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ORIGINAL ARTICLE

PREVALENCE OF INTESTINAL HELMINTHS AND ITS 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 many school age children by causing anemia, malnutrition and restricting physical and cognitive development. This study aimed to assess the prevalence of intestinal helminths and its associated risk factors among primary school children in Gedeo Zone, Southern Ethiopia.*

***Methods**: A cross-sectional study was conducted from February to April 2020. Primary school children aged 5 to 16 years, and given written consent by their parents/guardians were included in the study. Stool samples were collected, processed and examined using Wet Mount (WM) and Formol-Ether Concentration (FEC) techniques. Descriptive statistics including frequency, percentage, mean, range, and standard deviation (SD) was calculated to describe relevant variables. The Chi-square(X2) test, bivariate and multivariate logistic regression were also done to determine the association between the risk factors and intestinal helminths.*

***Result**: A total of 413 school children participated in the study. The mean age ± SD was 10.7±2.64 years. The prevalence of intestinal helminths was 114 (27.6%). Ascaris lumbricoid was the most prevalent intestinal helminth 77(18.6%) followed by Hookworm 15 (3.6%) and Trichuris trichiuria 9 (2.1%). Poor hand washing practice before meal (AOR=3.72; 95% CI: 0.211-3.9; P= 0.002), drinking water from river (AOR=2.9; 95% CI: 0.56-3.51; P=0.000), living in rural area (AOR=1.81; 95% CI: 0.43-2.33; P=0.008) and improper toilet use (AOR=2.16; 95% CI: 0.39-3.36; P= 0.000) were factors associated with intestinal helminths infections.*

***Conclusions:** The prevalence of intestinal helminths infection was high in primary school children in the Gedeo zone. Therefore, intervention works including periodic school-based deworming programs is needed to avoid helminth infection in primary school children.*

***Keywords**: Intestinal helminths, Risk factors, Primary school children, Ethiopia*

INTRODUCTION

Intestinal helminths infections are major health problem that affect the health of pre-school and school age children (1, 2). According to the 2020 WHO report, more than 1.5 billion people (24% of the world's population) are infected by helminths worldwide (3).Over 267 million preschool-age and 568 million school-age children live in areas where helminths infections are highly prevalent (3, 4).Soil transmitted helminths (STH), are the major causes of parasitic infections worldwide. 819 million individuals are infected with *Ascaris lumbricoides*, 465 million with *Trichuris trichiura*, and 439 million with hookworms (5). *Strongyloides stercoralis, Hymenolepis nana* and *Schistosoma mansoni* are also intestinal helminths that affect the health status (6, 7).

Intestinal helminths infections are common in the tropical and subtropical areas of Africa (8-10). The main reasons for their high prevalence is associated with increasing population density, poverty, contaminated food, unhygienic environment, inadequate health service, poor deworming practice and inadequate health education on mechanisms of transmission, inadequate toilet facilities, inadequacy and lack of safe water supply (11, 12).

Intestinal helminths infection is linked to intestinal bleeding, abdominal pain, intestinal obstruction, malabsorption, nutrient deficiency, malnutrition, anemia and school absenteeism(13-15) resulting in restrictions in physical and cognitive development among school children (16, 17).

In Ethiopia, infections with intestinal parasites are top in the morbidity list in different health facilities. *A. lumbricoides*, *T. trichiura, H. nana, histolytica/dispar,* and *S. mansoni* are commonly seen in the country (15).Intestinal helminths infections are common in Gedeo Zone, some of the factors identified were lack of knowledge about home sanitation and hygiene, poor toilet facilities and eating uncooked vegetables (31).

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, 5, 6), adequate data are lacking in Gedeo Zone, South Ethiopia. The outcome of this study helps health officials to plan intervention programs in order to minimize the burden of the disease by identifying the risk factors and to design periodic mass-deworming

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Programs. Therefore, this study aimed to determine the prevalence and associated risk factors of intestinal helminths among school children in Gedeo Zone, South Ethiopia.

Materials and Methods

Study design, period and area

A school-based cross-sectional study was conducted from February to April 2020 in selected Dilla town and Dilla Zuria woreda primary schools in Gedeo Zone, South Ethiopia. Dilla is located 360 Km South of Addis Ababa. The Zone had a projected population of 1,139,429 in 2017 and has eight districts/woredas (Figure 1). Cash crop is the predominant means of income for the residents.

Study Population

All primary school children aged 5 to 16 years available during the period of data collection were the study population.

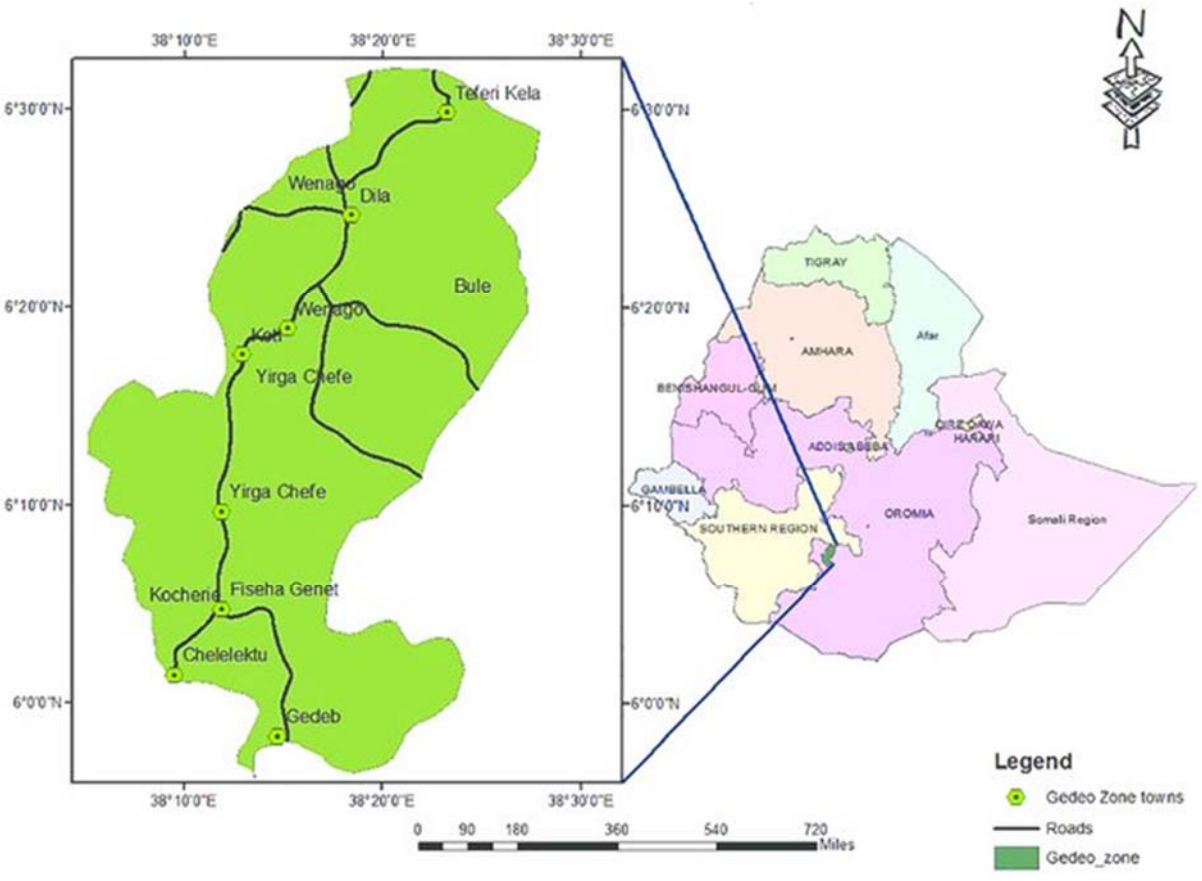
Inclusion Criteria

Participants whose parents/guardians gave written consent, willing to give stool samples, and did not take anti-helminths medication two weeks prior to the commencement of this study were included in the study.

Sampling techniques and sample size

Total of six primary schools were selected , three primary schools from Dilla (Kirinchaf, Dawit, Kofe,) and other three from Dilla zuria woredas (Sisota, Aroresa, and Chichu) by simple random sampling techniques.

Figure 1. Map of Gedeo Zone



To select the study participants, the primary school children were first stratified into six strata according to their educational levels (Grade 1 to 6) in the selected schools. The actual numbers of the study population from each class were selected using a systematic sampling technique by using the class rosters as the sample frame.

The sample size was calculated using the single population proportion formula, $n=Z^2P(1-P)/d2$, by taking a prevalence of 56% (18) (31) from a 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 was collected using a structured questionnaire written in local languages (Gede'offa and Amharic). Data on socio-demographic characteristics and risk factors (Age, Sex, Hand wash after toilet, Toilet Use, Took anti-helminths medications, Eat raw meat, Hand washes before meal, Source of drinking water, Shoe wearing habit) were collected.

All participating children were given a labelled clean and leak-proof container with an applicator stick to collect about 2g stool. The collected sample was emulsified in 10% formalin and transported to Dilla university referral hospital laboratory. Finally, the samples were processed and examined with direct wet mount (WM) and formol-ether concentration (FEC) techniques (19-21).

Data Quality Control

On-site training was given for data collectors. A pre-test was done on 5% (21) of school children before conducting the research to check the quality of questionnaires, reagents, and instruments. Three slides were prepared for each participant and examined by an experienced medical parasitologist to avoid observation bias. Discrepancies were resolved by a senior Microscopist of Dilla university referral hospital.

Data analysis

The data were double entered into Epi Data version 3.1software 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 were 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 less < than 0.05 was considered statistically significant. The data were expressed by text, figures, and tables.

Ethical Consideration

Ethical clearance was obtained 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. Written informed consent was obtained from parents or the legal guardians. Children infected with any of the parasites were referred to a nearby health institution for treatment. All the information obtained from the study participants was coded to keep confidentiality.

RESULTS

Socio-demographic characteristics

The mean age ± SD of the study participants was 10.7±2.64 years. 78% of the study participants were between 10-15 years. 227(55%) participants were males. About 207 (50.1%) of them live in urban areas (Table 1).

Prevalence of intestinal helminths

Among a total of 413 children, 114 (27.6%) were infected with helminths. The most prevalent helminths were *Ascaris lumbricoid* 77 (18.6%) followed by Hookworm 15 (3.6%), *Hymenolopsis nana* 12 (2.9%), *Tricuris tricuria* 9 (2.2%), and Taenia spp 1 (0.2%). Helminths infection was more commonly seen among the age group of 5-9 years, 86 (20.8%). 60(14.6%) of the infected students were males (Table 1). A higher prevalence of helminths infection was observed in students who lived in rural areas, 60 (14.4%) (Table 2).

Associated factors of intestinal helminths infection

About 368 (89.1%) school children washed their hands after toilet use. Participants who wore shoes always and sometimes were 305(73.8%) and 108 (26.2%), respectively. The source of drinking water was 317(76.8%) pipe, 89(21.5%) well and 7(1.7%) river.

Hand washing practice before meal (AOR=3.72; 95% CI: 0.211-3.9; P= 0.002), drinking water from river (AOR=2.9; 95%: CI 0.56-3.51; P=0.000), living in rural area (AOR=1.81; 95% CI: 0.43-2.33; P= 0.008) and poor toilet use habit (AOR=2.16; 95% CI: 0.39-3.36; P= 0.000) were significantly associated with helminths infection (Table 3).

DISCUSSION

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

The prevalence of intestinal helminths was 114 (27.6%). This finding is higher than those of the studies conducted in Gondar 16.7% (4), North Western Tigray 12.7% (5), Gurage zone 9.5% (22), and Ghana 17.3% (23) and lower than those of studies conducted in Alaba Kulito 55.7% (18), Jimma 53.3% (24). The variation of the result might be due to the level of environmental sanitation, source of drinking water, personal hygiene, and prevention and control measures.

Ascaris lumbricoide was the predominant intestinal helminths (18.6%), this is higher than studies conducted in Gondar 9% (4), Gurage Zone 3% (22) and Birbir town 3.3% (14). The variation might be linked with climatic difference, difference in mass deworming programs, source of drinking water or insufficient latrine facilities (23). The most affected age group was 5-9 with a prevalence of 20 (32.7%) similar to those of studies conducted in Gurage zone (22) and Mizan-Aman town (27).

Factors significantly associated with intestinal helminths infection were improper toilet use, those who used toilets had a protective effect from helminths than those who did not use the toilets (defecate on the open field). This finding is in line with those of other studies conducted in Ethiopia (15), North Western Tigray (15) and Jawi town (28).

Those who didn't wash their hand before meals were more likely to be infected with helminths, as compared with those who wash their hands. This finding is supported by a study conducted in Gurage Zone (22), northern Ethiopia (16). Those who drunk water from the river were more likely to be infected with helminths as compared to those who drunk water from wells and pipes. This is in agreement with other studies conducted in the Democratic Republic of Korea (29) and Argentina (30).

Living in rural areas had an increased chance of acquiring helminths infection than those who live in urban areas. The finding was consistent with a study conducted in Gedeo Zone (31) and Kenya (32). In rural areas, there is a scarcity of pipe water, toilet, low personal and environmental hygiene practice.

The prevalence of intestinal helminths was high in the study area. Poor hand washing practice before the meal, living in rural areas, drinking water from rivers and inappropriate toilet use were factors significantly associated with intestinal helminths. Therefore, Interventions such as avoiding 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.

Tables and Figures

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

Variables	Category	Freq.	Percent (%)
Age	5-9	61	14.8
	10-14	322	78
	>15	30	7.3
Sex	M	227	55
	F	186	45
Residence	Urban	207	50.1
	Rural	206	49.9
Religion	Christian	380	92
	Muslim	33	8

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

Intestinal parasite species	Sex n (%)		Residence n (%)	
	Male	Female	Urban	Rural
Ascaris lumbricoides	41(9.9)	36(8.7)	29(7)	41(9.9)
Trichuris trichiura	5(1.2)	4(0.9)	3(0.73)	2(0.48)
Hookworm	6(1.45)	9(2.2)	1(0.24)	12(2.9)
Hymenolepis nana	7(1.7)	5(1.2)	7(1.7)	4(0.9)
Taenia spp	1(0.4)	0	0(0)	1(0.24)
Total	60(14.6)	54(13)	40(9.7)	60(14.4)

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

Risk factors	Category	No.	COR(95% CI)	P-value	AOR(95% CI)	P-value
Age	5-10	61	0.75 (0.283-1.966)	0.55		
10-15	322	0.998(0.428-2.325)	0.99			
≥15	30	1				
Sex	M	227	1.14(0.739-1.755)	0.56		
	F	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	3.27(0.14-3.98)	0.000	3.72 (0.211-3.9)	0.002
Source of drinking water	Pipe	317	1			
	Well	89	1.79(0.213-15.152)	0.591		
	River	7	1.01(0.04-2.6)	0.000	2.9 (0.56-3.51)	0.000
Wear shoe	Some-times	108	1.077(0.662-1.753)	0.766		
	Always	305	1			
Residence	Urban	217	1			
	Rural	196	1.62(0.391-2.023)	0.050	1.81 (0.43-2.328)	0.008
Hand wash after toilet	Yes	368	1			
	No	45	0.43(0.228-0.808)	0.09	0.79(0.386-1.615)	0.517
Trimmed nail	Trimmed	214	1			
	Not trimmed	199	0.949(0.617-1.462)	0.814		
Toilet use	Yes	31	1			
	No	382	2.01(0.11-3.51)	0.000	2.16 (0.39-3.36)	0.000

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Abbreviations

HW: Hook Worm; TT: *Tricuris Tricuria;* STH: Soil -Transmitted Helminthes; WHO: World Health Organization.

Declaration

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. Written informed consent was obtained from partners or the legal guardians. Children infected with any of the parasites were referred to a nearby health institution for treatment.
All the information obtained from the study participants were coded to keep confidentiality.

Availability of data and materials
All relevant data are within the manuscript.

Competing interest
The authors declare that they have no competing interests.

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Authors' contributions
FW and YG conceived the study, participated in data collection, data analysis, drafted and finalized the manuscript for publication. Authors read and approved the final manuscript.

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