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Intestinal Parasitosis, Malnutrition and Associated Factors among Zenzelima Elementary School children, No

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Intestinal Parasitosis, Malnutrition and Associated Factors among Zenzelima Elementary School children, Northwest Ethiopia

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ABBREVIATION

BMI	Body Mass Index
EDHS	Ethiopia Demographic and Health Survey
FEC	Formol Ether Concentration Technique
HAZ	Height for age Z –score
IP	Intestinal Parasite
SD	Standard Deviation
STHs	Soil Transmitted Helminths
SPSS	Statistical Package for Social Sciences
WAZ	Weight for age Z-score
WHZ	Weight for height Z-score
WHO	World Health Organization

ABSTRACT

Background: Intestinal parasitic infections are widely distributed all over the world and comprise great health concerns in resource poor countries. Up to 600 million school children are living in area where high transmission of intestinal parasitic infections are common. Moreover malnutrition is responsible for the death of 7.6 million children in the globe every year. Even though conclusive results have been not yet obtained, several studies showed various factors for intestinal parasitosis and malnutrition.

Objective: This study aims to assess the magnitude of intestinal parasitic infections, malnutrition and associated factors among students at Zenzelima primary school.

Methods: A school based cross-sectional study was conducted from January to May 2018. A total of 405 school children were selected by using systematic random sampling**.** Fresh stool samples were processed by direct wet mount microscopy and formol-ether concentration technique. Z-scores of children's anthropometric statuses were generated using the WHO-AnthroPlus software. A structured questionnaire was used to collect socio-demographic variables and associated factors for intestinal parasitic infection and malnutrition. EpiData statistical software version 3.1 and SPSS statistical software version 23 were used for cleanup and analysis. Descriptive statistics, chi-square test and logistic regression analysis was done. P-value less than 0.05 at 95% CI was used to declare statistical significance

Results: The overall prevalence of intestinal parasitic infection in this study was 201(49.6%). The highest prevalence was due to hookworm infection 108(26.7%). In multivariate analysis, school children who never wore protective shoes were at higher odds of intestinal parasitic infections (AOR = 2.314, 95% CI: 1.285-4.167, P = 0.005). In anthropometric measurements, the current study identified 59(14.6%) underweight, 105(25.9%) stunting and 199(49.1%) thinness. The prevalence of intestinal parasitic infections, among underweight, stunted and thin school children was 59(67.8%), 57(54.3 %) and 108(54.3 %), respectively.

In multiple logistic regression analysis children with illiterate mother were significantly thinner (AOR = 1.806, 95% CI = 1.146-2.845).

Conclusions: Intestinal parasitosis and malnutrition were high in the study area. Lack of protective shoe wearing was significantly associated with intestinal parasitic infections and mothers' educational status was a predictor of thinness of the school children. The community leaders should advocate the habit of protective shoes for children and improving educational status for school children parents.

Key words: Intestinal parasitosis, Malnutrition, School children, Zenzelima, Northwest Ethiopia

1. INTRODUCTION

1.1. Background

Intestinal parasites are parasites that reside at the intestine of human and cause different consequences. Of these, they cause abdominal discomfort, dysentery, mechanical irritation of intestinal mucosa, mal-absorption syndromes and obstruction; they also compute nutrition at the absorption site and resulted in underweight, stunting, and thinness (Crompton *et al*., 2002). Intestinal parasitic infections are widely distributed all over the world and comprise great health concerns in poor regions in Latin America, Africa and Asia (Zarebavani *et al*., 2012,Wegayehu, 2013, Lazarte *et al*., 2015). About 12% of the global disease burdens caused by intestinal parasites are observed among children with age ranges from 5 to 14 years in developing countries (Awasthi *et al*., 2003). It is estimated that over 600 $x10^6$ school children are living in areas of high transmission of intestinal parasitic infections and are in need of treatment and preventive interventions (WHO, 2016). In developing countries, poor environmental and personal hygiene, overcrowding and climatic conditions that favor the development and survival of the parasites are some of the factors contributing to the high level of intestinal parasites transmission (Kenneth, 2012).

In Ethiopia, the exact prevalence of intestinal parasites has been not yet described. However, $79x10^6$ people are estimated to be living in STHs (soil-transmitted helminths infection) endemic areas, of these, 9.1 $x10^6$ pre-school-aged children, 25.3 $x10^6$ school children and 44.6 $x10^6$ adults (FDRE-MOH, 2016).

According to fragmented tests, school children are commonly infected with *A. lumbricoides, T. trichiura,* hookworm *spp., S. stercolaris* and *E. vermocularis* (Mahmud *et al*., 2013). *G. lamblia* and *E. histolytica/dispar* are common causes of intestinal protozoan infections throughout the nation (Mengistu, 2007, Abdullah *et al*., 2016, Melesse *et al*., 2017).

The presence of intestinal parasitic infections may have multiple effects among children including impaired physical and mental developments (Hotez *et al.*, 2009). The presence of chronic and heavy intestinal parasitic infections cause: intestinal bleeding, malabsorption of nutrients, nutritional deficiency and destruction of cells and tissues. The overall effect of these consequences results in growth retardation, reduced mental development, school

absenteeism, low academic performance, susceptible to malnutrition and infection (Brooker, 2010).

Nutritional status is a key indicator of every aspect of human health such as normal pattern of growth and development, physical activity and body response to illness (WHO, 1994). Under nutrition is responsible for the death of one-third of children ($7.6x10^6$ children) in the globe every year (WHO, 2010).

Ethiopia is one of the least developed countries in the world and is the second most severely affected by malnutrition, where children are the most affected (World Bank, 2006). Due to the low socio-economic and sanitation conditions, malnutrition is common problem of citizens particularly children of the country (Headey, 2014). According to the Ethiopian National Demographic Health Survey (2011), the magnitude of childhood under nutrition was 40% with regional differences ranging from 52% in Amhara to 22% in Addis Ababa (EDHS, 2011). It is sustained as the major public health problem of the country. For instance, 28% of all child mortality, 16% of all repetitions in primary school, and 8% of the workforce lost are associated with under nutrition (WFP, 2013).

Poverty, illiteracy, poor diet practice, genetic abnormalities, digestive difficulties, absorption problems and intestinal parasitic infections are major risk factors associated with under nutrition in children (Bhutta *et al.*, 2008,Westergren *et al.*, 2009). There are several mechanisms by which intestinal parasitic infections are thought to contribute children under nutrition resulting through reduction in digestion and absorption, chronic inflammation and loss of nutrients (Nokes *et al*., 1992; Crompton and Nesheim, 2002). In turn, under nutrition can make a person more susceptible to intestinal parasitic diseases, through down regulating immune defense mechanisms of the child which causes a vicious cycle (figure 1) (Chandra, 1996).

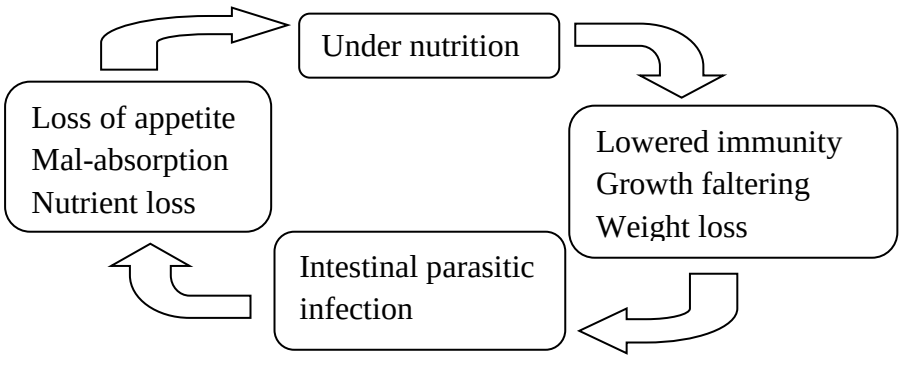

Figure 1. Malnutrition and infection vicious cycle (Chandra, 1996)

1.2. Statement of the problem

In Ethiopia, intestinal parasitic infections are of serious public health concern as they cause malnutrition, growth retardation and predispose to other infections (WHO, 2010). There are few documented reports implicating intestinal parasitic infection with poor nutritional status in school children (Begna *et al*., 2016, Melesse *et al*., 2017). Factors like climatic conditions, poor sanitation, unsafe drinking water and lack of toilet facilities are the main contributors to the high prevalence of intestinal parasites in the tropical and sub-tropical countries. Furthermore, lack of awareness about mode of transmission of intestinal parasitic infections increases the risk of infection and malnutrition (Berhanu, 2016, Tagel and Alemayehu, 2017).

There is paucity of data in Ethiopia in general and the study area in particular regarding the magnitude of intestinal parasitic infections and malnutrition. Even though factors associated with intestinal parasitic infections and malnutrition have been entertained in different studies; conclusive results to take exacting interventions are not yet attained. In addition, only few studies have been conducted describing the possible contribution of infection by different species of intestinal parasites in malnutrition in Ethiopia in general and the west Amhara in particular. Therefore, this study aims to determine the magnitude of intestinal parasitosis, malnutrition and associated factors among Zenzelima Elementary School children, Northwest Ethiopia

1.3. Significance of the study

Without having information about the current patterns of intestinal parasitic infections and malnutrition, planning is difficult for public health programs in order to prevent and improve health status of school children. The data will also help health care providers to develop nutritional care plan to support the children. In addition the findings will serve as baseline data for further studies on malnutrition and interventions among school children.

2. LITERATURE REVIEW

2.1. Prevalence of intestinal parasitic infections in school children

Study conducted among school children on prevalence of intestinal parasitic infections in Philippine was 667(84.7%), where the predominant parasite was *A. lumbricoides 363*(54.4%) followed by *T. trichiura 476*(71.4%) and hookworm *spp.* 169(25.3%) (Keren *et al.,* 2014). Similarly in Bolivia, overall intestinal parasites were found in 44(96%) of the school children, where seven types of parasites were identified; *G. lamblia 8*(17%), *E. histolytica/dispar 8*(17%), hookworm spp. *9*(19%), *A. lumbricoides 28*(61%), *T. trichiura 19*(41%) and *S. stercolaris 2*(4%) (Lazarte *et al*., 2015). A study conducted in Iran**,** on the prevalence of intestinal parasite among school children was 649(35.1%) where *G. lamblia* 128(18.4%), Hymenolepis *nana* 20(4.4%) and the prevalence of parasite infection in the boys 331(51.1%) was significantly higher than the girls 318(42.3%) (Haratipour *et al*., 2016).

The prevalence of intestinal parasitic infection among school children of Nigeria was found in 273(67.4%), where the predominant parasite was hookworm spp. 169(41.7%) followed by *A. lumbricoides 98*(24.2%); *T. trichiura 19*(4.7%); *G. lamblia 11*(2.7%) and *E. histolytica/dispar10* (2.4%). Prevalence tends to increase with age, with the highest infection occurring in the age group of 12–14 years, for Hookworm spp. and *A. lumbricoides* infection (Opara *et al.,* 2012). Another study in Uganda revealed that the prevalence of intestinal parasitic infections was 47(10.9%), 13(3.1%), 8(1.9%), 1(0.2%) for hookworm spp, *T. trichiura* and *A. lumbricoides*, respectively. The study revealed that 115(26.6%) and 198(46%) prevalence of stunting and underweight respectively were attributable to helminth infections (Lwanga *et al*., 2012).

Studies conducted in Ethiopia show that, there is high prevalence of intestinal parasitic infection for instance, a study in Gurage Zone, showed that the prevalence of intestinal parasite among school children was 258(40.2%) where *E. histolytica 77*(12%), *G. lamblia 48*(7.6%), *Taenia* spp 48(7,6%), *A. lumbricoides 33*(5.28%), hookworm spp. 29(4.5%) and *T. trichiura19* (3.1%) (Melesse *et al.,* 2017). A study in Tigray, the overall prevalence of intestinal parasitosis was 421(72%). Where *E. histolytica/dispar 227*(39%), *G. lamblia 59*(10%), Taenia *species* 4(0.7%), Hymenolepis *nana* 125(21%), *A. lumbricoides 28*(5%), *E. vermicularis* 86(15%), *S. stercoralis* 5(0.9), hookworm spp. 31(5%) and *T. trichiura 1*(0.2%) (Mahmud *et al.,* 2013). A study conducted in Gondar, the presence of a parasite in

92(22.7%) of children surveyed, from the total parasitic infection, the most common intestinal parasite identified was *A. lumbricoides* 51(48.1%), followed by *H. nana* 30(28.3%), Hookworm spp.10(9.4%) and *T. trichiura* 7(6.6%) (Amare *et al.,* 2013). A study conducted in Debre Elias, the prevalence of intestinal parasites to at least a single infection was 456(84.3%) where hookworm spp 385(71.2%), *E. histolytica/dispar 36*(6.6%) and *S. stercoralis 13*(2.4%). In this study the most significantly associated factors for the occurrence of intestinal parasite infection were unavailability of safe water supply and absence of shoe wore during interview (P<0.05) (Tilahun *et al.,* 2014). A study conducted in Jiga, 235(58.3%) were infected with intestinal parasites. The prevalence of infection with hookworm species, *A. lumbricoides* and *T. trichiura* were 189(46.9%), 17(4.2%) and 7(1.7%), respectively (Abraham and Berhanu, 2013). A study conducted in Zegie Peninsula, the overall prevalence of intestinal helminthic infections in the study area was 282(69.1%). Where the prevalence of hookworm spp., *A. lumbricoides*, *T. trichiura*, *H. nana*, and *S. stercoralis* infections were 177(43.4%), 52(12.7%), 41(10%), 19(4.6%), and 3(0.7%), respectively (Merem *et al*., 2017). Similar study conducted in Bahir Dar, overall prevalence of helminths among school children was 307(77.5%) and prevalence of *S. stercoralis*, hookworm *spp.* and co-infection was detected in 82(20.7%), 216(54.5%)and 64(16.3%), respectively (Amor *et al.*, 2016). Another recent study in Bahir Dar at Dona Berber primary school, the prevalence of overall intestinal parasitic infection among school children was 235(65.5%) and the most prevalent parasite detected in the study was *E. histolytica/dispar* 88(24.5%) followed by hookworm 82(22.8%) (Hailegebriel, 2017).

2.2. Prevalence of malnutrition in school children

The public health importance of intestinal parasitic infections remains important because of their effects on both nutritional and the immune status of populations (WHO, 2010). A study in Philippine, the prevalence of stunting, thinness, and wasting was 341(49.2%), 192(27.8%), and 172(59.7%) of all children, respectively (Keren *et al*., 2014). Bolivia, The z-scores height for age indicated that 17(37%) of the children were stunted (short for their age). Weight for age indicated that 8(17%) of the children were wasted (thin for their age). Weight for height indicated that 8(17%) of children were underweight (Lazarte *et al*., 2015). A study in Iran, on the prevalence rates of malnutrition based on weight-for-age, height-for-age and weight-for-height, were 124(6.7%), 107(5.8%) and 143(7.7%), respectively. Significant relationship was

found between malnutrition (height-for-age) and parasitic infections (P=0.02) (Haratipour *et al*., 2016).

A study in Enemorena-Ener District, Gurage Zone, Ethiopia, underweight, stunting and thinness were found to be 71 (48), 250(39%), and 262(40.9 %), respectively (Melesse *et al.*, 2017). Similarly a study in Tigray, the prevalence of stunting and thinness were 203(35%) and 200(34%) respectively. Poor personal hygiene habits were generally associated with nutritional deficiency (low body mass index). Boys were also more likely to be malnourished (Mahmud *et al*., 2013). Another study in Gondar, Overall prevalence of underweight, stunting and thinness/wasting in school children were 61(15.1%), 102(25.2%) and 36(8.9%), respectively. The prevalence of severe stunting, underweight and thinness/wasting was found to be higher in girls 41(10.2%), 15(3.7%), and 15(3.7%) than boys 29(7.3%), 11(2.8%) and 11(2.8%), respectively (Amare *et al*., 2013). A study conducted in Jiga reported 118(29.3%), 114(28.3%) and 188(46.7%) were stunted, underweight and undernourished, respectively. Underweight was more prevalent in males 142(35.3%) than in females 89(22.2%) ($p < 0.01$) (Abraham and Berhanu, 2013). In Zegie Peninsula, the prevalence of malnutrition in terms of stunting, being underweight and wasting was 61(15.3%), 27(18%), and 110(27.6%), respectively (Merem *et al*., 2017). A comparative study in Bahir Dar city and Mecha district 588(24.8%), school children were malnourished (Berhanu, 2016).

2.3. Association between intestinal parasitic infections and malnutrition of school children

The link of intestinal parasitic infections and malnutrition have been well recognized by many researchers who settled several conclusions regarding age groups at greatest risk and the effect of such infections on growth parameters especially weight and height (Thein-Hlaing, 1991). The intensity and type of parasitic infection contribute to its effect on nutrition (Walker, 1992).

A study in Nigeria found that the overall prevalence of nutritional indicators, stunting 172(42.3%); underweight 174(43.2%) wasting 44(10.9%) for rural and urban pupils respectively. Only Hookworm spp. and *A. lumbricoides* were significantly (P<0.001) associated with stunting, wasting and underweight (Opara *et al.*, 2012) .

In Ethiopia, a study conducted, in South Eastern Ethiopia, in Delo-mena District for instance, intestinal parasitic infections were associated with stunting and underweight (P<0.001 (Begna

et al., 2016). In South central Ethiopia, intestinal parasite infections were found to be a significant association with stunting (OR 0.41, 95% CI 0.29 - 0.57, P < 0.001) and thinness, (OR 0.53, 95% CI 0.38 - 0.73, P < 0.001) (Melesse *et al.*, 2017). A study in Tigray, there were no significant associations between stunting (P =0.404) and low BMI (P =0.864), and intestinal parasitic infections (Mahmud *et al.*, 2013). A study in Gondar, there was no statistically significant association between prevalence of malnutrition and the prevalence of parasitic infections (Amare *et al.*, 2013). Another similar study conducted in Zegie Peninsula, no significant association was found between intestinal parasitic infections and stunting, underweight and wasting ($p > 0.05$) (Merem *et al.*, 2017).

3. OBJECTIVES

3.1. General Objective

To assess the prevalence of intestinal parasitic infections, malnutrition and associated risk factors among Zenzelima primary school children, Northwest Ethiopia

3.2. Specific Objectives

1. To determine the prevalence of intestinal parasitic infections among Zenzelima primary school children.
2. To determine the prevalence of malnutrition among Zenzelima primary school children.
3. To identify factor associated with intestinal parasitic infections among Zenzelima primary school children.
4. To identify factors associated with malnutrition among Zenzelima primary school children.

4. METHODOLOGY

4.1. Description of the study area

This cross-sectional study was conducted at Zenzelima elementary school which is found in Bahir Dar city administration and Bahir Dar city is about 578 km far from the capital city of the country, Addis Ababa, located at 11º6'N, 37º38'E, an altitude ranging from 1,700 to 2,300 m and average annual rainfall ranges from 820 to 1,250 mm with minimum and maximum temperatures of 10 °C and 32 °C, respectively. Zenzelima belongs to Bahir city administration, has a total population of 11,428 people with a distribution of 6,024 females to 5,404 males (Agricultural Extension Worker, personal communication, May 5, 2018). Agriculture is the main source of income, but the opening of a new campus of Bahir Dar University in 2011 has led to an increase of small shops and restaurants (ECO-opia, 2013).

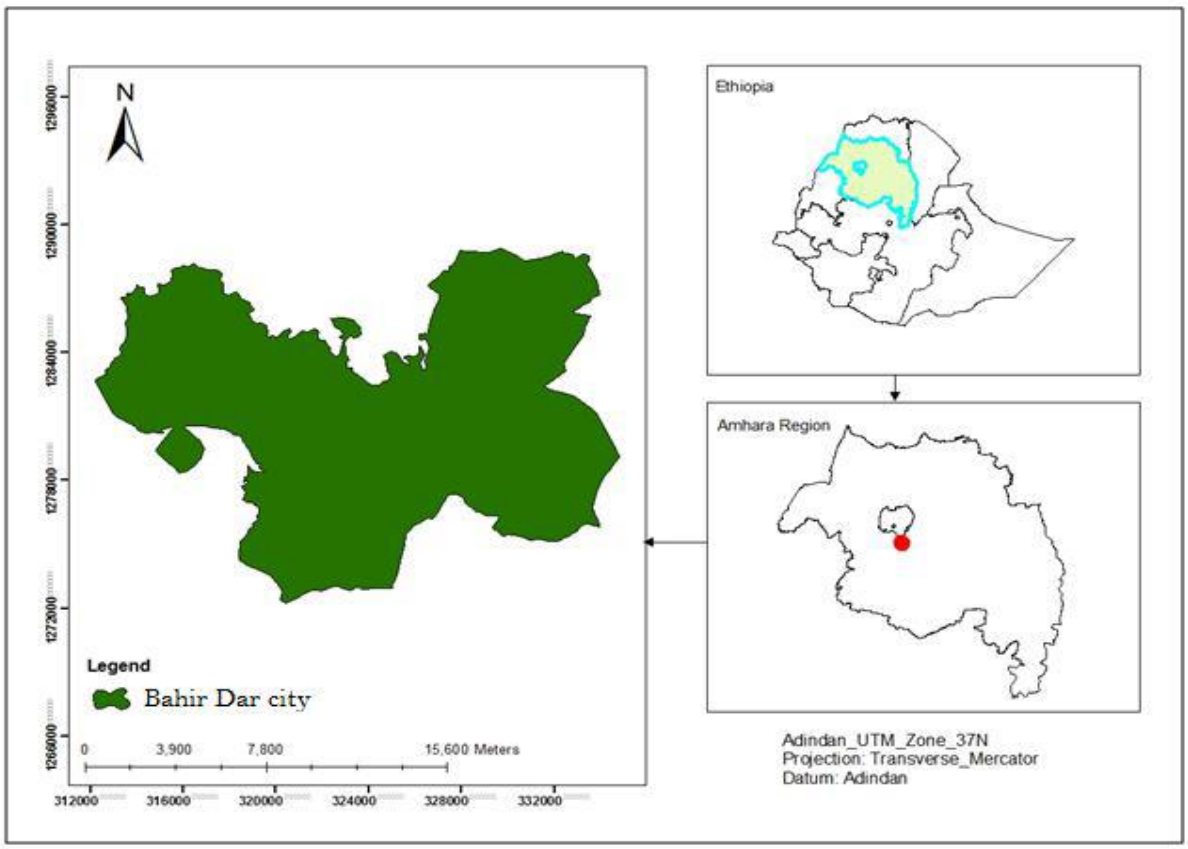

Figure 2: The geographic location of Bahir Dar city (Source: BOFED, 2013)

4.2. Study Design

A school based cross-sectional study was conducted from January 2018 to May 2018 among school children at Zenzelima primary school, Bahir Dar, Ethiopia.

4.3. Source Population

The source population was all students attending at Zenzelima primary school from grade 1 to grade 8.

4.4. Study population

The study population was all school children who did not have a history of being clinically ill and did not take anti-parasitic drugs within a period of one month before the study and during the study period.

4.5. Study participants

Study participants were all school children who gave written consent and assent and who were randomly selected and attend the school during study period.

4.6. Sample size

In the estimation of the sample size, the following assumptions were made: since there was no study conducted regarding malnutrition in the area, proportion was taken as 50% (p = 0.5), within 95% confidence interval at a confidence level of 5% using a statistical formula for sample size determination in health studies (Lwanga and Lemeshow, 1991).

$n=z^2 * p\ (1-p)/d^2$
Where n=required sample size
Z=critical value at 5% level (1. 96)
P=50.0%
d=5% (margin of error)
Then, $n= 1.96^2*0.50(1-0.50)/0.05^2 =384$
By adding 10% non-response rate, 422 individuals was selected. From this, 17 school children were not able to provide stool specimens and excluded from study. Therefore, a total of 405 children were participated in this study.

4.7. Sampling Technique

The total numbers of students from grade 1 to grade 8 were 2121 during the study period. A total of 36 classes were in the school and each class contains an average of 59 students. To select the school children, the students were stratified according to their educational level from grades 1 to grade 8. Allocation of the students to grade level was performed proportional to the number of students in each grade. Finally, the school children were selected using systematic random sampling using the class roster as the sampling frame.

4.8. Operational definitions

Body mass index: measure of body mass that is calculated as weight in kilogram divided by height in meter squared.

Nutrition: process by which living things acquire and utilize food for growth and maintenance

Malnutrition: is any condition caused by deficient or excess energy and/or nutrient intake, or an imbalance of nutrients.

Mixed infections: are the simultaneous infections of a host by two or more parasites.

Stunted: Height for age Z-score < -2SD from the median of WHO reference population.

Underweight: Weight for age Z-score < -2SD from the median of WHO reference population

Thinness: Weight for height < -2SD from the median of WHO reference population

4.9. Inclusion and exclusion criteria

4.9.1. Inclusion criteria

School children who live in the study area for at least three months and willing to participate in the study and whose parents or guardians signed a written consent was included in the study.

4.9.2. Exclusion criteria

School children who had a history of being clinically ill and taking drug within a period of one month before the study was not included in the study.

4.10. Variables

4.10.1 Dependent variables

- Intestinal parasitic infection
- Malnutrition

4.10.2 Independent variables

For intestinal parasitic infections

- Age
- Sex
- Place of residence
- Family size
- Wealth status
- Soil eating habit
- Source of drinking water
- Hand hygiene practice
- Presence of latrine
- Shoe wearing practice

For malnutrition

- Age
- Sex
- Place of residence
- Family size
- Wealth status
- Meal frequency
- Parent's occupation
- Intestinal parasitic infections

4.11. Data collection procedure

4.11.1. Questionnaire: A structured questionnaire was used to collect socio-demographic variables, and associated factors for intestinal parasitic infection and malnutrition. The data were collected via a face-to-face interview of children.

4.11.2. Stool sample collection and examination

The school children were provided with labeled stool cups fitted with plastic spatula to bring a sufficient amount of stool sample. The stool samples were processed via wet mount and Formol Ether Concentration Technique (FEC) for microscopic investigation of intestinal parasites.

4.11.3. Anthropometric Measurement

Anthropometric measurements were conducted by trained data collectors. Height was measured to the nearest 0.1cm, using Stadiometer. Before measurement of the height, the child's shoe was removed and a child was positioned feet together flat on the ground. On the other hand, weight was measured with digital weight scale. Weight of the child was measured to the nearest 0.1 kilogram with children in light clothing and shoes removed. The WHO Anthroplus software was used to estimate malnutrition among school children. Hence a child was considered underweight, stunted and thinness if the corresponding weight-for-age Z score (WAZ), height-for-age Z score (HAZ) and body mass index for-age Z score (BAZ) were less than -2 (WHO, 2009) .

4.12. Data quality assurance

To control the data quality all data collectors were trained. Supervisors were monitor data collection process daily. The questionnaire was first prepared in English language and translated to Amharic and again re-translated in to English to check for consistency. The questionnaire was also subject for pretest. Anthropometric equipment were calibrated frequently for every five measurements to control fallacy. All laboratory procedures were done with strict adherence to standard operating procedures (SOPs). Wet mount was done as soon as it reaches to the laboratory and then formalin-ether concentration technique was proceeding.

4.13. Data analysis

The data were first coded and entered using EpiData statistical software version 3.1 and then exported into SPSS statistical software version 23 for analysis and cleaned. Descriptive statistical analysis, such as simple frequencies, measures of central tendency and measures of variation was used to get summary values. The anthropometrics data were converted in to nutritional indices via WHO AnthroPlus software version1.0.4.Weight for age, height for age and weight for height Z-score was used to determine nutritional status of the children. Logistic regression analysis was done to see the association between independent and dependent variable and p-value less than 0.05 at 95% CI was used to declare statistical significance.

4.14. Ethical consideration

The study was conducted after ethically reviewed and approved by the Research and Ethical Review Committee of Bahir Dar University, College of Medicine and Health Science. Permission letter was obtained from Amhara Health Bureau and Amhara Educational Bureau. Assents and written consents were collected respectively from children and parents/guardians. No other investigations were done on the sample except those needed for the study objectives that were described in the consent form. Any information that was obtained during the study was kept confidential. Treatment was given for school children who were positive for intestinal parasites and malnourished by referring them to the Zenzelima health center for appropriate treatment and counseling.

5. RESULTS

5.1 The prevalence of intestinal parasitic infections across socio-demographic characteristics

In this study, of the 405 school children, 208 (51.4%) were males and 197 (48.6%) were females. The mean age of the school children was 10.66 ± 2.37 (mean ± SD) years with a minimum and maximum age of 6 years and 19 years, respectively. Two hundred seven 51.1% of school children were from 11-15 years of age; the age groups 16-19 comprised the lowest proportion 7(1.7%) of the school children (Table 1).

Majority 253(62.5%) of the students were from rural areas. Father's educational status of the school children showed that 235(58.8%) were literate and 167(41.2%) were illiterate. On the other hand, 292(72.1%) mothers of the school children were illiterate. Half (51.6%) of the school children use well or stream as source of drinking water. The remaining 185(45.7%) and 11(2.7%) use drinking water from pipe and river, respectively (Table1).

Of the total 405 stool samples examined, 201(49.6%) were positive for one or more intestinal parasitic species. The prevalence of intestinal parasitic infections among male and female was 95(45.7%) and 106(53.8%), respectively. With regard to age category, 94(49.2%) of intestinal parasites infected school children were 6-10 years old. While 103(49.8%) were in 11-16 years old. Concerning residence, 81(53.3%) of urban and 120(47.4%) of the rural residents were infected with one or more intestinal parasites.

In educational status, the prevalence of intestinal parasitic infection was 123(52.3%) in those school children whose father were literate and 78(46.7%) in illiterate. Regarding to mother educational status 150(51.4%) in illiterate and 51(45.1%) in literate had the infections.

About 85(53.8%) intestinal parasitic infection was found in those who had not toilet. while 116(47%) was observed in those who had toilet. About 106(50.7%) of intestinal parasitic infections were observed in those school children who were used well or stream water source. While 87(47.0%) of them in those who were used pipe water (Table 1).

Table 1: The prevalence of intestinal parasitic infections in association with socio-demographic characteristics among Zenzelima primary school children, Northwest Ethiopia, January – February, 2018 (N=405)

Characteristics		Intestinal parasitosis		Total	X^2	df	P-value
		Positive No (%)	Negative No (%)	No (%)			
Sex	Male	95(45.7)	113(54.3)	208(51.4)	2.678	1	0.102
	Female	106(53.8)	91(46.2)	197(48.6)			
Age	6-10	94(49.2)	97(50.8)	191(47.2)	0.172	2	0.917
	11-15	103(49.8)	104(50.2)	207(51.1)			
	16-19	4(57.1)	3(42.9)	7(1.7)			
Level of grade	1-4	103(48.8)	108(51.2)	211(52.1)	0.117	1	0.732
	5-8	98(50.50)	96(49.5)	194(47.9)			
Residence	Urban	81(53.3)	71(46.7)	152(37.5)	1.304	1	0.254
	Rural	120(47.4)	133(52.6)	253(62.5)			
Family size	<=5	96(47.8)	105(52.2)	201(49.6)	0.557	1	0.455
	>5	105(51.5)	99(48.5)	204(50.4)			
Father educational status	Literate	123(52.3)	112(47.7)	235(58.8)	1.239	1	0.266
	Illiterate	78(46.7)	89(53.3)	167(41.2)			
Mother educational status	Literate	51(45.1)	62(54.9)	113(27.9)	1.268	1	0.260
	Illiterate	150(51.4)	142(48.6)	292(72.1)			
Source of drinking water	Pipe	87(47.0)	98(53.0)	185(45.7)	2.948	2	0.229
	River	8(72.7)	3(27.3)	11(2.7)			
	Well or stream	106(50.7)	103(49.3)	209(51.6)			
Presence of toilet	Yes	116(47.0)	131(53.0)	247(61.0)	1.800	1	0.180
	No	85(53.8)	73(46.2)	158(39)			
Total		201(49.6)	204(50.4)	405(100.0)			

5.2 Prevalence of intestinal parasitic infections in association with behavioral and hygienic practice

About 367(90.6 %) of school children had a habit of hand washing before meal and trimming of their nail. On the other hand, 237(58.5%) of school children had a habit of open field defecation. Similarly, 225(55.6%) of school children had no habit of hand washing after defecation. About 343(84.7%) of school children had no habit of using closed shoes. Regarding to swimming habit 199(49.1%) of school children had swimming habit (Table 2).

The prevalence of intestinal parasitic infections in school children who had habit of defecation in open field was higher 121(51.1%) as compared to those who had not 80(47.6%). The prevalence of intestinal parasitic infections in school children who never wore protective shoes was higher 180(52.5%) (X^2=7.272, P<0.007) than those who wore protective shoes regularly 21(33.9%). Moreover, in those school children, who had habit of eating unwashed and washed fruits were 95(51.4%) and 106(48.2%), respectively (Table 2).

Table 2: The prevalence of intestinal parasitic infections in association with behavioral and hygienic practice among Zenzelima primary school children, Northwest Ethiopia, January – February, 2018 (N=405)

Characteristics	Intestinal Parasitosis		Total	X^2	Df	P-value
	Positive No (%)	Negative No (%)	No (%)			
Hand washing				0.950	1	0.330
Yes	185(50.4)	182(49.6)	367(90.6)			
No	16(42.1)	22(57.9)	38(9.4)			
Shortening of finger nail				0.086	1	0.865
Yes	183(49.9)	184(50.1)	367(90.6)			
No	18(47.4)	20(52.6)	38(9.4)			
Open field defecation				0.464	1	0.496
Yes	121(51.1)	116(48.9)	237(58.5)			
No	80(47.6)	88(52.4)	168(41.5)			
Hand washing after defecation				0.004	1	0.947
Yes	89(49.4)	91(50.6)	180(44.4)			
No	112(49.8)	113(50.2)	225(55.6)			
Eating unwashed fruit				0.404	1	0.525
Yes	95(51.4)	90(48.6)	185(45.7)			
No	106(48.2)	114(51.8)	220(54.3)			
Eating raw meat				0.023	1	0.878
Yes	97(49.2)	100(50.8)	197(48.6)			
No	104(50.0)	104(50.0)	208(51.4)			
Practice of wearing shoes						
Yes	21(33.9)	41(66.1)	62(13.3)	7.272	1	0.007*
No	180(52.5)	163(47.5)	343(86.7)			
Swimming habit						
Yes	97(48.7)	102(51.3)	199(41.1)	0.123	1	0.726
No	104(50.5)	102(49.5)	206(50.9)			
Total	201(49.6)	204(50.4)	405(100.0)			

*- statistically significant

Seven species of intestinal parasites were identified. The predominant intestinal parasite was hookworm spp. with a prevalence of 108(26.7%). The second most prevalent parasite was *G. lamblia* at 80(19.8%) followed by *E. histolytica/dispar* at 55(13.6%). The least encountered parasites were *A. lumbricoides* at 11(2.7%), *H. nana 6(*1.5%) *E. vermicularis* 2(0.5%) and *S. stercoralis* with 1(0.2%). In this study, multiple infections were 58(14.3%) of school children harbored two or more parasites (Figure. 2).

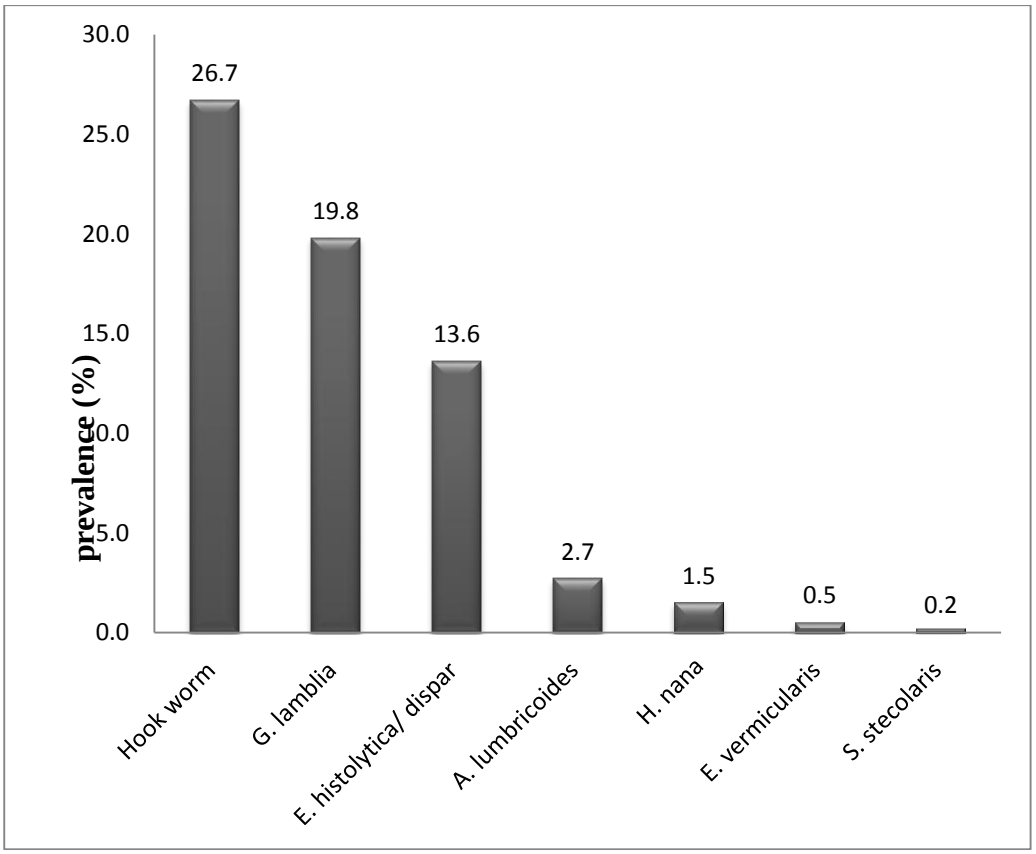

Figure 3 : Distribution of intestinal parasites among Zenzelima primary school children, Northwest Ethiopia, January – February, 2018

The prevalence of hookworm spp. infections among male and female were 57(27.4%) and 51(25.9%), respectively. With regard to residence, 46(30.3%) of hookworm infections were from urban area, while 253(62.5%) was in rural area. The prevalence of hookworm spp. infections in school children who never wore protective shoes had higher 102(29.7%) proportion (X^2=10.805, P<0.001) than those who wore protective shoes regularly 6(9.7%) (Table3).

The prevalence of *G. lamblia* infections among male and female were 33(15.9%) and 47(23.9%), respectively. Concerning residence, 32(21.1%) of urban and 48(19.0%) of the rural residents were infected with *G. lamblia*. About 45(24.3%) *G. lamblia* infection was found higher in those school children, who had habit of eating unwashed fruit (X^2=4.490, P<0.05). While 35(15.9%) was observed in those who had a habit of eating washed fruits (Table 3).

From 405 school children, 20(9.6%) males and 35(17.8%) females were infected by *E. histolytica/dispar*. With regard to residence, 19(12.5%) of urban and 36(14.2%) of the rural residents were infected with *E. histolytica/dispar.* About 21(11.4%) *E. histolytica/dispar* infection was found in those school children, who had habit of eating unwashed fruit. While 34(15.5%) was observed in those who had a habit of eating washed fruits (Table 3).

Table 3: The prevalence of predominant intestinal parasitic infections in association with behavioral and hygienic practice among Zenzelima primary school children, Northwest Ethiopia, January – February, 2018 (N=405)

Characteristics	Total No (%)	Hookworm spp			*G. lamblia*			*E. histolitica/dispar*		
		Positive No (%)	Negative No (%)	χ2 (df) (P-value)	Positive No (%)	Negative No (%)	χ2 (df) (P-value)	Positive No (%)	Negative No (%)	χ2 (df) (P-value)
Sex										
Male	208(51.4)	57(27.4)	151(72.6)	0.119(1)	33(15.9)	175(84.1)	4.077(1)	20(9.6)	188(90.4)	5.728(1)
Female	197(48.6)	51(25.9)	146(74.1)	(p=0.730)	47(23.9)	150(76.1)	(p=0.043)	35(17.8)	162(82.2)	(p=0.017)
Residence										
Urban	152(37.5)	46(30.3)	106(69.7)	1.609(1)	32(21.1)	120(78.9)	0.259(1)	19(12.5)	133(87.5)	0.242(1)
Rural	253(62.5)	62(24.5)	191(75.5)	(p=0.205)	48(19.0)	205(81.0)	(p=0.611)	36(14.2)	217(85.8)	(p=0.623)
Hand washing after defecation										
Yes	180(44.4)	50(27.8)	130(72.2)	0.205(1)	39(21.7)	141(78.3)	0.748(1)	24(13.3)	156(86.7)	0.017(1)
No	225(55.6)	58(25.8)	167(74.2)	(p=0.651)	41(18.2)	184(81.8)	(P=0.387)	31(13.8)	194(86.2)	(p=0.897)
Eating unwashed fruit										
Yes	185(45.7)	46((24.9)	139(75.1)	0.565(1)	45(24.3)	140(75.7)	4.490(1)	21(11.4)	164(88.6)	1.442(1)
No	220(54.3)	62(28.2)	158(71.8)	(p=0.45)2	35(15.9)	185(84.1)	(p=0.034)*	34(15.5)	186(84.5)	(p=0.230)
Practice of wearing shoes										
Yes	62(15.3)	6(9.7)	56(90.3)	10.805(1)	11(17.7)	51(82.3)	0.187(1)	3(4.8)	59(95.2)	4.767(1)
No	343(84.7)	102(29.7)	241(70.3)	(p=0.001)*	69(20.1)	274(79.9)	(p=0.666)	52(15.2)	291(84.8)	(p=0.029)
Presence of toilet										
Yes	247(61.0)	64(25.9)	183(74.1)	0.185(1)	44(17.8)	203(82.2)	1.502(1)	30(12.1)	217(87.9)	1.110(1)
No	158(39)	44(27.8)	114(72.2)	(p=0.667)	36(22.8)	122(77.2)	(p=0.220)	25(15.8)	133(84.2)	(p=0.292)
Total	405(100.0)	108(26.7%)	297(73.3)		80(19.8%)	325(80.2)		55(13.6)	350(86.4)	

*- statistically significant

5.3 Multivariate analysis of associated factors for intestinal parasitic infections

In the current study, based on multivariate analysis using logistic regression confirmed that children who never wore protective shoes (AOR = 2.314, 95% CI = 1.285-4.167, P = 0.005) as significant risk factors of intestinal parasitic infections among school children. Similarly, with regard to hookworm infection, the multiple logistic regression analysis indicated that children who never wore protective shoes maintained its previous identified significant association (AOR = 3.917, 95% CI = 1.634-9.386, P = 0.002). However, when the influence of other confounders was taken in to account, the contribution of eating unwashed fruit was no longer evident as predictor for the prevalence of *G .lamblia* infected school children (Table 4).

Table 4: Multivariate logistic regression analysis of variables associated with prevalence of intestinal parasitic infections among Zenzelima primary school children, Northwest Ethiopia, January – February, 2018 (N = 405)

	Characteristics	**Total N (%)**	**COR (95% CI)**	**AOR (95% CI)**	**P-value**
Intestinal parasitic infection	Practice of wearing shoes				
	Yes	62(15.3)	1.000*	1.000*	0.005#
	No	343(84.7)	2.156(1.223-3.801 Ψ	2.314(1.285-4.167)+	
Hookworm spp.	Practice of wearing shoes				
	Yes	62(15.3)	1.000*	1.000*	0.002#
	No	343(84.7)	3.950(1.650-9.459) Ψ	3.917(1.634-9.386)+	
Total N (%)		405(100.0)			

***-** reference category, **Ψ**-statistically significant at COR, **+** significant at AOR, # - P-value at AOR

5.4 The prevalence of malnutrition in association with socio-demographic characteristics

In the present study, Anthropometric measurements were made on 405 school children. The mean of height and weight were 1.33 cm (±0.12 SD) and 25.46 kg (±6.46 SD), whereas mean BMI was 14.14 kg/m² (±1.48 SD). The overall prevalence of malnutrition among school children was 236(58.3%). About 59/190 (14.6%), 105/405 (25.9%) and 199/405 (49.1%) school children were under weight, stunted and thin, respectively (Figure 3).

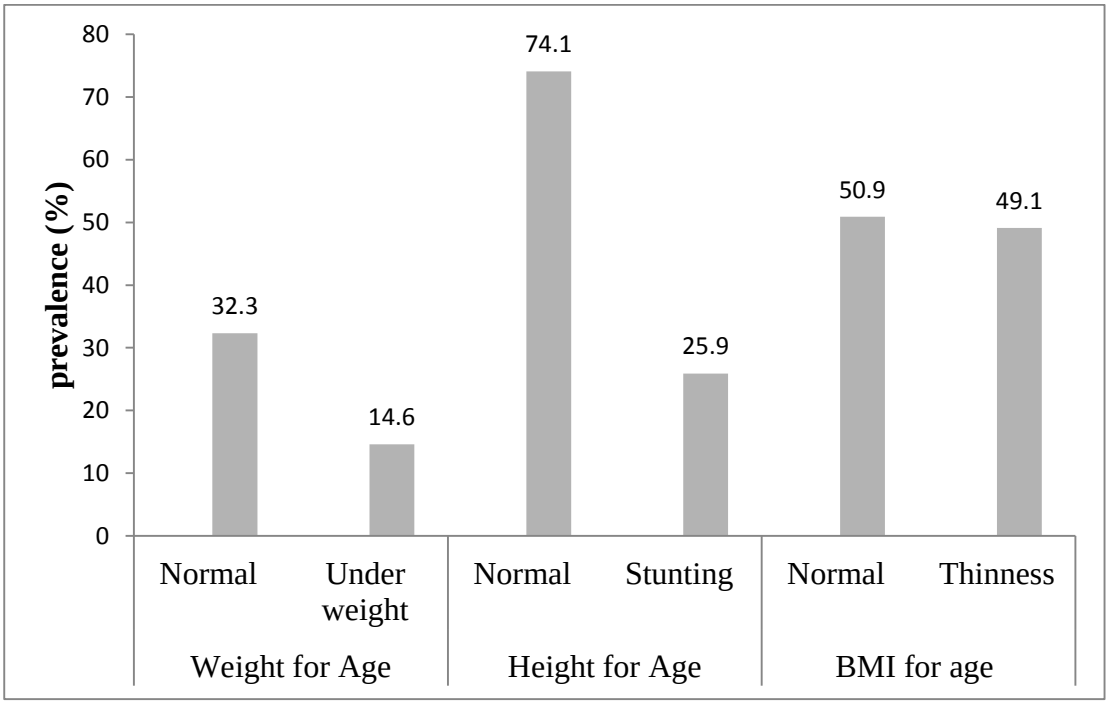

Figure 4: Distribution of malnutrition among Zenzelima primary school children, Northwest Ethiopia, January – February, 2018 (N=405)

The prevalence of being underweight, stunting and thinness for males were 29(49.2%), 55(52.4%) and 109(54.8%) and for females were 30 (50.8%), 50(47.6%) and 90(45.2%), respectively. In terms of residential location, the prevalence of stunting and thinness were higher 71(67.6 %) and 127(63.8%) in rural school children than urban children 34(32.4%) and 72(36.2%), respectively. Regarding family size, school children with >5 family members were

more stunted 58(55.2%) and thin 110(53.3%) than those with lower family size 47(44.8%) and 89(44.7%), respectively (Table 5).

The overall prevalence of intestinal parasite infections in underweight school children was 59(67.8%) and from these the prevalence of hookworm spp., *G. lamblia*, *E. histolytica/E.dispar*, *A. lumbricoides*, *Hymenolepis nana* and *E. vermicularis* were 20(33.9%), 23(39.0%), 12(20.3%), 3 (5.1%), 1 (1.7%) and 1 (1.7%) respectively.

Similarly, the overall prevalence of intestinal parasite infections among stunted school children was 57(54.3 %) and from these 35(33.3%), 21(20.0%), 14(13.3%) and 1(1%) were due to hookworm spp., *G. lamblia*, *E. histolytica/dispar*and *A.lumbricoides*, respectively (Table 5).

Furthermore, the overall prevalence of intestinal parasite infection among thin school children was 108(54.3 %) and from these 61(30.7), 40(20.1%), 23(11.6%) and 9(4.5%) were due to hookworm spp., *G. lamblia*, *E. histolytica/E.dispar* and *A. lumbricoides*, respectively. Statistically significant associations was found between *A. lumbricoides* infection and thinness *(X^2=4.832, P=0.028)* (Table 5).

Table 5: The prevalence malnutrition against socio-demographic characteristics and intestinal parasite infections among Zenzelima primary school children, Northwest Ethiopia, January – February, 2018 (N=405)

Characteristics	Total No (%)	Stunting			Thinness		
		No No (%)	Yes No (%)	χ2 (df) (P-value)	No No (%)	Yes No (%)	χ2 (df) (P-value)
Sex							
Male	208(51.4)	153(73.6	55(26.4)	0.059(1)	99(47.6)	109(52.4)	1.827(1)
Female	197(48.6)	147(74.6)	50(25.4)	(p=0.807)	107(54.3)	90(45.7)	(p=0.176)
Residence							
Urban	152(37.5)	118(77.6)	34(22.4)	1.603(1)	80(52.6)	72(47.4)	0.304(1)
Rural	253(62.5)	182(71.9)	71(28.1)	(p=0.205)	126(49.8)	127(50.2)	(p=0.581)
Father educational status							0.029(1)
literate	235(58.0)	176(74.9	59(25.1)	0.079(1)	119(50.6)	116(49.4)	(p=0.865)
Illiterate	167(41.2)	123(73.7)	44(26.3)	(p=0.779)	86(51.5)	81(48.5)	
Mother educational status							
literate	113(27.9)	81(71.7)	32(28.3)	0.467(1)	70(61.9)	43(38.1)	7.707(1)
Illiterate	292(72.1)	219(75.0)	73(25.0)	(p=0.494)	136(46.6)	156(53.4)	(p=0.006)*
Frequency of meal							
>3X	63(15.6)	45(71.4)	18(28.6)	1.884(2)	30(47.6)	33(52.4)	0.604(2)
3X	306(75.6)	225(73.5)	81(26.5)	(p=0.390	159(52.0)	147(48.0)	(p=0.739)
2X	36(8.9)	30(83.3)	6(16.7)		17(47.2)	19(52.8)	
Intestinal parasitic infection							
Positive	201(49.6)	144(71.6)	57(28.4)	1.229(1)	93(46.3)	108(53.7)	3.372(1)
Negative	204(50.4)	156(76.5)	48(23.5)	(p=0.268)	113(55.4)	91(44.6)	(p=0.066)
Hookworm Spp.							
Positive	108(26.7)	73(67.6)	35(32.4)	3.222(1)	47(43.5)	61(56.5)	3.180(1)
Negative	297(73.3)	227(76.4)	70(23.6)	(p=0.073)	159(53.5)	138(46.5)	(p=0.075)
G. lamblia							
Positive	80(19.8)	59(73.8)	21(26.2)	0.005(1)	40(50.0)	40(50.0)	0.030(1)
Negative	325(80.2)	241(74.2)	84(25.8)	(p=0.941)	166(51.1)	159(48.9)	(p=0.863)
E.histolytica/dispar.							
Positive	55(13.6)	41(74.5)	14(25.5)	0.007(1)	32(58.2)	23(41.8)	1.364(1)
Negative	350(86.4)	259(74.0)	91(26.0)	(p=0.932)	174(49.7)	176(50.3)	(p=0.243)
A.lumbricoides							
Positive	11(2.7)	10(90.9)	1(9.1)	1.669(1)	2(18.2)	9(81.8)	4.832(1)
Negative	394(97.3)	290(73.6)	104(26.4)	(p=0.196)	204(51.8)	190(48.2)	(p=0.028)*
Total	405(100.0)	300(74.1)	105(25.9)		206(50.9)	199(49.1)	

*- statistically significant

5.5 Multivariate analysis of associated factors of malnutrition

Based on the stunting, the multivariate logistic regression analysis of mother educational status showed that children with illiterate mother were about 1.806 times at high risk of developing stunting (AOR = 1.806, 95% CI = 1.146-2.845) when compared to those who had literate mother. However, when the influence of other confounders was taken in to account, the contribution of *A. lumbricoides* infections was no longer evident as predictor for the prevalence of thinness among school children (Table 6).

Table 6: Multivariate logistic regression analysis of variables associated with stunting and thinness among Zenzelima primary school children, Northwest Ethiopia, January – February, 2018 (N = 405)

Malnutrition	Characteristics	COR (95% CI)	AOR (95% CI)	P-value
Stunting	Family size			
	<=5	1.000*	1.291(0.825-2.019)	0.263
	>5	1.302(0.833-2.034)	1.000*	
	A.lumbricoides infection			
	Positive	0.279(0.035-2.205)	1.275(0.816-1.994)	0.286
	Negative	1.000*	1.000*	
Thinness / Wasting	Family size			
	<=5	1.000*	1.000*	0.103
	>5	1.473(0.996-2.178)	1.397(0.934-2.090)	
	Mother educational status			
	literate	1.000*	1.000*	0.011#
	Illiterate	1.867(1.198-2.911) Ψ	1.806(1.146-2.845)+	
	A.lumbricoides infection			
	Positive	4.832(1.031-22.647) Ψ	3.953(0.809-19.307)	0.089
	Negative	1.000*	1.000*	

***-** reference category, **Ψ**-statistically significant at COR, **+** significant at AOR, # - P-value at AOR

6. Discussion

In this study, the prevalence of intestinal parasitic infections among school children was investigated. The overall prevalence of intestinal parasite in the present study was 201 (49.6%). This prevalence was higher compared to previous works 258(40.2%) in Gurage Zone (Melesse *et al.*, 2017), 92(22.7%) in Gondar (Amare *et al.*, 2013) and 649(35.1%) in Iran (Haratipour *et al*., 2016). However, it was lower when compared to reports 235(58.3%) in Jiga (Abraham and Berhanu, 2013), 456(84.3%) in Debre Elias (Tilahun *et al.*, 2014), 421(72%) in Tigray (Mahmud et al., 2013), 282(69.1%) in Zegie Peninsula (Merem *et al*., 2017), 667(84.7%) in Philippine (Keren *et al.*, 2014) and 44(96%) in Bolivia (Lazarte *et al*., 2015). The observed difference might be because of variation in the study period, setting and season.

In the present study, hookworm with prevalence of 108(26.7%) was the predominant species. But, this was lower than previous reports 216(54.5%) in Bahir Dar (Amor *et al.*, 2016), 177(43.4%) in Zegie Peninsula (Merem *et al*., 2017), 189(46.9%) in Jiga (Abraham and Berhanu, 2013) and 385(71.2%) in Debre Elias (Tilahun *et al.*, 2014). The possible explanation for this difference might be due to the time gap, geographical and environmental difference of the localities. However, it was comparable with the prevalence rate of 169(25.3%) in Philippine (Keren *et al.*, 2014), 9(19%) in Bolivia (Lazarte *et al*., 2015) and 82(22.8%) in Bahir Dar at Dona Berber primary school (Hailegebriel, 2017).

The prevalence of giardiasis in the present study was 80(19.8%) and it was comparable with findings from Bolivia 8(17%) (Lazarte *et al*., 2015) and Iran 128(18.4%) (Haratipour *et al*., 2016). The findings of this study was relatively higher compared to previous study 11 (3.2%) in Nigeria (Opara *et al.*, 2012), in 48(7.6%) in Gurage Zone (Melesse *et al*., 2017) and 59(10 %) in Tigray (Mahmud *et al.*, 2013). The reason for the high prevalence of *G. lamblia* infection may be attributed to the habit of eating unwashed fruit in the study area. In addition, 185(45.7%) of school children in this study eat unwashed fruit.

The prevalence of *E. histolytica/dispar* in the present study was 55(13.6%). This finding is lower than findings from Bahir Dar at Dona Berber primary school 88(24.5%) (Hailegebriel, 2017). The findings of this study was higher than a previous study by Lazarte *et al*., (2015) 8(17%) from Bolivia, Melesse *et al.*, (2017) 77(12%) from Gurage Zone districts and Tilahun *et al.,* (2014) 36(6.6%) from Debre Elias. The reason for the high prevalence of *E. histolytica/dispar* infection may be attributed to the habit of eating unwashed fruit in the study area. In addition, 185(45.7%) of school children in this study eat unwashed fruit.

The prevalence of *A. lumbricoides* in the present study was 11(2.7%). This finding is in accordance with data from Gurage Zone 33(5.2%) (Melesse *et al.*, 2017). The findings of this study revealed that the prevalence of *A. lumbricoides* was relatively higher compared to prevalence rate of1(0.2%) in Uganda (Lwanga *et al*., 2012) and 28(5%) in Tigray (Mahmud *et al.,* 2013).

Findings from the current study revealed that infection with *A. lumbricoides* was considerably lower when compared to other studies carried out among school children. Higher infection rate has been reported 51(48.1%) in Gondar (Amare *et al.,* 2013), 99(24.2%) in Jiga primary school (Abraham and Berhanu, 2013), 52(12.7%) in Zegie Peninsula (Merem *et al*., 2017), 98(24.2%) in Nigeria (Opara *et al.*, 2012), and 363(84.7%) in Philippine (Keren *et al.,* 2014). The difference might be due to the time gap, geographical and environmental difference of the localities.

In the current finding, 84.7% (343/405) of school children reported that they have never wore protective shoes. In Multivariate analysis, children who never wore protective shoes (AOR = 2.314, 95% CI = 1.285-4.167, P = 0.005) were at higher odds of hookworm infection. This association was in agreement with other earlier reports (Tilahun *et al.,* (2014), (Hailegebriel, 2017), (Merem *et al*., 2017). Probably those students who do not wear shoe might be infected by soil transmitted helminthes through intact bare foot penetration.

Demographic variables such as age, sex, residence location were not implicated as determinants for occurrence of intestinal parasitic infections among the school children. This

similar finding has been reported by Pawlos *et al*. (2011). In the current finding, sanitary factors do not seem to play a role as a risk factor for the occurrence of intestinal parasitic infection in the studied population. Environmental determinants measured in this study such as eating unwashed fruit, swimming practices, washing hand before meal and after latrine use, access to toilet and source of drinking water were not statistically significant. Thus, in the current work these factors did not clearly indicate a true reflection of difference in terms of prevalence of infection. On the contrary, a study conducted by Tilahun *et al.,* (2014) and Merem *et al*., (2017) showed swimming practices, washing hand before meal and after latrine use, access to toilet, source of drinking water to be implicated for the prevalence of infection. Difference in findings among various studies could be variations in geography, socio-economic conditions and cultural practices of the population under consideration.

The public health importance of intestinal parasitic infections remains important because of their effects on both nutritional and the immune status of populations (WHO, 2010). In this study, the prevalence of malnutrition among school children was investigated. In the present study, anthropometric measurements were made based on weight for age, height for age and weight for height. The Anthroplus soft-ware does not calculate underweight for children older than 10 years because of the assumption that children older 10 years start to show secondary sexual characteristics and as age increases, weight also increases. Therefore, it is not recommended to use weight for age as good nutritional indicator for children older than 10 years. Consequently, the prevalence of being underweight among school children was 59/190(14.6%), which was comparable with findings from Zegie Peninsula elementary school 27 (18%) (Merem *et al*., 2017), Gondar 61(15.1%) Amare *et al*., 2013) and Bolivia 8(17%) (Lazarte *et al*., 2015). However, higher than findings from Iran 124(7.2%) (Haratipour *et al*., 2016). Furthermore, prevalence of underweight was lower than the one reported 114(28.3%) in Jiga (Abraham and Berhanu, 2013), 71 (48%), in Gurage Zone (Melesse *et al.,* 2017) , 174(43.2%) in Nigeria (Opara *et al.,* (2012) and 198(46%) in Uganda (Lwanga *et al*., 2012). This might be due to the difference of accessibility of food in quality and quantity, knowledge in feeding practice, price of food and the presence or the absence of intestinal parasitic infection.

In the present study, the prevalence of stunting was 105(25.9%). This was comparable with findings 118(29.3%) in Jiga elementary school (Abraham and Berhanu, 2013), 102(25.2%) in Gondar (Amare *et al*., 2013) and 115(26.6%) in Uganda (Lwanga *et al*., 2012). The prevalence of stunting in the current study was higher than the prevalence reported 27(18%) in Zegie Peninsula (Merem *et al*., 2017) and 107(5.8%) in Iran (Haratipour *et al*., 2016). Furthermore, prevalence of stunting was lower than the one reported 203(35%) by Mahmud *et al*., (2013) in Tigray, 250(39%) in Gurage Zone (Melesse *et al.*, 2017), 172(42.3%) in Nigeria found stunting (Opara *et al.*, 2012), 341(49.2%) in Philippine (Keren *et al*., 2014) and in Bolivia 17(37%) of the children were stunted (Lazarte *et al*., 2015).

In the current study, the prevalence of being thin among school children was 199(49.1%), which was higher than findings from Zegie Peninsula elementary school 110(27.6%) (Merem *et al*., 2017), Gondar 36(8.9%) (Amare *et al*., 2013) and Tigray 200(34%) (Mahmud *et al*., 2013). Contrary to this, a lower prevalence of thinness was reported in Nigeria 44(10.9%) (Opara *et al.*, 2012), Bolivia 8(17%) (Lazarte *et al*., 2015) in Philippine 192(27.8%) (Keren *et al*., 2014).

In multivariate analysis, the present study showed that no significant associations were found between intestinal parasitic infections and malnutrition (being underweight, stunting and thinness) ($p > 0.05$). This was in agreement with other earlier reports by Mahmud *et al., (2013)* in Tigray and Amare *et al*., (2013) in Gondar. In contrast a significant association of malnutrition with intestinal parasitic infection were reported by Begna *et al.,* (2016) in South Eastern Ethiopia, Delo-mena District and Opara *et al.,* (2012) in Nigeria. The variation might be due to differences of intensity of the parasitic infections.

According to thinness, the multiple logistic regression analysis indicated that having illiterate mother were about 1.806 times at high risk of being thin when compared to those who had literate mother (AOR = 1.806, 95% CI = 1.146-2.845). This was in agreement with other earlier reports by Abuya *et al., (2014)* in Nairobi. Mothers' education may enhance their skills for reducing the risk of thinness of their children. Since education improves ones knowledge, skill and attitude.

7. CONCLUSION AND RECOMMENDATIONS

CONCLUSION

The overall prevalence of intestinal parasitic infection in school children was 49.6%, with hookworm highly prevailing followed by *G. lamblia, E. histolytica/dispar*, and *A. lumbricoides.* In the multivariate analysis, the habit of wearing shoes was related with hookworm infection. Based on anthropometric measurements, the current study identified 25.9% stunting and 49.1% thinness. According to malnutrition evaluations in multivariate analysis, mothers' educational status was significant predictors of thinness of school children.

RECOMMENDATIONS

Based on the present findings, it is recommended that school children should regularly wear protective shoes and regular mass drug administration must be administered to decrease the burden of intestinal parasitic infections. It is also recommended that the community should be mobilized to improved educational status of child's mother in order to decrease the risk of thinness of the school children.

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Annex I: English and Amharic Versions of Participant Information Sheet

BAHIR DAR UNIVERSITY, COLLEGE OF MEDICINE AND HEALTH SCIENCES, SCHOOL OF HEALTH SCIENCE, DEPARTMENT OF MEDICAL LABORATORY SCIENCE.

You are invited to participate in a study to be conducted by MSc student at Bahir Dar University, College of Medicine and Health Sciences, Department of Medical Laboratory Science. Please read the following statements and ask any unclear points before you agree to participate.

Introduction

The topic of this study is Intestinal Parasitosis, Malnutrition and Associated Factors among Zenzelima Elementary School children, Northwestern Ethiopia. Participation in this study is exclusively voluntarily. If you are not interested to participate or if you once decide to participate and withdraw yourself at any time, there will be no consequences and you will get all the services provided in the school with no problems. If you decide to participate, you have to sign on the assent/parental permission template form and you may obtain a copy of this information sheet.

What is expected from me as participant of the study?

As a participant of this study, you are expected to agree that 3 grams of stool will be collected. In addition, you are expected to give answers for some questions about your health and socio-demographic conditions. Your name, address and phone number will not be disclosed and rather an identification code will be used in such conditions.

How much time will I spent to participate in this study?

You will spend 15-30 minutes until the specimen is collected, the questionnaire is filled and the assent/parental permission form is signed.

What are the risks of participating in this study?

Specimen collection will have no effect and pose no pain on you and the only thing you spend is just your time to fill the questionnaire.

How my information is to be kept in secrete?

All information that you give and the results from your specimen will be used for this study only.

Only limited numbers of professional will have access to the information. All the information will be encoded in a computer and saved with password protection.

What are the benefits from participation?

Since this study is MSc student research, there will not be payments for participants. But your participation is important for the assessment of intestinal parasitosis, malnutrition and associated factors. You will also obtain all the results of the analysis for free and communicated to health professionals for the appropriate management.

What are my rights as a participant of this study?

You have the right to withdraw yourself from the study at any time and all the services provided in the school will not be discontinued. You are also welcomed if you have any question for further explanations about the study. You can get the results of the analysis.

What can I do if I have a problem or a question?

Please direct any questions or problems you may encounter during this study to:

Abera Ademasu

Department of Medical Laboratory Sciences, College of Medicine and Health Sciences

Bahir Dar University

Mob: +251-91-1-82-25-88

Email: aberaadmasu2009@gmail.com

Agree to participate? Yes----- No-----

ባ/ዳር ዩኒቨርሲቲ፣ ህክምናና ጤና ሳይንስ ኮላጅ፣ የህክምና ላቦራቶሪ ሳይንስ ትምህርት ክፍል በማስተርስ ዲግሪ ተማሪ የመመረቂያ ጥናት ላይ እንዲሳተፉ ተጋብዘዋል። እባኮዎ በዚህ ጥናት ላይ ከመስማማተወ በፊት ከዚህ ቀጥሎ የሚገኘዉን ንባብ በጥሞና ያንብቡ ግልጽያልሆነዉን ማንኛዉንም ሃሳብ ይጠይቁ።

መግቢያ

የጥናቱ ርዕስ፡ የአንጀት ትላትል፤ የምግብ እጥረትና ተያያዥ ነገሮችን በዘ□ዘልማ የመጀመሪያ ደረጃ ት/ቤት ህጻናት ሲሆን ። እርሶ በዚህ ጥናት ሊይ የሚኖሮወት ተሳትፎ ሙሉ በሙሉ በበጎ ፈቃደኝነት ሊይ የተመሠረተ ነዉ። በዚህ ጥናት ዉስጥ ለመሳተፍ ከወሰኑ የስምምነት ቅጹ ሊይ በጹሑፍ ወይም በጣት ፊርማዎ ማስቀመጥ ይጠበቅቦዎታል። ከፈለጉ ይህንን የመረጃ ቅፅ አንድ ቅጅ ለራሶዎ ሊያስቀሩ ይችላሉ።

የጥናቱ ተሳታፊ በመሆኔ የሚጠበቅብኝ ምንድነዉ?

በዚህ ጥናት ለመሳተፍ ሚስማሙ ከሆነ 3 ግራም የአይነምድር ናሙና እንደሚወሰድ እና ለጥናቱ እንዲዉል መስማማት ይጠበቅብወታል። ከተወሰደዉም ናሙና ላይ የሚገኙ መረጃዎች ለሥራዉ አግባብነት ላላቸዉ ሰዎች ቢነገር የማይቃወሙ መሆኑን መስማማት ይጠበቅቦታል። ይሁን እንጂ ይህ ዓይነቱ መረጃ የእርሶን ማንነት የሚገልጹ መረጃዎን ማለትም ስም፣ አድራሻ፣ የስልክ ቁጥር ና የመሳሰለት መረጃዎት አይጨምርም። ይልቁንም ለዚህ ጥናት አገልግሎት ብቻ የሚዉል ሚስጥራዊ ቁጥር ጥቅም ላይ እንዲዉል ይደረጋሌ። በተጨማሪም ስለ እርሶዎ አጠቃሊይ የጤና ሁኔታ ለሚቀርቡ አንዳንድ ተጨማሪ ጥያቄዎች መልስ መስጠት ይጠበቅቦታል።

በዚህ ጥናት መሳተፍ ምን ያህል ጊዜ ይፈጃል?

የተዘጋጀዉን መጠይቅ ለመሙላት፤ የስምምነት ቅጹ ላይ ለመፈረምና ናሙና ለመስጠት 15-30ደቂቃ ያስፈልጋል።

በዚህ ጥናት መሳተፍ የሚያስከትላቸዉ ችግሮች ምንድን ናቸዉ?

ናሙና በሚሰበሰብበት ወቅት ምነም አይነት ችግር አያስከትልበዎትም እንዲሁም ምንም አይነት የህመም ስሜት አያስከትልም ። ስለዚህም የሚያጡት ነገር ቢኖር መጠይቁን በመሙላት የሚያጠፉት ጊዜ ነዉ።

የሕክምና መረጃ በሚስጥር ተጠብቆ መቆየት እንዴት ነዉ?

ስለራስዎና ስለልጅዎ የሰጡት ማንኛዉም መረጃ ከተወሰደዉ ናሙና ላይ የተገኘዉ የላቦረቶሪ ዉጤቶች የሚዉለዉ ለጥናቱ አላማ ብቻ ነዉ። ይህን መረጃ ሊያገኙ የሚችሉ የተወሰኑ የጥናቱ ተባባሪ ሠራተኞች ብቻ ናቸዉ። ከዚህም በላይ ስለእርሶ ያለዉን ማንኛዉንም መረጃ የተለየ የይለፍ ቃል ባለዉ የኮፒዉተር የመረጃ ማህደር ዉስጥ እንዲቀመጥ ይደረጋሌ።

በዚህ ጥናት መሳተፍ የሚያስገኛቸዉ ጥቅሞች ምንድናቸዉ?

ይህ ጥናት የማስተርስ ዲግር መመረቂያ እንደመሆኑ መጠን ለተሳታፊዎች ገንዘብ አይሰጥም። ለወደፊት በተመሳሳይ ሁኔታ ዉስጥ ላሉ ህጻናት መረጃ ላይ የተመሰረተ የጤና እንክብካቤ ለመስጠት ያግዛል። ከፈለጉ የላቦራቶሪ ዉጤቶችን ነፃ ያገኛለ።

በዚህ ጥናት ተሳታፍ በመሆኔ መብቶቼ ምንድንናቸዉ?

በጥናቱ ዉስጥ ያሉትን ተሳትፎ በማንኛዉም ጊዜ የማቋረጥ ሙለ መብትዎ የተጠበቀ ከመሆኑም በላይ ራሶን ከጥናቱ በማግለል ምክንያት የሚቀርብዎት ምንም ዓይነት የት/ቤቱ አገልግሎት አይኖርም። ከዚህም በተጨማሪ ጥናቱን በተመለከተ ማንኛዉንም ዓይነት ጥያቄ የመጠየቅና ገለፃ የማግኘት መብት አለዎት። የላቦራቶሪ ምርመራ ዉጤቱንም በነፃ ማግኘት ይችላሉ።

ጥያቄ ካለኝ ወይም ችግር ቢያጋጥመኝ ምን ማድረግ ይገባኛል?

ይህን ጥናት በተመለከተ ወይም ከዚህ ጋራ በተዛመደ መልኩ ስለሚያጋጥሙ ድንገተኛ ችግሮች ወይም ጥያቄ ካልዎት በሚከተለዉ አድራሻ ይጠቀሙ።

አበራ አድማሱ

የሕክምና ላቦራቶሪ ሳይንስ ት/ክፍል፤ የህክምናና ጤና ሳይንስ ኮሌጅ ተማሪ

ባህር ዳር ዩኒቨርሲቲ

ሞባይል +251911822588

ኢ-ሜይል aberaadmasu2009@gmail.com

እስማማለሁ----------አልስማማም--------

Annex II: **English and Amharic Versions of Assent Form**

This page contains an agreement signature to participate in the study entitled with ‘’ **Intestinal Parasitosis, Malnutrition and Associated Factors among Zenzelima Elementary School children, Northwestern Ethiopia’’.** So please read the following points and sign your signature at the end in the space provided.

1. I understand the objective of the study in ‘’ **Intestinal Parasitosis, Malnutrition and Associated Factors among Zenzelima Elementary School children, Northwestern Ethiopia’’** and I can communicate with the peoples that conduct the study when I want them.
2. I know that the information that I gave are going to be used for this study only.
3. I understand that, all the information given for the study and the results are confidential.
4. I understand that I will not get any money for my participation.
5. I understand that I have a right to stop from participation any time in the study.
6. All the information is explained by Mr./Mrs/.

Signature of the participant: _____

Address of the participant: _____

Date: _____

Please direct any questions or problems you may encounter during this study to:

Abera Ademasu

Department of Medical Laboratory Sciences, College of Medicine and Health Sciences

Bahir Dar University

Mob: +251-91-1-82-25-88

Email: aberaadmasu2009@gmail.com

የተሳታፊ የስምምነት ቅጽ

ይህ ገን '' Intestinal Parasitosis, Malnutrition and Associated Factors among Zenzelima Elementary School children, Northwestern Ethiopia'' የሆድ ትላትል፤ የምግብ እጥረትና ተያያዥ ነገሮችን በዘ□ዘልማ የመጀመሪያ ደረጃ ት/ቤት ህጻናት ላይ **ለሚከሄድ ጥናት ስለመሳተፍ የሚያመለክት የስምምነት ቅጽ ነዉ፡፡ ስለዚህ በዚህ ጥናት ዉስጥ ለመከተት / ለመሣተፍ / እባክዎን የሚከተለዉን ቅጽ አንብበዉ በመጨረሻ በተሰጠዉ ክፍት ቦታ ፊርማዎን ያኑሩ፡፡**

1. የጥናቱን ዓላማ ተገንዝቤአለሁ፤ ጥናቱን የሚያከሄደዉን ሰዉ ስፈልገዉ ማግኘት እንደምችልም ተረድቻለሁ፡፡

2. የአይነምድር ናሙና ተወስዶ ለጥናቱ ዓላማ እንደሚዉል ተረድቻለሁ፡፡

3. ለጥናቱ የሚሠጡ መረጃችና ከጥናቱ የሚገኙ ዉጤቶች በሚስጥር እንደሚጠበቁ ተረድቻለሁ፡፡

4. ከዚህ ጥናት ገንዘብ በተለየ መልኩ እንደማላገኝ ተርድቻለሁ፡፡

5. ከዚህ ጥናት በፈለግሁ ጊዜ አቋርጬ መዉጣት እንደምችል ተረድቻለሁ፡፡

6. ይህ መረጃ በአቶ/ ወ/ሮ/_____ተዛል□ልኛል፡፡

የተሳታፊ ኝርማ፡ _____

የተሳታፊ አድራሻ፡_____

ቀን፡ _____

ችግር ካጋጠመዎት ወይም ጥያቄ ካለዎት፤

አበራ አድማሱ

የሕክምና ሊብራቶሪ ሳይንስ ት/ክፍል፤ የህክምናና ጤና ሳይንስ ኮላጅ ተማሪ

ባህር ዳር ዩኒቨርሲቲ

ሞባይሌ +251911822588

ኢ-ሜይሌ፤ aberaadmasu2009@gmail.com

Annex III: English and Amharic Versions of Parental Permission Template

This page contains an agreement signature to give information on behalf of your child in the study entitled with **'' Intestinal Parasitosis, Malnutrition and Associated Factors among Zenzelima Elementary School children, Northwestern Ethiopia''**. So please read the following points and sign your signature at the end in the space provided.

1. I understand the objective of the **'' Intestinal Parasitosis, Malnutrition and Associated Factors among Zenzelima Elementary School children, Northwestern Ethiopia''** and I can communicate with the peoples that conduct the study when I want them.
2. I know that the information that I gave are going to be used for this study only.
3. I understand that, all the information given for the study and the results are confidential.
4. I understand that I will not get any money for giving information about my child.
5. I understand that I have a right to stop from my child"s participation any time in the study.
6. All the information is explained by Mr./Mrs.

Signature of the guardian: _____

Address of the guardian: _____

Date: _____

Please direct any questions or problems you may encounter during this study to:

Abera Ademasu

Department of Medical Laboratory Sciences, College of Health Sciences

Addis Ababa University

Mob: +251-91-1-82-25-88

Email: aberaadmasu@gmail.com

የተንከባካቢዎች የስምምነት ቅጽ

ይህ ገን ‘’ Intestinal Parasitosis, Malnutrition and Associated Factors among Zenzelima Elementary School children, Northwestern Ethiopia’’የሆድ ትላትል፤ የምግብ እጥረትና ተያያዥ ነገሮችን በዘ□ዘልማ የመጀመሪያ ደረጃ ት/ቤት ህጻናት ላይ **ለሚከሄድ ጥናት ለሚሳተፉ ልጆች መረጃ ለመስጠት መስማማትን የሚያመለክት የስምምነት ቅጽ ነዉ፡፡ ስለዚህ በዚህ ጥናት ዉስጥ ስለ ተሳታፊዉ ህፃን መረጃ በመስጠት ለመሳተፍ እባክዎን የሚከተለዉን ቅጽ አንብበዉ በተሰጠዉ ክፍት ቦታ ፊርማዎን ያኑሩ፡፡**

1. የጥናቱን ዓላማ ተገንዝቤአለሁ፤ ጥናቱን የሚያከሄድዉን ሰዉ ስፈልገዉ ማግኘት እንደምችልም ተረድቻለሁ፡፡

2. ከልጄ የአይነምድር ናሙና ተወስዶ ለጥናቱ ዓላማ እንደሚዉል ተረድቻለሁ፡፡

3. ለጥናቱ የሚሠጡ መረጃዎችና ከጥናቱ የሚገኙ ዉጤቶች በሚስጥር እንደሚጠበቁ ተረድቻለሁ፡፡

4. ከዚህ ጥናት ገንዘብ በተለየ መልኩ እንደማላገኝ ተረድቻለሁ፡፡

5. ከዚህ ጥናት በፈለግሁ ጊዜ ስለ ልጄ መረጃ መስጠቴን ማቆም **እንደምችል ተረድቻለሁ፡፡**

6. ይህ መረጃ በአዎ/ ወ/ሮ/_____ተዛል□ልኛል፡፡

የተሳታፊ ወላጅ ወይም አሳዳጊ ኝርማ፡ _____

የተሳታፊ አድራሻ፡_____

ቀን፡ _____

ችግር ካጋጠመዎት ወይም ጥያቄ ካለዎት፤

አበራ አድማሱ

የሕክምና ሊብራቶሪ ሳይንስ ት/ክፍል፤ የህክምናና ጤና ሳይንስ ኮልጅ

ባህር ዳር ዩኒቨርሲቲ

ሞባይሌ +251911822588

ኢ-ሜይሌ፤ aberaadmasu2009@gmail.com

Annex IV: English and Amharic Versions of Questionnaires

Bahir Dar Universty, College of Medicine and Health Sciences, Department of Medical Laboratory Science

Questionnaire for data collection on the prevalence of Intestinal Parasites and malnutrition of school age children in Zenzelima primary school, Bahir Dar, Ethiopia

My name is Abera Ademasu. I am a post graduate student of Bahir Dar Universty, College of Health Sciences, and Department of Medical laboratory science. Your participation is voluntary and you are not obliged to answer any questions that you do not want to answer. Please take a few moments to complete this questionnaire so that we can determine the prevalence of intestinal parasites, malnutrition and associated factors. Thank you in advance in anticipation of your cooperation. If you are not comfortable with the interview, please feel free to stop it any time you like. Participation or withdrawal from this study will have not any effect on your service at Zenzelima elementary school.

Direction for filling up the enclosed questionnaire:

- ❖ Please mark "X" on the appropriate choice.
- ❖ Give the detailed as required in the space provided.

	I) Socio-demographic data (for all age groups)					
101	Participant code: _____					
102	Level of grade:_____					
103	Age _____					
104	Sex	Male	Female			
		1	2			
105	Residence	Urban	Rural			
		1	2			
106	Family size _____					
107	Family income per month _____					
108	Literacy rate of mother		Secondary school & above	Primary school	Illiterate	
			1	2	3	
109	Literacy rate of the father		Secondary school & above	Primary school	Illiterate	
			1	2	3	
	II) Life Style and personal hygiene					
110	Practice of hand washing before and after eating			Yes	No	
				1	2	
111	Practice of eating raw and/or unwashed fruit			Yes	No	

				1	2	
112	Practice of eating raw meat		Yes	No		
			1	2		
113	Water source of drinking	Pipe	River	well or stream		
		1	2	3		
114	Practice of open field defecation		Yes	No		
			1	2		
115	Practice of hand washing after toilet/defecation			Yes	No	
116	Presence of toilet	Yes	No			
		1	2			
117	Practice of finger nail trim		Yes	No		
			1	2		
118	Practice of wearing closed shoe	Always	Sometimes		Rarely	Never
		1	2		3	4
119	Practice of playing with soil		Yes	No		
			1	2		
120	Soil eating habit		Yes	No		
			1	2		
121	Swimming Habit	Always	Sometimes		Never	
		1	2		3	

	Anthropometric and other measurements						
122	Weight _____. ___ kg,						
123	Height _____. ___ cm						
124	Last term's examinations average marks____,_____,						
	III) Feeding habit						
125	How many meals eat per day?	> Three X	Three X	Two X	One X		
		1	2	3	4		
	How many times the child actually eats the following diet?						
	Food Kind	Daily	3-5 X a week	1-2 X weekly	1 X a week	1X every 2 week	Rarely
126	Milk and Dairy products						
127	Meat						
128	Fish						
129	Legumes						
130	Vegetables						
131	Fruits						

Stool microscopy result

Direct Wet Mount:_____

Concentration:_____

መጠይቅ

ባ/ዳር ዩኒቨርሲቲ፣ ባህር ዳር ህክምና ጤና ሳይንስ ኮላጅ፣ የህክምና ላቦራቶሪ ሳይንስ ትምህርት ክፍል፣ በዘንዘልማ የመጀመሪያ ደረጃ ት/ቤት ህጻናት ላይ ለሚደረገዉ የሆድ ትላትልና የምግብ እጥረት ጥናት መረጃ መሰብሰቢያ መጠይቅ። እኔ አበራ አድማሱ እባላለሁ። በባህር ዳር ዩኒቨርሲቲ፣ ጤና ሳይንስ ኮሌጅ፣ የህክምና ፓራሳይቶሎጅ ትምህርት የሁለተኛ ዲግሪ ተማሪ ነኝ። የእርስዎ ተሳትፎ በፍቃደኝነት ላይ የተመሰረተ በመሆኑ መረጃ መስጠት ካልፈለጉ አይገደዱም። ካለዎት ጠባብ ጊዜ ወስደዉ መጠይቁን በመሙላትዎ በቅድሚያ እያመሰገንኩ መጠይቁ ካልተመቸዎት በማንኛዉም ሰዓት እንዲያቆሙት በትህትና እገሌግለሁ። ከሰላምታ ጋር!

መመሪያ ¨መጠየቁን ለሞሙላት፡ ❖ ምርጫ በቀረቡት በመረጡት ላይ የ 'X' ምልክት ያድርጉ ❖ ዝርዝር መረጃ በሚጠይቁ በተሰጡት ክፍት ቦታ ላይ ይሙሉ ሀ) ማህበራዊ መረጃ								
101	የተሳታፊ ኮድ:_____							
102	የትምህርት ደረጃ፡ ----------							
103	እድሜ፡----------							
104	ፆታ	ወንድ	ሴት					
		1	2					
105	የመኖሪያ አድራሻ፤		ከተማ	ገጠር				
			1	2				
106	የቤተሰብ ብዛት፡----------							
107	የቤተሰብ ወርሀዊ ገቢ፡----------							
108	የእናት የትምህርት ደረጃ፤		ከ12ና ከዚያ በላይ		የመጀመሪያ ደረጃ		ያልተማረ	
			1		2		3	
109	የአባት የትምህርት ደረጃ፤		ከ12ና ከዚያ በላይ		የመጀመሪያ ደረጃ		ያልተማረ	

									1			2			3				
ለ) የአኗኗር ዘዬና የአመጋገብ ልምድ መረጃ																			
110	ከምግብ በፊትና በኃላ እጅ የመታጠብ ልምድ							አወ		የለም									
								1		2									
111	ጥሬ/ያልታጠበ ፍራፍሬ የመመገብ ልምድ									አዎ		የለም							
										1		2							
112	ጥሬ ስጋ የመመገብ ሌምድ					አዎ		የለም											
						1		2											
113	የመጠጥ ዉሃ መገኛ			ቧንቧ		ወንዝ			ጉድጓድ ወይም ምንጭ										
				1		2			3										
114	ሜዳ ላይ የመፀዳዳት ልምድ				አዎ			የለም											
					1			2											
115	ከሽንት ቤት መልስ ወይም ከተፀዳዱ በኋላ እጅ የመታጠብ ልምድ								አዎ					የለም					
									1					2					
116	ሽንት ቤት አለ	አዎ		የለም															
		1		2															
117	የእጅ ጥፍር ቶሎ ቶሎ የመቁረጥ ልምድ				አዎ			የለም											
					1			2											
118	ሽፍን ጫማ የመልበስ ልምደዎ ምን ይመስላል				ሁሌጊዜ			አልፎአልፎ		በጣም አልፎአልፎ				አልለብስም					
					1			2		3				4					
119	በአፈር የመጫወት ልምድ			አዎ		የለም													
				1		2													
120	አፈር የመብላት ልምድ			አዎ		የለም													
				1		2													
						1		2		3									
121	ዉሃ ዋና ልምድ				ሁሌጊዜ			አልፎአልፎ		የለም									
					1			2		3									
ሐ. ተጨማሪ መረጃ																			
122	ክብደት _____. ___ ኪግ,																		
123	ቁመት ___ ___ሜ . ___ ሴሜ																		

124	የቅርብ ጊዜ አማካኝ ውጤት _____					
መ. የአመጋገብ ልምድ						
125	በቀን ስንት ጊዜ ይመገባሉ	3 ጊዜና ከዚያ በላይ	3 ጊዜ	2 ጊዜ	1 ጊዜ	
		1	2	3	4	

በምን የህል ጊዜ መጠን ከታች የተገለፁትን የምግብ አይነቶች ይመገባሉ								
	የምግብ አይነት	በየቀኑ	በሳምንት ከ3-5 ጊዜ	በሳምንት ከ1-2 ጊዜ	በሳምንት 1 ጊዜ	በ2 ሳምንት 1 ጊዜ		
126	ወተትና የወተት ውጤቶች							
127	ስጋ							
128	አሳ							
129	ጥራጥሬ							
130	አትክልት							
131	ፍራፍሬ							
የላቦራቶሪ ውጤት								
ዳይሬክት፡_____								
ኮንሰንትሬትድ፡_____								

Annex V: Stool Specimen Processing Procedures

a) Direct wet mount

Principle: Intestinal parasites can be identified by examination of fresh stool samples. In stool samples we can find worms and segments of worms visible to the eye. By microscopic examination of fresh stool samples, we can find eggs and larvae of worms. We also find protozoa trophozoites and cysts. In heavy and moderate infection, a direct smear examination with normal saline and/or iodine to stain cysts is usually sufficient. For light infections, a concentration of the stool sample might be required to find helminth eggs and protozoa by microscopic examination (WHO, 1991).

Procedure

1. Place a drop of normal saline on a clean slide
2. Using a piece of stick, place a small amount of specimen, including blood and mucus in one end of the slide and cover it with a cover slide
3. First examine microscopically using 10 x objectives to give good contrast and use the 40x objective to identify trophozoites of protozoa.

Reporting: Report the name of the parasite found (WHO, 1991).

b) Formalin-Ether concentration technique

Principle: In the Ridley modified method, feces are emulsified in formalin, the suspension is strained to remove large fecal particles, ether or ethyl acetate is added and the mixed suspension is centrifuged. Cysts, oocysts, eggs, and larvae are fixed and sedimented and the fecal debris is separated in a layer between the ether and the formalin. Fecal fat is dissolved in the ether (WHO, 1991).

Procedure

1. using a stick, emulsify 1g of stool in 4 ml of 10% Formalin in a tube
2. Add a further 3-4 ml of 10% formalin, cap the tube and mix well by shaking
3. Sieve the emulsified feces and collect the suspension in a beaker
4. Transfer the suspension to centrifuge tube and add 3-4 ml of diethyl ether or ethyl acetate
5. Mix the tube for 1 minute centrifuge at 3000 rpm for 1 minute
6. Discard the ether, fecal debris and formol water
7. Tap the bottom of the tube and mix the sediment
8. Add a drop of normal saline in a clean slide, add a piece of specimen and cover it with cover slide
9. First examine microscopically using 10 x objectives to give good contrast and use the 40x objective to identify cysts and ova of parasites and add iodine to the smear for staining (WHO, 1991).

Declaration Form

Intestinal Parasitosis, Malnutrition and Associated Factors among Zenzelima Elementary School children, Northwestern Ethiopia

By: Abera Ademasu

Advisors	Signature and date
Megbaru Alemu (MSC, Associate Professor)	_____
Mulat Yimer (MSC, Associate Professor)	_____

Internal Examiner

Woyneshet Gelaye (Lecturer)	_____