WOLKITE UNIVERSITY

COLLEGE OF MEDICINE AND HEALTH SCIENCES

DEPARTMENT OF MEDICAL LABORATORY SCIENCE

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The Prevalence and Associated Factors Of Soil –Transmitted Helminthiasis and Drug Efficacy Of Mebendazole For Treatment Of Soil-Transmitted Helminthiasis among Primary School Children at West Azernet Berbere District, Central Ethiopia, 2025

By

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We hereby certify that we have read and evaluated this Thesis titled “**The Prevalence and Associated factors Of Soil-Transmitted Helminthiasis and Drug Efficacy Of Mebendazole For Treatment Of Soil-Transmitted Helminthiasis among Primary School Children at West Azernet Berbere District, Centeral Ethiopia”** prepared under our guidance by Nahom Zeleke Dolena.We recommend that the thesis shall be submitted as fulfilling the requirements for the award of a MSc. Degree in Medical Parasitology.

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ACRONYMS AND ABBREVIATIONS

AOR= Adjusted Odds Ratio

CI= Confidence Interval

COR= Crude Odds Ratio

CR=Cure Rate

EPG: = Egg per gram

ERR = Egg Reduction Rate

FR = Failure Rate

IPIs = Intestinal Parasitic Infections

KK = Kato Katz

MDA= Mass Drug Administration

NTD=Neglected Tropical Diseases

PC=Preventive Chemotherapy

SAC= School Aged Children

SPSS =Statistical Package for Social Sciences

SSA=Sub Saharan Africa

STH=Soil-transmitted Helminthes

WASH= Water Sanitation and Hygiene

WHO= World Health Organization

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ABSTRACT

BACKGROUND: Different types of parasitic worms are responsible for soil-transmitted helminthes infections. Drug efficacy studies of soil-transmitted intestinal helminthes have not been well addressed in different parts of the tropics and subtropics, including the current study area.

OBJECTIVE: To assess the drug efficacy of soil-transmitted helminthes infection and the factors that is linked to it in elementary school students in the West Azernet Berbere District, Central Ethiopia.

METHOD: Prospective study design involving 354 school children was conducted from February-April 2024 in the base line survey. Sixty-four study participants were involved in the second survey for drug efficacy. A systematic random sampling technique was applied. The Kato-Katz method was used to evaluate stool samples. Senior nurses administered 500 mg of mebendazole as a single dosage to students who had soil-transmitted helminthes infections. Then, after the redosing regimen, or after 28 days of treatment completion, the drug efficacy of mebendazole was performed based on the cure rate and egg reduction rate. .The data was coded and entered into EPI data version 3.1 and exported for further analysis to SPSS version 21 computer software. The cure rate and egg reduction rate were examined using descriptive analysis.

RESULTS: A total of five intestinal helminths species were found, with an overall prevalence of 19.8% (70/354) (95% CI 18.9-20.0) in the baseline survey. The most common parasites found were 36(10.2%), *A.lumbericoides* 21(5.9%) *T. trichiura*, 10(2.8%) *hookworm*, other helminths found were *Taenia spp.* 2(0.6%) and *E.vermicularis* 1(0.2%). After the redosing, the cure rate of mebendazole against *A.lumbericoides* rose from 87.9% in the single dose to 100%; similarly, the cure rate for *T. trichiura* rose from 84.2% in the single dosage to 100%.The mebendazole cure rate for *hookworms* rose from 77.8% with a single dosage to 100% with a redosing.

CONCLUSION: Therefore, the cure rate and egg reduction rate of single-dose and redosing phase of mebendazole is satisfactory to treat *Ascaris lumbericoides*, *Trichuris trichiura* and *Hookworm* infections.

KEY WORDS: Soil-transmitted helminths, Drug efficacy, Mebendazole, Azernet Berbere District, Central Ethiopia.

1. INTRODUCTION

1.1. Background

Soil-transmitted helminths (STHs) are a class of nematode parasites that infect humans by coming into touch containing parasite eggs or larvae that grow well in the warm, humid countries with tropical and subtropical soil(1). *Ascaris lumbericoides* (*A. lumbricoides*), *Trichuris trichiura*(*T. trichiura*) and the most common *hookworms* (*Necator americanus* and *Ancylostoma duodenale)* are biologically significant soil-transmitted helminths species that infect people (2). STHs are spread through contact with polluted water and soil, as well as by eating eggs that are passed in the feces and skin penetration of infective larvae (1,2).

STH pathogenesis starts with direct harm caused by worm activity, which is comparable to internal organ obstruction or the direct pressure effect of developing parasites (3). Particularly in children, adult Ascaris invades orifices, causing appendicitis, cholecystitis, pancreatitis, and gastric ascariasis. This leads to small bowel obstruction and intestinal blockage (4). Clinical symptoms of soil-transmitted helminths infection can be divided into two categories: severe symptoms linked to larval movement via the viscera and skin, and severe and persistent symptoms caused by adult worms parasitizing the gastrointestinal system(1,2).

Ascaris lumbricoides the adult worm reduces school attendance and performance and impairs growth, physical fitness, and cognition. Rectal prolapsed, colitis and trichuris dysentery syndrome are all brought on by *T. trichiura*. Intestinal blood loss, iron-deficiency anemia, and protein malnutrition are all brought on by *hookworm*(3,4).

Microscopy is a straightforward and inexpensive method of detecting STHs, but it lacks a reasonable sensitivity for several reasons, such as, periodic parasite ova excretion, low level of severity of infection below the threshold of discovery, and inappropriate sample storage and transportation that causes parasite decomposition(5). The Kato-Katz (KK) system is currently the "gold standard" system advised by the WHO for finding STH eggs, particularly when egg quantification is necessary (40,47).

T.trichiura and *A. lumbricoides* eggs are identified and kept identifiable for a number of months by the kato–Katz system, However, its performance is weak for the discovery of *hookworm* infection because these eggs usually break apart in 60 minutes or less especially in tropical climates, resulting in false-negative results(18). Treatment of infection caused by soil-transmitted helminths substantially concentrates on eradicating adult worms from the digestive system. The mechanisms of action employed for the elimination of soil-transmitted helminths infection are Albendazole (single 400 mg stat oral cure) and mebendazole (single 500 mg stat oral cure). The mechanism of action of these benzimidazole medications is binding to the β-tubulin of nematodes and inhibiting parasite polymerization of microtubules which results the death of adult worms through a procedure that may require many days. In addition, blocking glucose uptake in susceptible helminths, therefore, depleting energy needed for their survival(8,9).

The principal methodology suggested by WHO for the management and eradication of STH infections is by preventative chemotherapy (PC) for every group at risk ; containing primary school children(6). The three fundamental strategies to control soil-transmitted helminthiasis comprise health education, water sanitation and hygiene (WASH), and mass drug administration (MDA).In Ethiopia, mebendazole (a single 500 mg oral drug) is presently employed in deworming programs focusing on STHs(10).

1.2. Statement of the problem

Parasitic infections are a major public well-being issue around the world, especially in developing nations(1). STHs are among the foremost prevalent parasite diseases worldwide, specifically in sub-Saharan Africa(2,3). STHs infected roughly 1.5 million individuals around the world in the WHO 2021 report, especially in tropical countries(4.,5). Ethiopia ranks second, third, and fourth for ascariasis, hookworm infection, and trichiurasis, respectively, among the top five sub-Saharan countries with the highest frequency of STHs(6). Both the fecal egg reduction rate (ERR) and the cure rate (CR) are commonly used measures to evaluate drug efficacy, decrease in both the incidence and severity of illnesses(10).

Regarding the burden of drug resistance concerning low egg reduction and cure rate, a limited number of studies in the public have reported the reduced efficacy of anthelminthic drugs. Moreover, the few studies of anthelminthic drug resistance carried out so far have been confounded by methodological flaws such as the type of diagnostic methods, variable quality of anthelminthic agents, suboptimal drug regimens, drug dose rates, and geographical location(46). The effectiveness of mebendazole may be diminished by extended dosing and repeated exposure to the same drug type in the same location (19-21).

Fecal pollution of the school grounds, including the playground, classrooms and adjacent water sources could all be risk factors in the current study area. The drug efficacy studies of mebendazole were not well addressed in Ethiopia, including the current study area. Therefore, in line with the aforementioned risk factors and research gaps on drug efficacy, the present study was carried out to evaluate the drug efficacy of mebendazole with an emphasis on STH infection among primary school children in the West Azernet Berbere district, Central Ethiopia.

1.3 .Significance of the study

The result of the current study gives information on the prevalence of STHs, and the efficacy of mebendazole on STHs that may help the healthcare provider, health sectors, policymakers, and other stakeholders to design efficient preventive and control strategies for the community. Furthermore, the findings of this study may be used as a base line data for further research that is going to be undertaken in the area.

2. LITERATURE REVIEW

2.1. Magnitude of Soil-transmitted helminths among primary school children

Intestinal parasitic infections (IPIs) present a significant challenge in poor countries with limited access to sanitary facilities and clean water sources (1). In particular, the soil-transmitted helminths (STHs), which include *Ascaris lumbricoides(A. lumbricoides), Trichuris trichiura (T. trichiura),* and the *hookworms Ancylostoma duodenale (A. duodenale)* and *Necator americanus (N. americanus*), are among the neglected tropical diseases (NTDs) with significant public health significance in sub-Saharan Africa(2,3).

A study conducted in El Salvador among school children showed that *Trichuris trichiura* was the most common (4.1%), followed by *A. lumbricoides* (2.75%), and the least common was *hookworm* (1.83%)(19). On the other hand, high *A. lumbricoides* frequencies in Cameroon (54.9%), followed by in a similar study group, *hookworm* (20.3%) and *T. trichiura* (33.8%) were reported (20).Another study conducted in India also showed that high frequency of STH among SAC, which is 92.6 %(21). Another study conducted on primary school children in the Temeke district showed a high prevalence of *hookworm* (22.4%), followed by *A. lumbricoides* (4.1%) and *T. trichiura* (0.7%). While *S. stercoralis* and *E. vermicularis* had similar prevalence (1.7%)(22).

A study that was carried out in Kenya between primary school-age children indicated that out of 179 children examined, 154 (86%) were positive for the STH studied, with *T. trichiura* accounting for the highest infection at 50.84%, followed by *A. lumbricoides* at 25.14% *10.06%*.(23).An elevated frequency (87.7%) of STH between primary school children aged 5-13 years was reported in Ebenebe Town in Nigeria, of which *A. lumbricoides* (54.1%), *hookworm* (45.5%), *T. trichiura (18%),* and *S. stercoralis (5.9*%)(24). Among schoolchildren ages 5 to 16, a pooled prevalence of 66.2% was found from the south, where the most common species was *T. trichiura* (10.4%), *hookworms* (17.8%), and *A. lumbricoides* (53.4%) ($P < 0.001$), *Taenia sp*. (9.6*%), S. stercoralis* (0.7%), and *E. vermicularis* (0.3%).

According to a study conducted in rural Guinea on 286 randomly chosen children ages 5 to 16, 53% of them had at least one form of STH infection(25). In Ethiopia, several epidemiological studies showed that soil-transmitted helminths infections were prevalent throughout the countries in a number of areas, with prevalence ranging from 90% in Ethiopian schoolchildren to lower levels(5).Near Lake Tana in northwest Ethiopia, a pooled prevalence of 65.6% among Ethiopian Orthodox Church students was recorded; of these, a high prevalence of *A. lumbricoides* (31.8%) was found. the least prevalent was *T. trichiura* (3.7%), which was followed by *hookworm* (29.4%)(26).

According to a study in Jimma, the overall frequency of STH was 41.7%, with a high frequency of *A. lumbricoides (19.8*%) followed by *T. trichiura (15.6*%) among SAC(27). According to a study done to determine the prevalence of helminthic infections, the reported prevalence of *hookworm* was 20.7% in Hawassa(28). In Butajira, however, the overall prevalence of any STH infection was 43.5% in mothers and 4.9% in children (29).

A research carried out in the Mirab Abaya District found that 10.4% of SAC residents had *hookworm* infection overall(30).Another study revealed that the frequency of STH infection between SAC was 63% in Chencha town(31) and 10.6% for *A. lumbricoides* in Arba Minch town (32).The study conducted in Zarima town among school children showed that, of 319 study participants, 263 (82.4%) study participants were infected with one or more STHs. The most common isolate was *hookworms* (19%) and *A. lumbricoides* (22%). *T. trichiura* (2.5%), was the least common(33). While it was 44.2% in Tilili town, northwest Ethiopia, with a high frequency of *A. lumbricoides* (39.7%) followed by *T. trichiura* (7.8%)(34). According to the study, 83.8% of students in a rural area near Lake Langano in southeast Ethiopia had intestinal parasites overall. *Hookworm* was the most common parasite among intestinal helminths (64.7%), followed by. *T. trichiura* (18.8%), *Taenia spp*. (17.6%), and *E. vermicularis* (2.9%)(35).

Among schoolchildren in Babile, eastern Ethiopia, nine intestinal helminths species were found, with 113 out of 415, or a total frequency of 27.2%. *H. nana* was the most common parasite found to be involved(10.1%), followed by *hookworm* (6.7%)(36).A different study conducted in Western Abaya found that the overall prevalence of intestinal helminthic infection in the Umolantie population was 60%.*Hookworm* was the most common helminths (57.7%)(37).

2.2. Risk factors of Soil-transmitted helminths among primary school children

Soil-transmitted helminths infections are dispersed globally with high frequency rates in countries with tropical and subtropical climates due to prevailing major threat factors like shortage of acceptable sanitary facilities, improper methods for disposing of waste, and lack of clean water supply, overcrowded conditions, bare footing, poor socioeconomic status(1). According to a study carried out among school children in Tilili town, shoe-wearing habits, personal hygiene, and environmental hygiene were associated with STH(43). Children with latrines in their homes were less affected than those without (23). Also, those with conventional pit latrines are more susceptible to intestinal helminths infections than those who have better and ventilated toilets. Still, those who experienced water flashes were unharmed.(40). Also, not dewormed children, children from pre-urban areas, and those with no facilities for defecation were more affected than those wormed, children from urban areas, and those using their flush toilets(38).

2.3. Drug efficacy of Mebendazole among primary school children

In Ethiopia, soil-transmitted helminths continue to be one of the most significant public health issues (13–15). The present investigation estimates mebendazole medical efficacy against three STHs in school-age children. Typically, both qualitative and quantitative individual tests for eggs in feces at an ideal time interval after treatment are used to assess mebendazole effectiveness. The fecal egg reduction rate (ERR) and the cure rate (CR) are markers that are generally used to measure drug efficacy, the decrease in frequency and the intensity of infection(10)

An investigation conducted in Northwest Ethiopia found that the CR and ERR of mebendazole as a single-cure treatment for *A. lumbricoides* were 60% and 76.4%, respectively. This result is less than the former study findings in Zanzibar(10). This may be justified because mebendazole effectiveness may be diminished by prolonged dosing and repeated exposure to the same drug type at the same area. According to the study conducted on the drug efficacy of mebendazole among primary school children in Uganda, the cure rate and egg reduction rate against the parasite were 96.9% and 99.9%, respectively. Despite the fact that the present investigation demonstrated that mebendazole was reasonably successful in treating *A. lumbricoides*, the cure rate for *hookworms* was only 23.1%, and the ERR was only 49.6% (15).

3. OBJECTIVE

3.1 General objective

To assess the drug efficacy of mebendazole and associated factors of Soil-transmitted helminths among primary school children in the West Azernet Berbere District, Central Ethiopia,

3.2 Specific objectives

- To determine the magnitude of STH infections among primary school children in the West Azernet Berbere District, Central Ethiopia.
- To identify associated risk factors of STH infections among primary school children in the West Azernet Berbere District, Central Ethiopia
- To determine mebendazole drug effectiveness of STHs among primary school children in the West Azernet Berbere District, Central Ethiopia.

4. METHODS AND MATERIALS

4.1. Study setting and period

The study was carried out between February to April 2024 among primary school children in the West Azernet Berbere District, which is situated 86 km to the west of the zonal capital of Worabe, 250 kilometers from Addis Ababa, and 27 kilometers from Hossana, the regional capital One of the rural Woreda in the Silte Zone of Central Ethiopia is the West Azernet Berbere District. It has 20 kebeles.

According to the 2007 census conducted by the Central Statistics organization report, the entire population in 2023/24 is estimated to be 88,300; among these, 43,444 are males and 44,856 are females. In the Woreda, there are 35 primary schools with 5000 students, of which 2680 are males and 2320 are females. Regarding health institutions, there are 4 governmental health centers (Lera, Bilalo, Mugo, and Jiro), 17 health posts, and 8 private clinics.

Since the district is classified as a temperate zone in its agroecologic setting, soil-transmitted helminths infections are more or less prevailing. As a result, due to poor access to clean water, low income, poor sanitation, and lack of functional toilet facilities, the prevalence of STH persists.

4.2. Study design

Prospective study design was conducted to assess the prevalence, associated factors and drug efficacy of Soil-transmitted helminths among elementary school children in the West Azernet Berbere District, Central Ethiopia.

4.3. Populations

4.3.1. Source Population

All primary school children in the West Azernet Berbere District were the source population.

4.3.2. Study Population

All randomly selected primary school children in the selected primary schools during the study period were the study population.

4.4. Inclusion and Exclusion Criteria

4.4.1. Inclusion criteria

- Primary school Children aged 7-18 in the selected primary schools and available during the study period (for the prevalence study).
- At baseline, all students aged 7-18 years who were screened for the parasite, and those who were infected with STH were included in the study (for the efficacy study).

4.4.2. Exclusion criteria

- At baseline screening, all students who had taken antihelminthic drugs within 6 months before data collection and also those study participants who had vomited within 4 hours after drug administration were excluded from the study(46)

- Children who had severe medical conditions had allergies to the medication and had liquid or diarrheal specimens.

4.5. Sample size determination and procedure

4.5.1. Sample size determination

The size of the sample for the baseline survey was calculated by applying the single population proportion formula with the following assumptions of 95% confidence level, 5% margin of error, and 10% non-response rate with the prevalence rate of 70.1% for STH from the previous study conducted in Northwest Ethiopia(10)

$$n = \frac{(Za/2)^2 P(1-P)}{d^2} \text{…………..} (42)$$

Where,

N = estimated size of sample

D = is error of margin (0.05)

P= the overall prevalence of intestinal helminths infections among school children (70.1 %)

$Z_{\alpha/2}$: at 95% confidence level= 1.96

n= $(1.96)^2 \times 0.701(1-0.701)/ (0.05)^2$

n= $(3.8416) \times 0.701(0.299)/ (0.0025)$

n=322

Hence, the size of sample for the base line survey with a 10% non-response rate will be 354

4.5.2 Sampling Technique/Procedure

To estimate the percentage of students who will involve in the study, first, four schools were chosen by simple random sampling technique from the study area. Second, from each school, classes were chosen with a proportionate distribution to the size of classes. Then, study subjects were chosen by the systematic random sampling technique taking a sample frame from the school registration book. A random selection of the first child was made from the registration book, and each subsequent child was chosen proportionately until the necessary sample was taken from each class. For more detail, sample size proportional allocation in schools is summarized as follows:

P=n/N(41)

Where,

- P== proportion of students in each school
- n=number of students in each school
- Total number of students in the selected schools
- ➢ The total number of eligible students in the four selected schools =3803
    1. Jaremo primary school =696
    2. De Mala Primary School =981
    3. Lera primary school =1538
    4. Kecha primary school =588

Then, after the proportion is obtained, the sample size from each school is calculated by multiplying the proportion with the total sample size. Therefore, based on the aforementioned information, the sample size from each school is proportionally allocated as follows.

Jaremo primary school p=n/N 696/3803= 0.183, therefore, sample size =proportion X total sample, 0.183x354=65

De mala primary school =981/3803 =0.257X354=91

Lera primary school =1538/3803 =0.404X354=143

Kecha primary school =588/3803 =0.154X354=55

4.6 Study Variables

4.6.1. Dependent Variables

- Magnitude of Soil transmitted helminths
- Drug efficacy of mebendazole

4.6.2. Independent variable

- Socio-demographic variables(Age,sex,grade level)
- Behavioral factors(Latrine usage, finger nail trimming and shoe wearing habit)

4.7 Operational definition

Drug efficacy: The ability of an antihelminthic drug (mebendazole) to produce the desired effect (the ability to cure)

Infection intensity: For *A. lumbricoides*: - light infection (1-4999EPG), moderate (5000-49999EPG), and heavy (greater than 50,000EPG).

For*T. trichiura*:- light infection (1-999EPG), moderate (1000-9999 EPG), and heavy (greater than 10,000EPG).

For *Hookworm*:- light infection (1-1999EPG), moderate (2000-3999 EPG), and heavy (greater than 4,000EPG) (50). The severity of the infection determined by taking the geometric mean for affected children(40)

The cure rate (CR): is calculated as the ratio of study participants who were negative after treatment on day 28 divided by the number of positive subjects at baseline.

Egg reduction rate (ERR): is calculated as 1-(arithmetic mean of egg count at follow up divided by arithmetic mean of egg count at baseline) X100% (10).

Interpretation of Antihelminthic drug effectiveness:-**Satisfactory** if the ERR is greater than or equal to the reference value.

Reference efficacy (egg reduction rate %): *A. lumbricoides* ≥95%, *Hookworm* ≥70% and *T. trichiura* ≥50 %(46)

Treatment failure rate = Study participants with recurrent parasitic infection divided by number of stool samples for which stool examination was done × 100%.

School children: are those children who are aged 7-18 and attend primary school.

4.8 . Data collection methods and procedures

4.8.1. Questionnaire

After reviewing different relevant literature, data collection tools were developed to address the study objectives. The questionnaire was first translated from English to the Amharic language (which was the common language of the study area). After that, the final or the agreed Amharic version of the questionnaire was retranslated back to English by professional language experts to check for any inconsistency or distortion in the meaning of words in the content of the questionnaire.

4.8.2. Stool sample collection

The parents/guardians of students and school communities were well informed and instructed about the aim of the study and on how students going to give stool samples throughout the study period. Finally, the students were ordered to bring approximately 4gms of stool sample by providing them labeled,clean,dry plastic sheet, applicator stick, and soft paper.

4.8.3 Laboratory procedure

4.8.3.1 Kato-Katz technique

Kato-set (Template with hole, screen, nylon or plastic, plastic spatula), Newspaper or glazed tile, Microscope slides, Cellophane as cover slip soaked in Glycerol-malachite green solution, Fresh stool, and Gloves.

In the Kato-Katz technique, a single Kato-Katz slide per feces will be prepared using a part of the feces sample. Large particles are removed by pressing four grams of feces through a mesh filter. Next, some of the sieved material is put into a template's hole on a slide. Once the hole is filled, the template is taken out, and a piece of cellophane soaked in glycerol (glycerin) is placed over the residual sample (about 41.7 mg, depending on the size of the template). The fecal matter surrounding the eggs is "cleared" by the glycerol. Then, the preparation is examined with a 10x objective and confirmed with a 40x objective by well-trained expertise. Thus, to get eggs per gram of feces (EPG), the quantity of eggs was multiplied by 24 since a 41.7 mg template was used(47).The severity of the sickness was evaluated using the amount of eggs per gram of feces, or EPG. WHO cut-off values for the infection intensity classification were based on egg counts.

4.8.4 Drug Administration

Before the medication was given, each child received a small breakfast (such asa biscuit or a piece of bread), and all eligible study participants were treated with the same batch and brand of a single dose of 500 mg stat of mebendazole, which was properly stored and within its expiration date. The children were kept under close observation while the nurses administered the tablets. Senior nurses monitored treated subjects to record any negative drug effects at school. Two weeks following treatment, a second analysis of the stool sample was carried out for those study participants who had STH infection. Redosing of mebendazole (single 500 mg oral dose) was given for those students who were positive in the reexamination of stool. The effectiveness of mebendazole was determined by cure rate and failure rate. (CR) = The ratio of study participants who were negative after treatment on day 28 divided by the number of study subjects infected at baseline. (Treatment FR) =Study participants with recurrent parasitic infection divided by the number of stool samples for which stool examination was done X 100%.

4.9. Quality control

To make sure the quality of the questionnaire data, training for two days were given to supervisors and data collectors. To evaluate the questions' appropriateness, their clarity, and the interviewer's and respondent's response, a pretest was done on 5% of the total size of sample at the almost identical sociodemographic population of Wilo Primary School. By skilled data collectors any unclear questions and repeated concepts were solved. To assure the quality of the data, supervisors and the principal investigator closely monitored and supervised the data collecting period. The gathered information was carefully reviewed every day to ensure it was clear, consistent, and comprehensive. Ten percent of slides of each from positive and negative slides were examined by blinded rechecking (re-reading) for confirmation of the result by expert laboratory technologists. The result of the stool examination was recorded in a well-prepared format.

4.10 Data analysis

After being coded, cleaned, and imported into EPI data version 3.1, the data was exported to SPSS version 21 for additional analysis. All of the variables in the surveys have their frequencies determined. To examine the relationship between the dependent and outcome variables, bivariable logistic regression was used. In the multivariate logistic regression model, variables having p-values less than 0.25 from the bivariate analysis were included. A level of statistical significance was established at p-value < 0.05 to determine the strength of association.

4.11 Ethical considerations

Ethical clearance of the research was obtained from the institutional ethical review board of Wolkite University and offered to the West Azernet Berbere District Education and Health office. A formal cooperative letter was taken from the West Azernet Berbere district Education and Health office for further process to continue the study on chosen primary schools. Parents and guardians of the students gave their informed consent. Those who signed written consent after being fully informed only engaged in the research process, and codes were given to participants to ensure confidentiality of their responses.

4.12 Dissemination of result

The results of the research will be submitted to the Wolkite University College of Medicine and Health Sciences Department of Medical Laboratory Science. A copy will be given to West Azernet Berbere District Education and Health offices specifically. An attempt will be made to present the outcome in conferences, workshops, seminars, and meetings that are held either locally or internationally. Publication of the research findings will also be considered.

5. RESULT

5.1. Socio-demographic characteristics

A total of 354 elementary school students participated in the study. Of the total, the number of male and female subjects accounted for 56.8% and 43.2%, respectively. The age composition of the study participants ranged from 7 to 18 years. The mean (±sd) age of the students was 13.86 (±1.377). Most, 174 (49.2%), of the study subjects were in the 13-15 years age group (Table 1).

Table 1: Socio-demographic characteristics of study participants for STH infections among primary school children in west Azernet Berbere district, Central Ethiopia, 2025

SN	Variable	Categories	Frequency(n=354)	Percentage (%)
1	Sex	Male	201	56.8
		Female	153	43.2
2	Age	10-12	71	20.1
		13-15	174	49.2
		16-18	109	30.8
3	Religion	Muslim	260	73.4
		Orthodox	54	15.3
		Protestant	40	11.3
4	Ethnicity	Site	262	74.0
		Hadiya	51	14.4
		Gurage	41	11.6
5	Grade Level	Grade 6	73	20.6
		Grade 7	142	40.1
		Grade 8	139	39.3

5.2 Magnitude of STH among primary school children

Overall prevalence of STH was (70/354)19.8% (95% CI: 18.9-20.0)(Figure.1).There were five different parasite species identified, including *A. lumbricoides*, *T. trichuria*, *hookworm* species, *Taenia* spp., and *E. vermicularis,* from which *A. lumbricoides* and *T. trichiura* account for 10.2% and 5.9%, respectively, which is the highest, followed by *hookworm* spp(2.8%) *and Taenia species* and *E. vermicularis* were the least common helminths (0.9%).

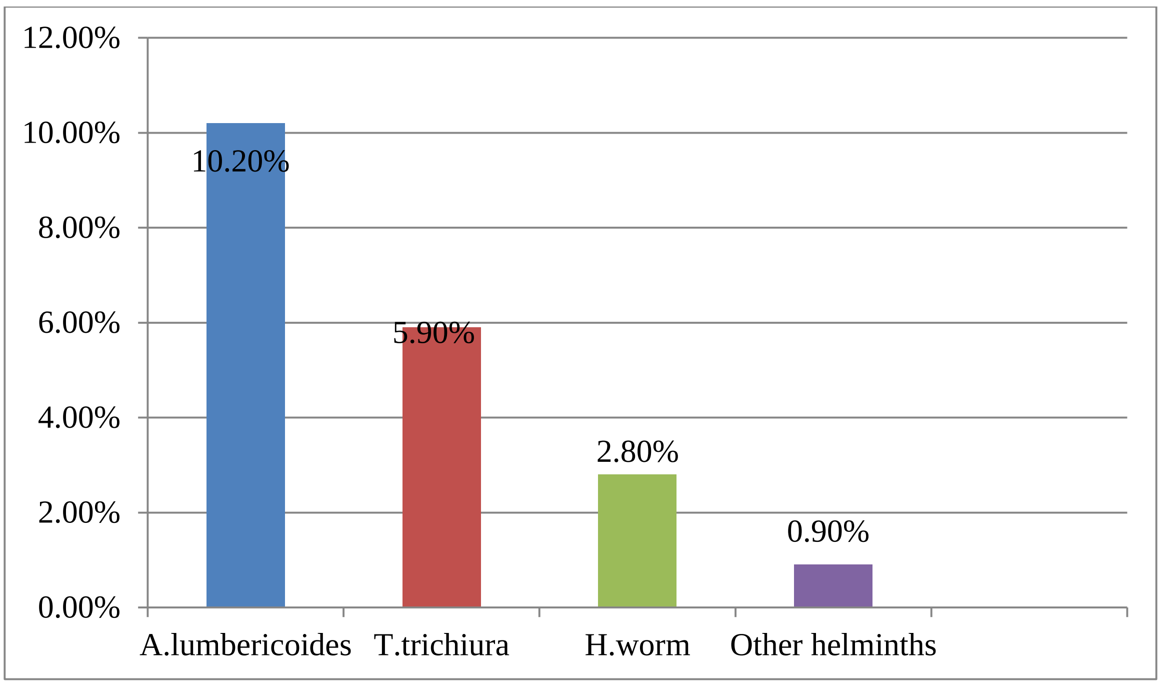

Figure 1: Magnitude of STHinfections among study participants of primary school children in west Azernetberberedistrict, Central Ethiopia, 2025

5.3 Factors associated with STH

Risk factors of STH infection

Binary logistic regression analysis was used to find possible risk factors for STH infection. A cut-off point of P-value < 0.25 was used to find potential factors for multiple logistic regressions to identify associated risk factors for the infection. The result of the multivariate analysis of the current study pointed out that variables such as the habit of latrine usage, hand washing before eating meals, fingernail trimming, and wearing shoes was found to be one of the possible risk factors for STH infection.

The likelihood of STH infection among study participants who have no habit of latrine usage was statistically significant and about 1.85 times higher (AOR = 1.85, 95% CI 1.10-3.23, and $P < 0.001$) when compared to those who have a habit of using latrines. The odds of STH infection among school children who have no habit of hand washing before eating meals were statistically significant and about 1.72 times higher (AOR=1.72, 95% CI 1.12-2.67, and $P<0.001$) than those who regularly wash their hands before eating meals. Also, students who do not trim their fingernails have a higher risk of contracting STH infection by about 2 times (AOR=2.12, 95% CI 1.27-3.54, and $P<0.001$) than those students who regularly trim their fingernails. Likewise, study participants who did not wear protective shoes had an increased risk of STH infection of about 1.51 times (AOR=1.51, 95% CI 1.24-2.6, and $P<0.001$) than those who wore protective shoes(Table.2).

Table 2: Associated local risk factors of STH infection among primary school children in west Azernet Berbere district, Central Ethiopia,2025

Risk factors	Response	Infected	Non Infected	Total	Bivariate Result (COR 95% CI)	P-value	Multivariate Result (AOR 95% CI)	P-value
Latrine usage habit	Yes	20	179	199	1	0.041**	1	0.00*
	No	50	105	155	1.29(0.71-2.32)		**1.85(**1.10,3.23)	
Hand washing before meal	Yes	12	174	186	1	0.080**	1	0.02*
	No	58	110	168	1.2(0.78-1.52)		**1.72(**1.12-2.67)	
Finger nail trimming	Yes	15	185	200	1	0.009**	1	0.00*
	No	55	99	154	0.62(0.32-1.19)		**2.12(**1.27-3.54)	
Shoe wearing habit	Yes	24	167	191	1	0.012**	1	0.04*
	No	46	117	163	1.02(0.75-1.41)		**1.51**(1.24-2.6)	

COR crude odd ratio, CI =confidence interval, AOR = adjusted odd ratio, CI= confidence interval and*= indicates significant variables (p-value<0.05)

5.4 The Mean Egg Count and Infection Intensity of STHs

The average count of eggs for study participants containing identifiable *A. lumbricoides* eggs , *T. trichuria*, *Hook worm,* and other helminthes at the baseline fecal examination was 98, 52, 72, and after single-dose administration of mebendazole was 5, 26, and 19, respectively. All infections were light according to the WHO cut-off value for infection intensity in both baseline fecal examination, after single-dose administration and redosing of mebendazole(Table.3).

Table 3: Arithmetic mean of fecal egg count at baseline, after single-dose and redosing treatment of mebendazole among infected children in west Azernet district central Ethiopia, 2025

SN	Helminthes species	At baseline	Mean egg count per gram of stool	
			After a single dose of MEB(N)	After redosing of MEB(N)
1	*A.lumbericoides*	98EPG	5EPG	0
2	*T.trichiura*	52EPG	24EPG	0
3	*H.worm*	72EPG	19EPG	0

N= number, MEB=mebendazole,EPG=Egg per gram

5.5. Therapeutic efficacy of mebendazole among primary school children

The effectiveness of the treatment of soil-transmitted helminthes (STH) was evaluated in terms of cure rate and egg reduction rate after administration of the anthelminthic drug. A total of 36 school children were positive for *A. lumbricoides*, and33 of them had completed the study following treatment with mebendazole. Of 21 *T. trichiura*-infected school children, 19 finished the follow-up study after starting mebendazole medication. Among 10 *hookworm*-infected school children, 9 took mebendazole treatment and completed the study. On day 14, it was unable to obtain the second stool sample from three *A. lumbricoides,* two *T. trichiura,* and one *hookworm*-infected schoolchildren because they were absent from school. Mebendazole single-dose cure rate for *A. lumbricoides*, *T. trichiura*, *hookworm,* and other helminths (*E. vermicularis*) was 87.9%, 84.2%, 77.8%, and 100%, respectively. However, the mebendazole cure rate for the corresponding *A. lumbricoides. trichiura*, *hookworm,* and other helminths-infected school children rose to 100% after the redosing treatment. As shown in Table 4.

(CR) = <u>The number of study subjects who were negative after treatment</u>X100%

The number of study subjects who were infected in the baseline

Survey and who completed the study.

(CR) (*A.lumbricoides* after single dose of Mebendazole) =29/33X 100=**87.9%**

(*T.trichiura* after single dose of Mebendazole) = 16/19X100= **84.2%**

(*Hookworm* after a single dose of Mebendazole) = 7/9X100= **77.8%**

(*E.vermicularis* after a single dose of mebendazole) =1/1X100 = **100%**

Table 4: Cure rate of mebendazole among STH-infected children of West Azernet Berbere district, Central Ethiopia.2025

SN	Helminthes species	NIC(N)	NCCS(N)	The cure rate of mebendazole	
				Initial dose (N,%)	Redosing (N,%)
1	*A.lumboricoids*	36	33	29(87.9%)	4(100)
2	*T.trichuria*	21	19	16(84.2%)	3(100)
3	*H.worm*	10	9	7(77.8%)	2(100)
4	Other helminth(*E.vermicularis)*	1	1	1(100%)	

N = number, NIC=number of infected children, NCCS=number of children who completed the study.

The Egg reduction rate of single-dose mebendazole against *A.lumbericoides*, *T.trichiura*, *Hookworm,* and other helminths(*E.vermicularis*)was 94.6%, 52%, 74%, and 100% respectively. The ERR of mebendazole after the redosing regimen was 100% to the respective *A. lumbricoides*, *T.trichiura*, *Hookworm,* and *E.vermicularis* infected school children.

(ERR%)= (1- Arithmetic mean egg count at follow-up)X100%

(Arithmetic mean egg count at base line)

ERR(*A.lumbericoides* in single dose Mebendazole) 100X 1- 5/98 **= 95%**

(*T.trichiura* in single dose Mebendazole) 100X 1- 24/52 = **54%**

(*H.worm spp*. in a single dose of Mebendazole) 100X 1- 19/72 = **74%**

(Other helminths (*E.vermicularis*) 100X1-0/5 =**100%**

Table 5: Egg reduction rate of mebendazole among STH-infected primary school children of West Azernet berbere district, Central Ethiopia.2025

Helminths species	At base line	ERR of single dose MEB	
		Initial dose	Redosing
A.lumbericoides	98	5(95%)	0(100%)
T.trichiura	52	24(54%)	0(100%)
H.worm	72	19(74%)	0(100%)
Other helminths(*E.vermicularis*)	5	0(100%)	0(100%)

ERR=Egg reduction rate, MEB= mebendazole

6. DISCUSSION

Soil-transmitted helminthes infections continue to be among the leading health challenges in Ethiopia(44). Therefore, periodic monitoring and assessment of anthelminthic drug effectiveness are crucial to tackling the challenge of helminthic infections. In the current study, the overall frequency of STHs was 19.8% (95% CI: 18.9%-20.0%). This finding is higher than studies carried out in Gondar town (16.7%) [35], Nigeria (12.6%), and Brazil (14.4%)(18). However, this result was quite lower than the report from the previous studies in Jimma (41.7%)(27), Zarima town (82.4%)(33), Butajira (43.5%)(29), Lake Langano (83.8%)(35), Babile, eastern Ethiopia (27.2%)(36), Western Abaya Omolante village (60%)(37), Tigray region (28.6%)(45), Rural Guinea (53%)(25), and in Kenya (86%)(23).

This difference in prevalence might be due to the difference in pure water sanitation and hygiene (WASH). In the current study, the prevalence of *A. lumbricoides* was 10.2% (95% CI: 7.1%-13.3%). Which is higher than reported in rural Bahir Dar (1.7 %)(10), in Salvador (2.75%)(19). and Nigeria (4.1%)(24). However, the current finding is lower than the study done in Zarima town (22%)(33), in Cameroon (54.9%)(20), in Dembia plains (41.3%) and in Adarkay district (43.0%)(8), in Kenya (25.14%)(23),in Nigeria (54.1%)(24), and in Jimma (19.8%)(27). This might be explained by differences in toilet usage and sanitation, as well as the parasite's endemicity (1).

In the present study, the prevalence of *T .trichiura* was 5.9 %(95% CI: 3.7%-8.5%). This finding is higher than the previous studies conducted in Nigeria (0.7%)(24), Cameroon(0.74%)(20), and Zarima town(2.5%)(33). In contrast, the present finding is lower than studies done in Cameroon(33.8%)(20), Kenya(50.84%)(23), Nigeria(18%)(24), Jimma town(15.6%)(27), and lake Langano, Ethiopia(18.8%)(35). Variations in prevalence may be caused by lack of latrine maintenance, low improved latrine coverage, and lack of health education about sanitation (9).

In the current study, the frequency of *Hookworm* was 2.8%(95% CI:1.4%-4.2%) which is in line with the previous studies done in EL Salvador(1.83%)(19), whereas the current result is lower than studies conducted in rural Bahir Dar (41.3%) and Durbetie town(46.9%)(10), in Cameroon(20.3%)(20), in Nigeria(22.4%)(24), in Kenya(10.06%)(23), inTanzania (25%), in Southern Lao PDR (17.6%), in Vietnam (38%)(44) and Lake Tana northwest Ethiopia(29.4%)(26), in Hawassa(20.7%)(28), in Mirab Abaya(10.4%)(30), in Zarima town(19%)(33), Lake Langano, Ethiopia(64.7%)(35), in Babile, eastern Ethiopia(6.7%)(36), in Western Abaya Omolante village (57.7%)(37). As factors of hookworm transmission, this variation in occurrence may be due to the type of soil, the amount of moisture present, and the shoe-wearing habits of children (30). The overall frequency of other helminths infections such as *Taeniaspp*. and *Entrobious .vermicularis* were low (0.9%)(95% CI:0.0%-2.0%).

The result of the multi-variate analysis of the current study pointed out that variables such as the habit of latrine usage, hand washing before eating meals, fingernail trimming, and wearing shoes was found to be a possible risk factor for STH infection. The factors contribute to STHs infections in school aged children vary according to socio economic, environmental and behavioral context. The current study identified some associated risk factors of STHs infection such as the habit of latrine usage, hand washing before eating food, finger nail trimming and shoe wearing.

School aged children who have no habit of latrine usage were more likely to be infected with STHs than other individuals. Moreover, school children with larger family size was associated with a higher likelihood of STHs infection compared to smaller families, aligning with findings from Chencha district, southern Ethiopia (31). This can be explained by factors such as inappropriate use of latrine, shortage of clean water supply, inadequate sanitation and hygiene practices (16). The odds of STH infection among school children who have no habit of hand washing before eating meals were higher supporting finding from Tach Armachiho district(45) and Motta town(46) in northern region. This could be due to lack of adequate sanitary facilities, inappropriate waste disposal system and lack of safe water supply (19).

Also, students who do not trim their fingernails have a higher risk of contracting STH infection, supported by findings from Ambo town western Ethiopia(16) and India where school children trimmed their nails once a week(9),which suggest that untrimmed finger nails can harbor STHs.The might be due to personal hygiene. Likewise, study participants who did not wear protective shoes had an increased risk of STH infection, aligning with findings fromTach Armachiho district(45) and Motta town(46) in northern region. This could be due to the agricultural-based economy of the community and continuous barefoot soil contact which increase the chance of being infected with larvae of hookworm (24).

Among primary school students in the current study, the cure and egg reduction rates of mebendazole against the three soil-transmitted helminths have been assessed. The CR of mebendazole administered once against *A. lumbricoides* in the present study was 87.9% (95% CI: 80.9-95.9%). The current result is higher than the previous study reports in northwest Ethiopia (60%) and Zanzibar(10), Vietnam (38%), Tanzania (25%), and Southern Lao PDR (17.6%)(44). In the present study, the ERR of single –dose mebendazole against *A. lumbricoides* was 94.6% (95% CI: 90.5-100%). This result is higher than the previous study report in North West Ethiopia (76.4%)(10). Whereas the efficacy of mebendazole against *A .lumbricoides* in this study is lower than Bafoussam, Cameroon (100%)(43)., Western Indonesia (100%)(16), and Tanzania (95%)(17).This may be justified because mebendazole effectiveness may be diminished by prolonged dosing and repeated exposure to the same drug type at the same area(10).

In the current study, the efficacy of single-dose mebendazole against *T .trichiura* was. 84.2% (95%C.I 80.9-95.9%) which is higher than the previous report in Bafoussam, Cameroon (14.29%)(43), in Tanzania(28.6%) and in Southern Lao PDR (17.6%)(44). The presence or absence of the b-tubulin codon 200 polymorphism, which has been connected to benzimidazole resistance or tolerance, could be one explanation for the difference in cure rate(43). In the current study, the efficacy of single-dose mebendazole against *hookworm* was 77.8%(95% CI:75.4-89.1%) which is higher than the earlier studies done in north west Ethiopia(10), in Pemba Island Zanzibar(22.4%)(43), in Tanzania (25%), Southern Lao PDR (17.6%) and Vietnam (38%)(44). This variation might be justified as *hookworm* losing its sensitivity to mebendazole because of the existence of resistance-coding alleles in *hookworms* due to the mutations (10).

7. CONCLUSION

According to this study, it is clear that there was a moderate frequency of soil-transmitted helminthes infection in the study area, as a result of poor implementation of the three major prevention and control measures such as regular de-worming campaigns undertaken regularly by the national program (MDA), health education, and water sanitation and hygiene (WASH) for intestinal helminthiasis. In this study, a 500-mg mebendazole in its single dose and redosing regimen had a satisfactory result on the three types of STHs infection. Therefore, single-dose and redosing regimen of mebendazole can be used to treat *hookworm*, *T. trichuria*, and *A.lumbericoides* infections.

8. RECOMMENDATION

According to the current study, the frequency of soil-transmitted helminthes was nearly moderate. The study also signified drug efficacy of mebendazole was satisfactory as evaluated by cure rate and egg reduction rate. Therefore;

West Azernetberebere district Health office in collaboration with the district education office should strengthen the three major prevention and control strategies such as water sanitation and hygiene (WASH), mass drug administration (MDA), and health education undertaken by the national program to halt intestinal helminthiasis infections and more over, undertake regular health education program especially with health extension workers through hygiene and sanitation club in the schools in order to raise the awareness regarding intestinal helminthiasis infection, antihelminthic drug effectiveness and drug resistance issues.

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