognitive development among school children [9].

Intestinal helminths infections are common in district/woredas of Gedeo Zone, since people living in the area has low socio-economic status, poor personal and environmental sanitation, overcrowding and lack of safe and clean water supply.

Even if, many studies have been conducted on the prevalence of intestinal helminths infection and associated factors among school children in different parts of Ethiopia [1], [4-6]; there are still several localities for which epidemiological information is not yet properly documented including Gedeo Zone especially in dilla zuria woredas, Southern Ethiopia. The outcome of this study will help health officials to plan intervention programs, to minimize

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the burden of the disease by identifying the risk factors, improve the health status of children, environmental sanitation and personal hygiene, and design periodic mass-deworming programs in the study area. Therefore, this study aimed to determine the prevalence of intestinal helminths and associated factors among school children in Gedeo Zone, Southern Ethiopia.

## MATERIALS AND METHODS

### Study design, period and area

A cross-sectional study was conducted from February to April 2020 in selected Dilla town and Dilla zuria woreda primary schools in Gedeo Zone, Southern Ethiopia. Dilla is located at 360 Km to the South of Addis Ababa, the capital of Ethiopia. The Zone had a projected population of 1,139,429 million in 2017. Agriculture, mainly coffee cultivation is the predominant means of livelihood for residents. Gedeo Zone has six districts (woredas) (Figure 1).

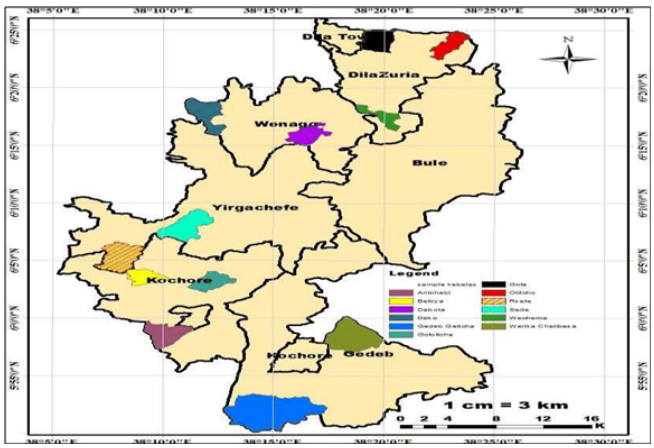


**Figure 1:** Map of Gedeo zone, Southern Ethiopia.

### Inclusion criteria

Participants whose parents/guardians able to give written consent and who gave stool sample were included in the study.

### Exclusion criteria

Participants who were on anti-helminths medication in the past three months prior to the study and unable to give stool sample were excluded from the study.

### Sampling techniques and sample size

There are 31 primary schools in Dilla and Dilla zuria woredas and six of them were selected by simple random sampling techniques, three primary schools from Dilla (Kirinchaf, Dawit, Kofe,) and other three primary schools from Dilla zuria woredas (Sisota, Aroresa and Chichu). To select the study participants, the primary school children were first stratified into six strata according to their educational level (Grade 1 to 6) in the selected school. Then, from each stratum, the students were allocated for each school and grade level/each classroom by using the proportional allocation technique. Finally, the actual numbers of the study population in the study from each class were selected using a systematic sampling technique by using the class rosters as the sample frame. The sample frame of the study was 5004 students, among which 417 of them were taken as sample size. The 417 sample respondents were selected through systematic sampling. In order to select the sample, we employed a formula to determine the range between successive sample people. Accordingly, we have chosen every 12$^{th}$ respondents randomly choosing the first respondent (first number).

Sample size was calculated using the single population proportion formula, n=Z2P (1-P)/d2, by taking a prevalence of 56% [10] from previous similar study conducted in Southern Ethiopia, 95% confidence interval, 5% margin of error and 10% non-response rate. So, the total sample size of the study participants was 417.

### Data collection and processing

The data were collected using structured questionnaires prepared in local languages (Gede'offa and Amharic). Data on socio-demographic characteristics and associated risk factors for intestinal helminths (age, sex, hand wash after toilet, toilet use, took anti-helminths medications, eat raw meat, hand wash before meal, source of drinking water, shoe wearing habit) was collected.

All participating children's were instructed to bring about 2g of stool and were supplied with labelled clean and leak-proof container with applicator stick. The collected sample was emulsified in 10% formalin and transported to Dilla University referral hospital laboratory. Finally the samples were processed by direct Wet Mount (WM) and Formol-Ether Concentration (FEC) techniques [11].

### Data quality control

To keep the quality of data, on-site training was given for data collectors. Pre-test was done on 5% [12] of school children before conducting the research to check the quality of questionnaire, reagents and instruments. Three slides were prepared for each participant and examined by experienced medical parasitologist to avoid observation bias. Discrepancies were resolved by the senior Microscopist of Dilla University referral hospital.

### Data analysis

The data were double entered into Epi Data version 3.1 software and exported to SPSS version 20 software for analysis. Descriptive statistics including frequency, percentage, mean, range and Standard Deviation (SD) was calculated to describe relevant variables. The Chi-square ($X^2$) test, bivariate and multivariate logistic regression was also done to determine the association between the associated factors and intestinal helminths. The crude and adjusted Odds Ratio (OR) and 95% confidence interval was calculated. P-value <0.05 was considered as statistically significant. The data were expressed by text, figure and tables.

### Ethical consideration

Ethical clearance was received from the research and ethical review committee of Dilla University. The objective of the study including procedure followed, benefits, potential risks and discomforts was explained to the participants, parents and the school community then written informed consent was obtained from partners or the legal guardians. Children infected with any of the parasite were referred to the nearby health institution for treatment. All the information obtained from the study participants was coded to keep confidentiality.

## RESULTS

### Socio-demographic characteristics

A total of 413 primary school children were participated in this study. The mean age ± SD of the study participants was 10.7 ± 2.64 years. About 322/413(78%) of the study participants were

between the age group of 10-15 years. Two hundred twenty seven study participants (55%) were males. About 207(50.1%) of them were live in urban areas (Table 1).

**Table 1:** Socio-demographic characteristics of primary school children in Gedeo Zone, Southern Ethiopia.

| Variables | Category | Frequency | Percentage (%) |
|---|---|---|---|
| Age | 05-Sep | 61 | 14.8 |
| | Oct-14 | 322 | 78 |
| | >15 | 30 | 7.3 |
| Sex | Male | 227 | 55 |
| | Female | 186 | 45 |
| Residence | Urban | 207 | 50.1 |
| | Rural | 206 | 49.9 |
| Religion | Christian | 380 | 92 |
| | Muslim | 33 | 8 |

## Prevalence of helminths infection

Out of 413 children, 114(27.3%) were infected by intestinal helminths. *Ascaris lumbricoides* was the most prevalent helminths 77(18.6%) followed by Hook worm 15(3.6%), *Hymenolepis nana* 12(2.9%), *Trichuris trichiura* 9(2.2%) and *Taenia* spp. 1(0.2%). The prevalence of helminths was higher among the age group of 5-9 years 86(20.8%) and 60(26.4%) of them were males (Table 1). Higher prevalence of helminths was observed among primary school students live in rural areas, 60(29.1%)(Table 2).

## Associated factors of intestinal helminths infection

About 368(89.1%) school children washed their hand after defecation. Participants who wear shoe always and who wear sometimes were 305(73.8%) and 108(26.2%), respectively. The source of drinking water from pipe, well and river was 317(76.8%), 89(21.5%) and 7(1.7%) respectively.

By using bivariate and multivariate logistic regression hand washing practice before meal, residence, source of drinking water and use of toilet were significantly associated with intestinal helminths infection. Hand washing practice before meal (AOR=0.46; 95% CI:0.232-0.915; P=0.027), drinking water from river (AOR=1.01; 95% CI:0.004-2.600; P=0.000), living in rural area (AOR=0.63; 95% CI:0.397-0.915; P=0.052) and poor toilet use (AOR=0.45; 95% CI:0.114-0.520; P=0.000) were significantly associated with intestinal parasite infections (Table 3).

**Table 2:** Prevalence of intestinal helminths by sex and residence among primary school children in Gedeo Zone, Southern Ethiopia.

| Intestinal parasite species | Sex (%) | | Residence (%) | |
|---|---|---|---|---|
| | Male | Female | Urban | Rural |
| *Ascaris lumbricoides* | 41(18.1) | 36(19.4) | 29(14) | 41(19.9) |
| *Trichuris trichiura* | 5(2.2) | 4(2.1) | 3(1.4) | 2(0.97) |
| Hookworm | 6(2.6) | 9(4.8) | 1(0.48) | 12(5.8) |
| *Hymenolepis nana* | 7(3.1) | 5(2.7) | 7(3.4) | 4(1.94) |
| *Taenia* spp. | 1(0.4) | 0 | 0(0) | 1(0.48) |
| Total | 60(26.4) | 54(29) | 40(19.3) | 60(29.1) |

**Table 3:** Risk Factors associated with intestinal helminths infection among primary school children in Gedeo Zone, Southern Ethiopia.

| Risk factors | Category | Number | COR(95% CI) | P-value | AOR(95% CI) | P-value |
|---|---|---|---|---|---|---|
| Age | 05-Oct | 61 | 0.75(0.283-1.966) | 0.55 | | |
| | Oct-15 | 322 | 0.998(0.428-2.325) | 0.99 | | |
| | ≥ 15 | 30 | 1 | | | |
| Sex | Male | 227 | 1.14(0.739-1.755) | 0.56 | | |
| | Female | 186 | 1 | | | |
| Eat raw meat | No | 229 | 1 | | | |
| | Yes | 184 | 0.897(0.582-1.384) | 0.624 | | |
| Hand wash before meal | Yes | 365 | 1 | | | |
| | No | 48 | 0.27(0.145-0.498) | 0 | 0.46(0.232-0.915) | 0.027 |
| Source of drinking water | Pipe | 317 | 1 | | | |
| | Well | 89 | 1.79(0.213-15.152) | 0.591 | | |
| | River | 7 | 1.01(0.004-2.600) | 0 | 1.02(0.005-2.700) | 0 |
| Wear shoe | Sometimes | 108 | 1.077(0.662-1.753) | 0.766 | | |
| | Always | 305 | 1 | | | |
| Residence | Urban | 217 | 1 | | | |
| | Rural | 196 | 0.62(0.391-1.023) | 0.05 | 0.63(0.397-1.004) | 0.052 |
| Hand wash after toilet | Yes | 368 | 1 | | | |
| | No | 45 | 0.43(0.228-0.808) | 0.009 | 0.79(0.386-1.615) | 0.517 |
| Trimmed nail | Trimmed | 214 | 1 | | | |
| | Not trimmed | 199 | 0.949(0.617-1.462) | 0.814 | | |
| | Yes | 31 | 1 | | | |
| Toilet use | No | 382 | 0.23(0.11-0.51) | 0 | 0.45(0.114-0.520) | 0 |

## DISCUSSION

We have conducted a cross-sectional study to determine the prevalence of intestinal helminths and its associated risk factors among school primary children in Southern Ethiopia.

The prevalence of intestinal helminths was 114(27.3%).This finding is higher than study conducted in Gonder 16.7% [4], North Western Tigray 12.7% [5], Gurage zone 9.5% [13] and Ghana 17.3% [14] and lower than study conducted in South Ethiopia 55.7% [15], Ethiopia 29.9% [16], Jimma 53.3% [17]. The variation of the result might be due to variations in environmental and socioeconomic conditions, study period and implementation of prevention and control measures. In our study *Ascaris lumbricoides* was the predominant intestinal helminths (18.6%), This is lower than study conducted in Southern Ethiopia 30% [16], Dawuro Zone 23.2% [18] and higher than study conducted in Gondar 9% [4] and Gurage Zone 3% [13] and Ethiopia 3.3% [16]. The variation might be linked with level of environmental sanitation, climatic difference, mass deworming programs, and source of drinking water or insufficient latrine facilities. The most affected age group was, 5-9 with prevalence of 20(32.7%) similar with study conducted in Gurage zone [13] and in South west Ethiopia [19]. This might be related with low level of protective immunity, inadequate knowledge on prevention and control mechanisms, ingestion of parasitic egg, contact with contaminated soil and poor hand washing practice [20,21].

Factors significantly associated with intestinal helminths infection was improper toilet use, those who used toilet had protective effect from helminths than those who did not use toilet (defecate on open field) [22,23]. This finding is in line with other studies conducted in Ethiopia [16], North Western Tigray [5] and North-west Ethiopia [24].Those who didn't wash their hand before meal were more likely to be infected with helminths, as compared with those who wash their hands. This finding is supported by study conducted in Gurage Zone [13], Ethiopia [16]. Those who drank water from river were more likely to be infected with helminths as compared to those who drank water from well and pipe [25]. This is in agreement with other studies conducted in Democratic Republic [26] and Argentina [27].Living in rural areas had increased chance of acquiring helminths infection than those who live in urban areas. The findings were consistent with study conducted in Southern Ethiopia [28] and Kenya [29]. In rural areas, there is scarcity of pipe water, toilet and low personal and environmental hygiene practice.

## CONCLUSION

The prevalence of intestinal helminths was high in the study area, 114(27.3%). Poor hand washing practice before meal, living in rural areas, drinking water from river and poor toilet use were factors significantly associated with intestinal helminths.

Therefore, Interventional measures such as avoid open defecation, construction of latrine, periodic mass deworming programs and health education on various personal and environmental hygienic practices should be done routinely to prevent and control intestinal helminths.

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