INTESTINAL PARASITIC INFECTIONS AND NUTRITIONAL STATUS OF PUBLIC ELEMENTARY SCHOOL CHILDREN IN JIMMA TOWN, SOUTHWEST ETHIOPIA

BY

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ABSTRACT

Introduction: *Intestinal parasitic infections (IPIs) are major public health problems in several tropical and subtropical developing countries with poor socio-economic status. Intestinal parasites are one of the factors that cause malnutrition. Children are the most important risk groups for IPIs. Prevention and control intervention programs of IPIs in general and soil-transmitted helminths (STHs) in particular rely on up to date epidemiological information. There is scarcity of data on prevalence of IPIs and nutritional status in public elementary schools in Jimma Town.*

Objective: *The objective of this study was to determine prevalence of IPIs and assess their association with nutritional status among public elementary schoolchildren in Jimma Town, Southwest Ethiopia.*

Methods: *A facility-based cross-sectional study was conducted involving 407 schoolchildren selected by multi-stage sampling techniques, from April to May 2014 in Jimma Town. Structured questionnaire was used to gather relevant information on demographic characteristics and dietary habit. Fresh stool sample was collected from each study participants, examined by direct wet mount and McMaster egg counting technique. Moreover, body weight and height were measured to calculate z- scores of height-for-age and weight-for-height indices. Data were analyzed using SPSS version 20.*

Results*: The overall prevalence of IPIs was 68.6%. Prevalence of intestinal helminths and protozoan infections was 63.4% and 10.9%, respectively. Trichuris trichiura was the predominant parasite (34.9%) followed by Ascaris lumbricoides (28.5%) and hookworms (11.4%). Moreover, prevalence of malnutrition in terms of stunting, underweight and wasting was 22.3%, 6.9% and 8.1%, respectively. There was significant association between malnutrition with wealth index (AOR= 0.566, 95%, CI: 0.320-0.901) and mothers'/guardians occupation (AOR = 2.095, 95%, CI: 1.5455-4.199). Age group (AOR=1.152, 95%, CI: 1.149-2.61), place of bathing (AOR=2.576, 95%, CI: 1.141-6.575) and shoe wearing habit (AOR=1.643, 95%, CI: 1.104-2.598) were predictors of IPIs. T. trichiura infection was significantly associated with stunting.*

Conclusion*: Prevalence of IPIs was high and malnutrition (stunting) was significantly associated with T. trichiura infection. Efforts should be made to improve hygienic practices of the schoolchildren. The health extension program should pay attention to elementary schools in Jimma Town in prevention of IPIs and improve nutritional status of the schoolchildren. School based de-worming programs should be implemented to prevent deleterious outcomes of the IPIs and to achieve accelerated stunting reduction.*

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS AND ACRONYMS

AOR:	Adjusted Odds Ratio
BMI:	Body Mass Index
CI:	Confidence Interval
COR:	Crude Odds Ratio
DDS:	Dietary Diversity Score
EPG:	Egg Per Gram
HAZ:	Height-for-Age Z score
IPs:	Intestinal Parasites
IPI:	Intestinal Parasitic Infection
IPIs:	Intestinal Parasitic Infections
Lab:	Laboratory
MAM:	Moderate Acute Malnutrition
NCHS:	National Center for Health Statistics
PI:	Principal Investigator
SAC:	School Age Children
SD:	Standard Deviation
SPSS:	Statistical Package for Social Sciences
SSA:	Sub Saharan Africa
STH:	Soil Transmitted Helminths
Vs:	Versus
WA:	Weight-for-Age
WAZ:	Weight- for- Age Z-score
WH:	Weight-for-Height
WHO:	World Health Organization
WHZ:	Weight-for-Height Z-score

CHAPTER ONE

INTRODUCTION

1.1 Background

Intestinal parasitic infections (IPIs) are among the most prevalent and persistent of all childhood infections worldwide [1, 2]. The major IPIs of global public health concern are the protozoan species *Entamoeba histolytica/dispar/moshkovskii (E. histolytica/dispar/moshkovskii)* and *Giardia lamblia (G. lamblia)* and helminthes: *Ascaris lumbricoides* (*A. lumbricoides), Trichuris trichiura* (*T. trichiura)* hookworms, *Entrobius vermicularis (E. vermicularis), Hymenolepis nana (H. nana), Strongyloides stercolaris (S. stercolaris)* and *Schistosoma mansoni (S. mansoni)* [3].

The transmission of IPs are initiated by ingestion of the infective stages of the parasites from which the infective stages of IPs been found to stick on. These stuffs could be contaminated water, food, fingers, utensils, door handles and money. It can also be transmitted from person to person and by skin penetration of the infective stage of the parasites. The poor personal hygiene, environmental hygiene, and health system promotes to the high level of IP transmission [4-7]. Schoolchildren carry the heaviest burden of the associated morbidity, due to their dirty habits of playing or handling of infested soils, eating with soiled hands, unhygienic toilet practices, drinking and eating of contaminated water and food [8].

The impact of IPIs depends on different factors including type of parasitic species, intensity of infection, the immunological status of the host, socio-economic factors [1] and socio-demographic factors [9]. IPs can live within the intestine of their hosts for years without causing any symptoms. But they show clinical manifestations like: abdominal pain, nausea, vomiting, coughing, diarrhea, weight loss, anorexia, abdominal distention, fatigue, dysentery, rash or itching around the rectum and anemia [10]. IPs also affects the nutritional status of the host [11].

Malnutrition refers to cellular imbalance between supply of nutrients and body's need for them to ensure specific functions of the body for growth, maintenance and other functions [12, 13]. Each nutrient deficiency disease characterized by an imbalance at the cellular level. Energy providing macronutrients (protein, fat and carbohydrate), micronutrients (vitamins and minerals) and water are required for good health [14].

Malnutrition covers a broad spectrum of illness, including under nutrition, specific nutrient deficiencies and over nutrition [15, 16]. Several factors influence the risk of malnutrition. It may result from unbalanced diet, inadequate food intake, incorrect feeding practices, infection, digestive difficulties and absorption problems [14]. It depends on determinants like socio-economic and physical condition in which an individual lives [17]. Good nutritional status is required to maintain maximum resistance to infection and the ability to recover from these infections [18].

The major intervention mechanisms used to prevent and control of IPIs and malnutrition involve anti parasitic drug treatment, personal hygiene, environmental sanitation, control of intermediate host, supply of quality water and health information initiatives aimed at improving the nutritional status [19].

1.2 Statement of the problem

Intestinal parasitic infections are widely distributed throughout the world causing large threats to the public health, economy, physical and cognitive development particularly among children in developing countries [3, 20]. Human IPs caused by intestinal helminthic and protozoan parasites result in significant morbidity and mortality in endemic countries. Globally in 2010, an estimated 819.0 million people were infected with *A. lumbricoides*, 438.9 million with hookworms and 464.6 million with *T. trichiura* [21].

One third of Sub-Saharan Africa's (SSA) population are affected by one or more STHs and these infections are first cause of disease burden among children and account for 11.3% of the total burden of disease in children, making it the most common cause of morbidity. These infection also cause malnutrition and iron deficiency anemia particularly among children [22].

In Ethiopia, like in other developing countries, IPIs are widely spread. A great proportion of annual visits at outpatient services of the health institutions are due to such infections [23]. One third of Ethiopians are infected with Ascariasis, one quarter is with Trichuriasis and one in eight lives with hookworms [23].

The negative effect of IPIs on nutritional status is very common with highest intensity in school-age-children (SAC) [4]. IPIs may affect growth in different ways. For instance, the nutritional status of the host may be impaired by the increased nutrient demands of the parasite itself or by specific actions of the parasite. For example, adult *A. lumbricoides* block the absorbance of surfaces of the mucosal wall and hookworms infections affect human life by causing blood loss [24]. The high prevalence of severe Ascariasis and Trichuriasis in children may lead to micronutrient deficiency (iron deficiency anemia, vitamin A deficiency) and protein-energy malnutrition [25, 26].

Malnutrition is the most widespread public health problem in the world. It promotes infection and infection leads to malnutrition [15]. The relationship between malnutrition and infection is complex and both interact synergistically with each other to aggravate the health conditions of the groups at risk. More than one third of all child deaths are attributable to under nutrition [15]. This combination is the leading cause of death among young children in developing countries [17]. It is reported that approximately 183 million children are underweight-for-age, 67 million are underweight-for-height (wasted) and 226 million are low height-for-age (stunted) [27].

There are documented reports implicating IPI with poor nutritional status of SAC [12, 28, 29]. Infection with IPs are associated with decreased child growth, low plasma vitamin A, loss of weight, iron deficiency anemia, diarrhea and stunted growth [30]. Alteration of the normal gastrointestinal flora by IPs has been found to be associated with diarrhea, a major cause of childhood morbidity and mortality in developing countries [31].

Studies in many parts of the country have shown a high prevalence of IPIs amongst schoolchildren [32-35]. In addition, children in Ethiopia are affected by malnutrition due to multi-factorial reasons. Nutritional deficiencies are the causes for poor school enrolment, absenteeism, early dropout and weaknesses in physical and intellectual performance in primary schoolchildren [13].

The finding of this study will help to design interventions that minimize the effect of IPIs and malnutrition by providing recent data on the prevalence of IPIs and nutritional status of SAC in Jimma Town.

CHAPTER TWO

LITERATURE REVIEW

Intestinal parasitic infections are among the most prevalent and persistent of all childhood infections worldwide. Many individuals living in endemic areas are infected with IPs continuously from soon after birth to childhood [1]. The prevalence of IPs found to be higher in the lower altitudes and high temperature (warm climates) of the world. These infections are widespread in under developed countries [9].

2.1 Distribution of intestinal parasites

A cross-sectional study carried among 200 SAC by Escobedoin *et al*., 2008 in Cuba showed overall prevalence of IPIs to be 93.8% of which STHs was 59.5%. The prevalence of *A. lumbricoides, T. trichiura* and hookworms infections were 40.5%, 35.5% and 5.5%, respectively. *G. lamblia* (38.5%) was the commonest pathogenic protozoan [36]. Another cross-sectional study conducted in two Mexican states by Quihui *et al.,* in 2006 showed protozoan infections to be 65%. *A. lumbricoides, T. trichiura* and *E. histolytica/dispar/moshkovskii* showed lower prevalence. Children from lower income families, with unemployed, less educated mothers and defecation in open areas was a high risk factor of IPs [37].

A school based cross-sectional study conducted by Tandukar *et al.,* 2011 in Nepal showed prevalence of IPs to be 16.7%. The prevalence of protozoan and STHs were 13.6% and 3.1%, respectively. The highest rate of IPs was seen among 11–15 age groups. The most common parasite was *G. lamblia* (44.4%) followed by *E. histolytica/dispar/moshkovskii* (20.3%). IPs were significantly associated with children whose family occupation was agriculture [38]. However, this study does not clearly state the method of sample size determination and sampling technique used.

A study conducted by Nebil A. *et al.,* 2013 in rural Malaysia showed that 78.1% of the children were infected with STHs. The prevalence of *T. trichiura*, *A. lumbricoides* and hookworms infections were 71.7%, 37.4% and 17.6%, respectively. Age ≥ 6 years, using unsafe water supply as a source for drinking water, absence of toilet in the house, large family size (≥ 7 members), not washing hands before eating and after defecation were significantly associated with STHs [39].

Another study conducted among SAC by Olabiyi K. *et al.,* 2013 in Nigeria showed prevalence of IPIs to be 34.8%. Age groups 9-11 years were mostly infected. *A. lumbricoides* was the prevalent (42.5%) followed by hookworms (26.4%). It was also observed that IPIs were mostly high among government owned primary SAC (47.5%) [40].

According to study conducted by Soriano M. *et al.,* in 2011 among SAC showed prevalence of *G. lamblia, E. coli, B. hominis, E. nana, H. nana* and *E. vermicularis* to be 29%, 17%, 15%, 9%, 5% and 2%, respectively. Mixed infection was seen in (4.4%) children [41]. Other study conducted by Ngonjo T. *et al*., 2012 in Kenya showed overall prevalence of helminthic and protozoan infections to be 31% and 28.7%, respectively. The common infections were *A. lumbricoides,* hookworms, *T. trichiura* and *S. mansoni* [42].

2.2 Burden of intestinal parasites among schoolchildren in Ethiopia

Intestinal parasitic infection cause serious public health problem in Ethiopia. Hookworms infection estimated to infect 11 million people, *A. lumbricoides* 26 million people and *T. trichiura* 21 million people [43]. Thus, Ethiopia bears 5.6% of hookworms, 15% of *A. lumbricoides* and 13% of the burden of *T. trichiura* burden in SSA.

A cross-sectional study conducted in Amhara national regional state by Mulat 2012 among SAC showed that 77.9% were infected with one or more IPs and the pre- dominant parasite was hookworms (23.6%) followed by *G. lamblia* (22.8%) and *E. histolytica/dispar/moshkovskii* (21.6%). Hand washing habit was significantly associated with IPIs. Similarly students who had no clean finger nails and had not wearing shoes habit acquire IPIs as compared to those who had wearing shoes habit and clean finger nails, respectively [34].

A comparative cross-sectional study conducted by Serkadis D. *et al.,* in 2012 among 369 government and private elementary schoolchildren in Jimma Town showed prevalence of STH infection to be 20.9% in private and 53.5% in government elementary schools. The most common parasites from both schools were *T. trichiura*. However, hookworms infections were present only among government schools. The school type and sex were significantly associated with STHs. High prevalence rate of STH infections were identified among students with the age range of 11-15 years in both private and government schools [33].

2.3 Malnutrition in children

Malnutrition refers to all deviations from adequate and optimal nutritional status in infants, children and adults. An institutional based cross-sectional study conducted by Mekonnen H. *et al.,* 2013 among 790 SAC showed prevalence of stunting, underweight and thinness to be 243 (30.7%), 96 (59.7%) and 294 (37.2%), respectively. The prevalence of malnutrition was high among schoolchildren aged 6-14 years old. Those children who were found to be both stunted and underweight were only eight (1.01%). Family size and latrine availability were significantly associated with malnutrition. However, statistically significant association was not found between malnutrition and IPIs and other health conditions [44].

The national survey of health and nutrition of schoolchildren conducted by Hall A. *et al.,* 2005 among 7572 children from 142 schools in Ethiopia showed that 7556 (22.3%) were stunted and 23.1% were thin. The prevalence of *A. lumbricoides,* hookworms, *T. trichiura, H. nana and G. lamblia* was 20.7%, 7.7%, 6.0%, 2.0% and 3.2%, respectively [45].

2.4 Relationship between IPIs and anthropometric indicator of schoolchildren

A cross-sectional study conducted among 320 children by Ana Lourdes S. *et al*., 2013 showed prevalence of STHs to be 72.5%, children 10 years of age were more infected. Prevalence was 30%, 67% and 16% for *A. lumbricoides, T. trichiura* and hookworms, respectively. Stunting was observed in 5.6% of children and it was associated with increasing age. Also 2.2% of study children were thin and 1.3% underweight. Moderate to heavy infections and poly-parasitism were significantly associated with decreased values in WAZ [46].

Other study conducted by Quihui cota *et al*., 2006 among SAC showed that more than half of the children in the study infected by IPs. Pathogenic parasites like *G. lamblia, H. nana* and the non-pathogenic parasites *E. coli and E. nana* were having higher prevalence. Higher prevalence of IPs was found in children with lower HAZ and WAZ than in normally nourished children. Significant associations were found between *H. nana* and *T. trichiura* infection and nutritional status [37].

Similarly, a school based cross-sectional survey conducted by Ulukanligil M. *et al.,* 2004 among 806 children, showed that underweight was significantly associated with sex of children, boys had significantly higher underweight rate than girls. Wasting was significantly associated with the type of

settlements. *A. lumbricoides* was the most prevalent helminthes followed by *T. trichiura*, *H. nana* and *Taenia* species [47].

A cross-sectional study conducted by Lwanga F. *et al.,* 2012 in Uganda among 432 primary schoolchildren showed prevalence of hookworms, *T. trichiura, S. mansoni* and *A. lumbricoides* infections to be 10.9%, 3.1%, 1.9% and 0.2%, respectively. IP prevalence was associated with age and sex. The prevalence of stunting, underweight and moderate acute malnutrition (MAM) was 22.5%, 5.3% and 18.5%, respectively. Children in the age group of 10–14 year were 2.9 times more likely to be stunted compared to the other age group ($p = 0.002$) but, no association was observed between IPIs and nutritional status [48].

A cross-sectional study conducted by Kenneth N. *et al.,* 2012 among 418 schoolchildren in Nigeria showed prevalence of infection with any IPs were 67.4%. The prevalence of IPs and under nutrition were significantly higher in rural than in urban children. The prevalence of stunting, underweight and wasting for rural and urban children were 42.3% vs. 29.7%, underweight: 43.2% vs. 29.6% and wasting: 10.9% vs. 6.4%, respectively. Hookworms and *A. lumbricoides* were significantly associated with stunting, wasting and underweight ($p<0.001$) [49].

A similar cross-sectional study conducted in Northwest Ethiopia by Bemnet A. *et al.,* 2013 among 405 schoolchildren showed that 22.7% of children found to be positive for IPs and the most predominant IPs detected was *A. lumbricoides* (48.1%). Prevalence of underweight, stunting and wasting was 15.1%, 25.2%, 8.9%, respectively. However, there was no statistically significant association between prevalence of malnutrition and IPIs [12]. Similar study in Angulale by Linh *et al.,* 2012 showed that 30.2% of children were infected with *G. lamblia and E. histolytica/dispar/moshkovskii.* Infection with any helminthes was also identified in 7.0%, stunting was found among 10.2% of the boys and 12.1% of the girls, while wasting was found in 19.5% of boys and 19.7% of girls. Underweight was seen in 20.5% of the boys and 21.1% of the girls. Generally, those with poor nutritional status were more likely to have any IPIs [50].

Other study conducted among 358 schoolchildren in Adama by Reji P. *et al.,* 2008 showed that 35.5% children were infected by one or more parasites. The most frequent parasites were *E. histolytica/dispar/moshkovskii* (12.6%) and *H. nana* 8.9% and the least was *S. mansoni* 0.3%. The majority of infection intensity was light. The rate of IPIs was not significantly associated with sex, age and nutrition ($P > 0.05$). The overall prevalence of malnutrition was 21.2%. Those children whose

families had a monthly income of less than 200 ETB were highly affected by malnutrition ($p < 0.008$), but IPIs was not associated with malnutrition [29].

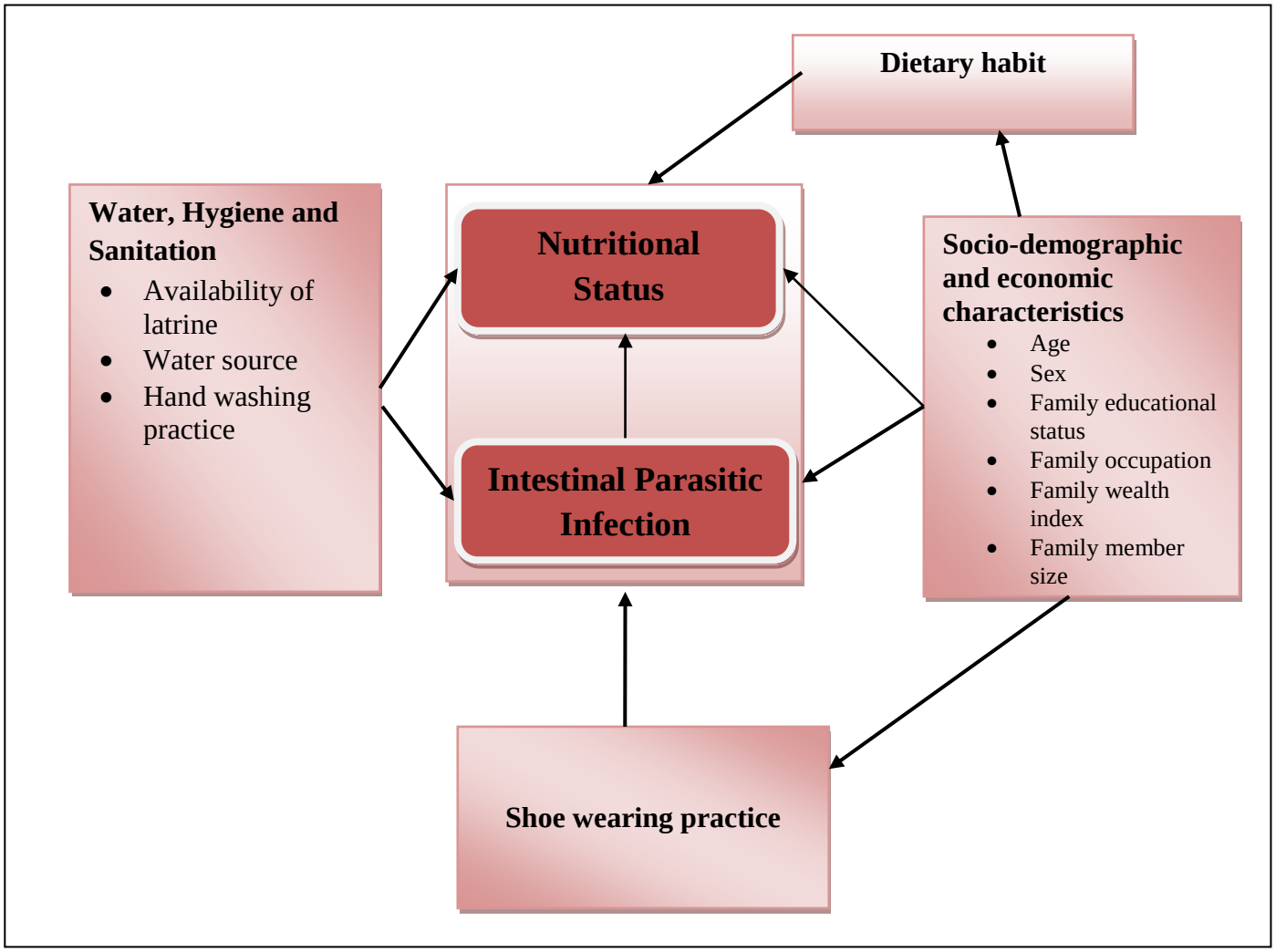

Figure 1: Conceptual framework of intestinal parasitic infection and nutritional status

2.5 Significance of the study

In Ethiopia, many studies have been carried out on the prevalence of parasitic infection in children but there are limited studies on IPs and nutritional status among SAC [23, 28, 33]. Prevalence of IPI is high in Jimma Town, however according to available data there are no published studies conducted on IPIs and nutritional status among SAC in Jimma Town.

Therefore, this study aimed at providing recent and valuable information on the prevalence of IPI and nutritional status among schoolchildren in Jimma Town for those who are working on the prevention and control of IPI. In addition, it can be used as a baseline data for further study in the area.

CHAPTER THREE

OBJECTIVES

3.1 General objective

To determine the prevalence of intestinal parasitic infections and assess their association with nutritional status of public elementary schoolchildren in Jimma Town, Southwest Ethiopia.

3.2 Specific objectives

- To determine prevalence of intestinal parasitic infections among schoolchildren in Jimma Town.
- To determine nutritional status of the schoolchildren in Jimma Town.
- To identify factors associated with nutritional status of schoolchildren.
- To identify factors associated with intestinal parasitic infections among schoolchildren in Jimma Town.

CHAPTER FOUR

METHODS AND MATERIALS

4.1. Study area and period

The study was conducted from April to May 2014, in public elementary schools in Jimma Town found in Oromia regional state. Jimma Town is located at 350 km Southwest of Addis Ababa. According to the 2007 Central Statistical Agency (CSA) census report, the projected total population of the town is 134,040 [51]. The town generally characterized by warm climate with mean annual maximum and minimum temperature of 30°C and 14°C, respectively. The annual rainfall ranges from 1138 to 1690 mm.

In the town, there are 14 public and 20 private elementary schools. According to the information obtained from Education Office of Jimma Town, there are a total of 26,290 SAC attending class in Jimma Town in 2013/14 academic year of which, 19,449 (9047 males and 10402 females) were in public and 6841 (3348 males and 3493 females) were in private elementary schools.

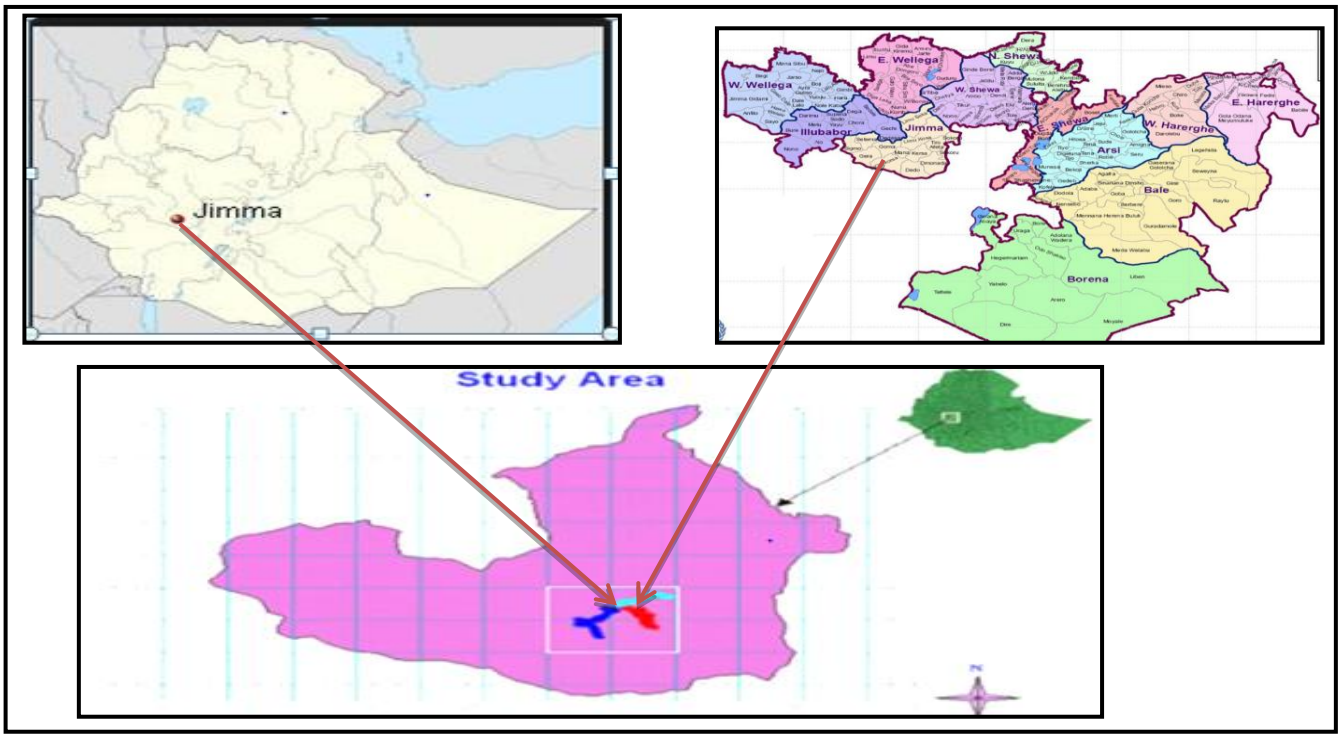

Figure 2: Administrative map of Jimma Town

4.2 Study design

Facility based cross-sectional study design used.

4.3 Population

4.3.1 Source population

The source populations were all children attending public elementary schools in Jimma Town in the academic year 2013/14.

4.3.2 Study population

The study population was those schoolchildren enrolled in the selected four public elementary schools in Jimma Town during the academic year of 2013/2014.

4.3.3 Study subjects

The study subjects were schoolchildren randomly selected from the four public elementary schools in Jimma Town who met the inclusion criteria.

4.4 Sample size determination and sampling techniques

4.4.1 Sample size determination

The sample size was calculated using the general formula for single population proportion [45] with the following assumptions: proportion of parasitic infection among public elementary schoolchildren in the study area to be 86.2% [35], 95% confidence level and 5% marginal error. Thus:

$$\mathbf{n=\frac{Z^2 \times p(1-p)}{d^2}}$$

$$\mathbf{n=}\frac{(1.96)^2 x 0.862\ (0.138)}{(0.05)^2}$$

$$\mathbf{=\underline{185}}$$

Where:

P = Prevalence rate of 86.2% [35]

d = Margin of sampling error tolerated between the sample and population 5%

α = Critical value at 95% confidence interval of certainty (1.96)

n = minimum sample size

Z = 95% confident level

Since multistage sampling technique was used in this study, a design effect was considered; hence the sample size was multiplied by 2 after adding 10% for anticipated non-response rate. Finally, the calculated sample size was **407** schoolchildren.

4.4.2 Sampling techniques

Four hundred seven (407) children were selected using multistage sampling technique. The schools were clustered geographically in to four groups by Jimma Town Office of Education. These are Jiren: (Jiren 1, Jiren 2, yewket chora), Jimma: (Ginjo, Jitu, Jimma), Mandera: (Hibret, Mandera, Seto-yedo) and Hermata: (Kito, Medresa, Dilfre, Hermata, Hamle). Then one school was randomly selected from each stratum using lottery method and then the total sample size of 407 children was allocated to each of the selected schools in proportion to the total number of student population in each school. Finally, a systemic random sampling technique was applied to select the study subjects from each classroom (Figure 2).

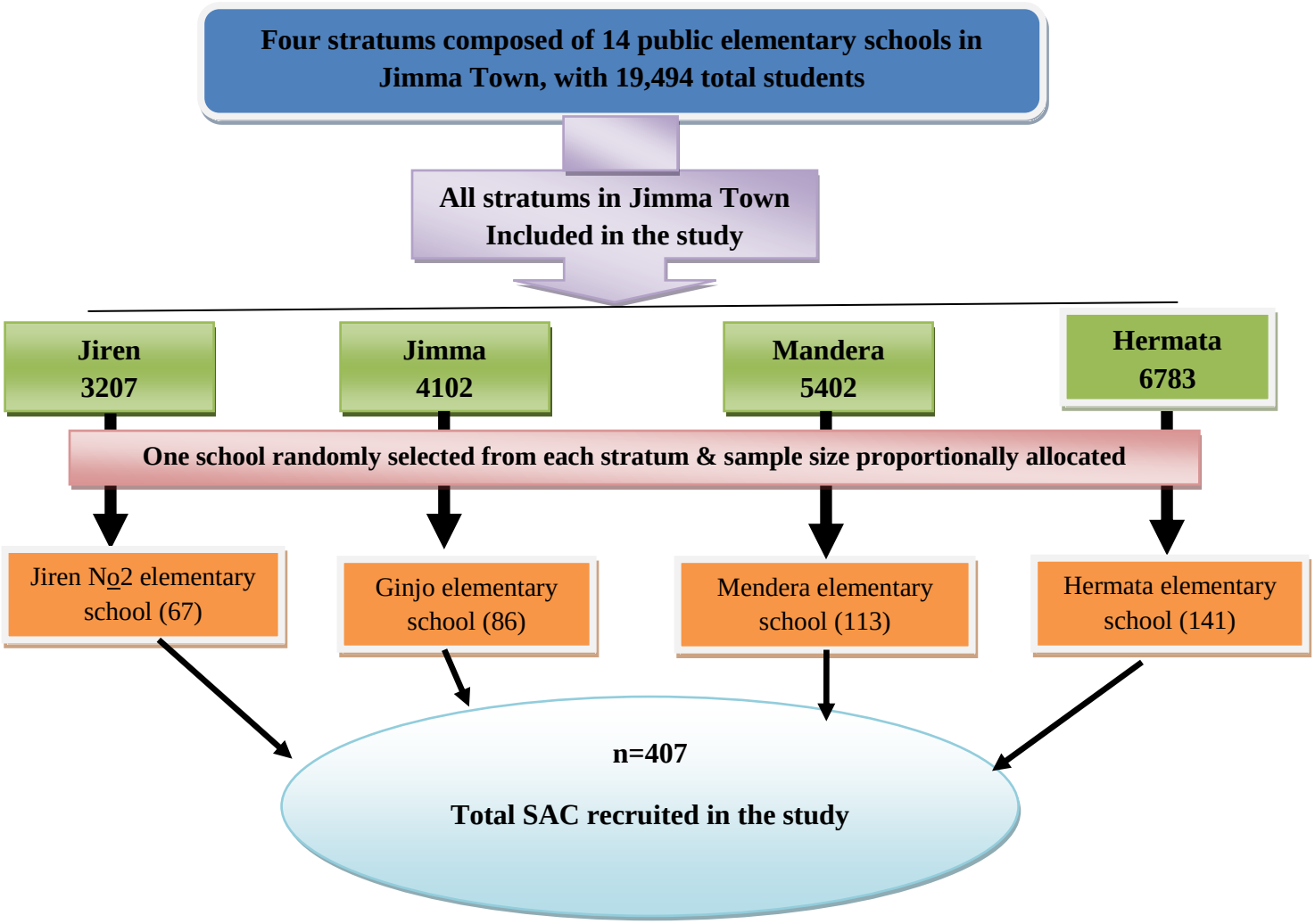

Figure 3: Flow chart showing sampling procedure and scheme of schoolchildren in Jimma Town

4.5 Inclusion and exclusion criteria

4.5.1 Inclusion criteria

- Children available at school during the study period.
- Children whose ages were between five and fourteen years.
- Children who were willing to participate and those parents/guardians have signed the consent form.

4.5.2 Exclusion criteria

- Children who had taken anti-helminthic or protozoa drug within one month before the study.
- Children who provide insufficient sample.

4.6 Methods of data collection

4.6.1 Demographic data

A pre-tested, structured questionnaire was used to collect data related to the objectives of the study. The questionnaire covered a range of topics including socio-economic and demographic factors like educational status of parents, occupation of parents, household family sizes and others. Wealth index was developed based on the ownership of fixed assets including: radio/tape, television, car, refrigerator, sofa, bicycle, motorcycle, mobile/telephone and others. The wealth index was then computed into tertiles. The questionnaire was initially prepared in English and then translated to Amharic and Afan Oromo by a fluent speaker of both languages to ensure its consistency. Then, two trained clinical nurses interviewed the children's parents/guardians in their mother tongue, Afan Oromo or Amharic language.

4.6.2 Collection and examination of stool specimen

4.6.2.1 Collection of stool specimen

Before collection of stool specimen, the research benefits were explained to the teachers and the selected schoolchildren. Then each selected schoolchildren was provided with a labeled clean stool cup, a piece of applicator stick and a plain paper. The stool cup had a code number, the code number of the container and the name of the children who took that particular container were recorded in a laboratory report format. This was so as to avoid the accidental exchange of specimens among children. The children were instructed that, once they go to the latrine,

defecate on a piece of paper provided, to avoid contamination from the toilet environment and then using an applicator stick they should pick up a portion of the stool and put it into the clean plastic container provided and deliver it. Using a list of names with their corresponding code numbers, stool specimen was collected. The number on the container were compared with the number recorded when they were provided the container to check if it was the right container for her/him. The collected samples were transported immediately for examination to Jimma University STH Laboratory.

4.6.2.2 Examination of stool specimen

The parasitological examinations of the stool were carried out using direct wet mount preparation and McMaster egg counting technique following standard operational procedures (SOP).

Direct stool examination

Each fecal sample was examined as a direct wet smear in physiological normal saline. The slides were systematically examined under the (10X) and high power (40X) objectives by experienced laboratory technologist at Jimma University STH Laboratory.

McMaster egg counting technique

McMaster egg counting technique was employed to identify and determine intensity of infection in the study participants. Briefly, two grams of stool were suspended in 30 ml of saturated salt solution at room temperature (density, 1.2, prepared by adding NaCl to 5 l of warm distilled water until no more salt went into solution and the excess settled on the bottom of the container). The fecal suspension was poured three times through a wire mesh (aperture of 250 mm) to remove large debris. Then, 0.5 ml aliquots will be added to each of the two chambers of a McMaster slide. Both chambers were examined under a light microscope using a 100x magnification and the fecal egg count, expressed as EPG for each helminthes species, obtained by multiplying the total number of eggs by 50.

A study participant was considered positive for IPIs, if they were infected with at least one species of IP and they are considered to have a multiple infection, if they were infected with more than one IP species.

The intensity of infection was reported based on the WHO criteria [52]. For *A. lumbricoides*, 1–4,999 EPG was reported as light, 5,000 to 49,999 EPG as moderate and 50,000 EPG and higher as heavy infection. For *T. trichiura*, 1–999 EPG were reported as light, 1,000–9,999 EPG as moderate and 10,000 EPG and higher as heavy infection. An egg count of 1-1,999 EPG, 2,000-3,999 EPG and 4,000 EPG and higher was reported as light, moderate and heavy, respectively for hookworms infections.

4.6.3 Physical examination

Trained clinical nurse examined the study participants physically for wearing shoes, presence of edema and fingernail status. The observations were recorded in the recording format.

4.6.4 Assessment of nutritional status

4.6.4.1 Anthropometric measurements

Body size and growth were assessed through weight and height measurements. Weight and height was measured using a digital portable weighing calibrated scale (Detecto, USA) of the selected schoolchildren by trained clinical nurse. The schoolchildren were weighed wearing lightly clothed, without shoes. The height was measured to the nearest 0.1 cm precision. The weighing scale was calibrated to zero before taking every measurement. To reduce intra-individual errors, weight and height was measured twice and the mean value was used for the analysis. The Z-scores of height-for-age (HAZ), weight-for-height (WHZ) and weight-for-age (WAZ) was calculated using WHO Anthro 2007 (World Health Organization, Geneva, Switzerland) [53]. Under nutrition was defined for a child, who has less than -2 Z-scores (-2SD). This value was used as cut-off points for determination of malnourishment. Children were classified as stunted, wasted and underweight if their HAZ, WHZ and WAZ was < - 2 SD, respectively.

weight-for-age reference data are not available beyond age 10 because this indicator does not distinguish between height and body mass in an age period where many children are experiencing the pubertal growth spurt and may appear as having excess weight (by weight-for-age) when in fact they are just tall.

4.6.4.2 Dietary diversity score

The dietary diversity was assessed using questions that specifically covered food consumption during the past 24 hr period containing cereals and grain, fruits, vegetables, protein rich foods, dairy products, oily and fat, discretionary calories foods that are commonly consumed in the study area. Participants were asked to report the frequency of consumption of each food using the past 24 hours. Participants received 1 point if they consumed at least once during the last 24 hours of the foods within each subgroup and 0 points if they never consumed the food. The food items were grouped into seven according to the food guide pyramid [54]. A dietary diversity score (DDS) was calculated as the sum of the food groups consumed over 24 hours. The dietary diversity score ranged from one to seven. The

mean (±SD) dietary diversity score in the study group was 4.92 (± 0.93). Then tertiles of the dietary diversity score were computed with the highest tertile defined as diversified diet, while the lowest two tertiles combined were labeled as undiversified diet.

4.7 Variables

4.7.1 Dependent variable

- Intestinal parasitic infection
- Nutritional status

4.7.2 Independent variables

- Age
- Sex
- Dietary habit
- Family occupation
- Family education status
- Height & weight
- Latrine availability
- Latrine using habit
- Shoe wearing habit
- Household wealth
- Source of water for drinking
- Fingernail status
- Family member size
- Place of bathing
- Hand washing habit before meal
- Hand washing habit after defecation

4.8 Data quality management

To have reliable information the data collector were trained by the principal investigator (PI) before the survey. Pre-test was conducted on 20 children from Mendera elementary school prior to actual data collection. SOP was followed in every steps of the analysis of samples. Data collected using the

questionnaires were checked for completeness at the end of each day. Moreover, negative specimens were re-examined on the same day at the same time by another laboratory technologist and PI.

4.9 Data analysis and interpretation

Data were entered, cleaned and analyzed using SPSS for windows version 20 (SPSS, INC., Chicago, IL, USA). Descriptive statistics were used to summarize socio-demographic profile of the study participants. Bivariate and multivariate logistic regressions were used to determine association of malnutrition with IPIs and risk factors associated with IPIs and malnutrition. All variables with p-values less than 0.25 in the bivariate analysis were candidates for multivariate logistic regression and P-value less than 0.05 was considered statistically significant.

4.10 Ethical consideration

This research was reviewed and approved by ethical review committee of Jimma University and permission was obtained from each school administrations. Informed written consent was obtained from children's parent/guardians or study participants after a clear explanation of the purpose of the study, the procedure, benefits and possible discomfort including the right of voluntary participation and withdrawal at any time if they wished to do so. Any information obtained from participants during the study was kept confidential and those study participants who became positive for any parasite were treated according to the national guideline. Those study subjects who were malnourished were referred to Jimma University Specialized Hospital for further management.

4.11 Operational definitions

Schoolchildren: Are those children whose age is between 5 and 14 years old.

Stunting: Those schoolchildren who are < -2 SD of HAZ from the median value of the WHO child growth standard median.

Severe stunting: Those schoolchildren who are < −3 SD of HAZ from the median value of the WHO child growth standard median.

Under nutrition: Is a nutritional disorder developed due to inadequate intake of nutrients.

Underweight: Underweight refers to a deficit and is defined as low WAZ at < −2 SD of the median value of the WHO child growth standard median.

Wasting: Describes a recent and severe process that has produced a substantial weight loss, usually because of acute shortage of food or severe disease. Wasting refers

to low WHZ at < −2 SD of the median value of the WHO child growth standard median.

Severe wasting: Defined as weight-for-height < − 3 SD of the median value of the WHO child growth standard median.

High dietary diversity: Those study subjects who had the highest tertile of the dietary diversity score.

Poor dietary diversity: Those study subjects who had a dietary diversity score of the lowest two tertiles combined.

Rich: Those study subjects having the highest tertile of the wealth index score.

Medium: Those study subjects having the medium tertile of the wealth index score.

Poor: Those study subjects having the lowest tertile of the wealth index score.

CHAPTER FIVE

RESULTS

5.1 Demographic characteristics of the study participants

A total of 407 study participants were involved in this study. From these, three of the study participants had inappropriate stool specimen and they were excluded from analysis. Four hundred four schoolchildren of which 217 (53.7 %) females and 187 (46.3%) males were included in this study, with 99.3% response rate. The mean age of the children was 9.84 ± 2.16 (mean ± SD) years with age range from 5 to 14 years. Majority of mothers/guardians of the children (44.8%) were housewives and fathers 74 (34.2%) were government employees. More than half (65.1%) of the study participants live in family with household size of < 5, 165 (40.8%) of the study subjects father had above secondary education level and 157 (38.9%) of their mothers had no formal education. Almost equal percent of study participants have rich and poor wealth status, 33.4% and 34.9%, respectively. Majority (91.6%) of the study participants used protected water source and 34 (8.4%) unprotected water source for drinking. Almost all (99%) of participants had latrine at home. Most of the children (72.3%) eat raw vegetables (Table 1).

Table 1: Characteristics of the elementary schoolchildren in Jimma Town, Southwest Ethiopia, April to May 2014.

Variable	Frequency n (%)
Sex	
Female	217 (53.7)
Male	187 (46.3)
Age group in years	
5-9	123 (30.4)
10-14	281 (69.6)
Fathers occupation	
Farmer	28 (6.9)
Merchant	54 (13.3)
Government employee	138 (34.2)
Daily laborer	117 (29.0)
Private employee	67 (16.6)
Mothers/guardians occupation	
House wife	181 (44.8)
Merchant	53 (13.1)
Government employee	74 (18.3)
Daily laborer	41 (10.2)
Private employee	55 (13.6)
Fathers education	
No formal education	60 (14.9)
Primary	165 (40.8)
Secondary	99 (24.5)
Above secondary	80 (19.8)

Continued …	
Mothers/guardians education	
No formal education	157 (38.9)
Primary	134 (33.2)
Secondary	67 (16.6)
Above secondary	46 (11.3)
Source for water drinking	
Protected	370 (91.6)
Unprotected	34 (8.4)
Availability of latrine at home	
Present	400 (96.6)
Absent	4 (3.4)
Raw vegetable eating habit	
Yes	292 (72.3)
No	112 (27.7)
Household Wealth	
Poor	141 (34.9)
Medium	128 (31.7)
Rich	135 (33.4)

n= number

5.2 Prevalence of intestinal parasitic infections

The overall prevalence of IPIs in this study was 68.6%. Eight species of IPs (*A. lumbricoides*, *T. trichiura*, hookworms, *E. vermicularis*, *G. lamblia*, *E. histolytica/dispar/moshkovskii*, *S. mansoni and H. nana*) were identified in this study. The most frequent parasite identified was *T. trichiura* 141 (34.9%), followed by *A. lumbricoides* 115 (28.5%) and hookworms 46 (11.4%). While the least was *S. mansoni* (2%) (Figure 4).

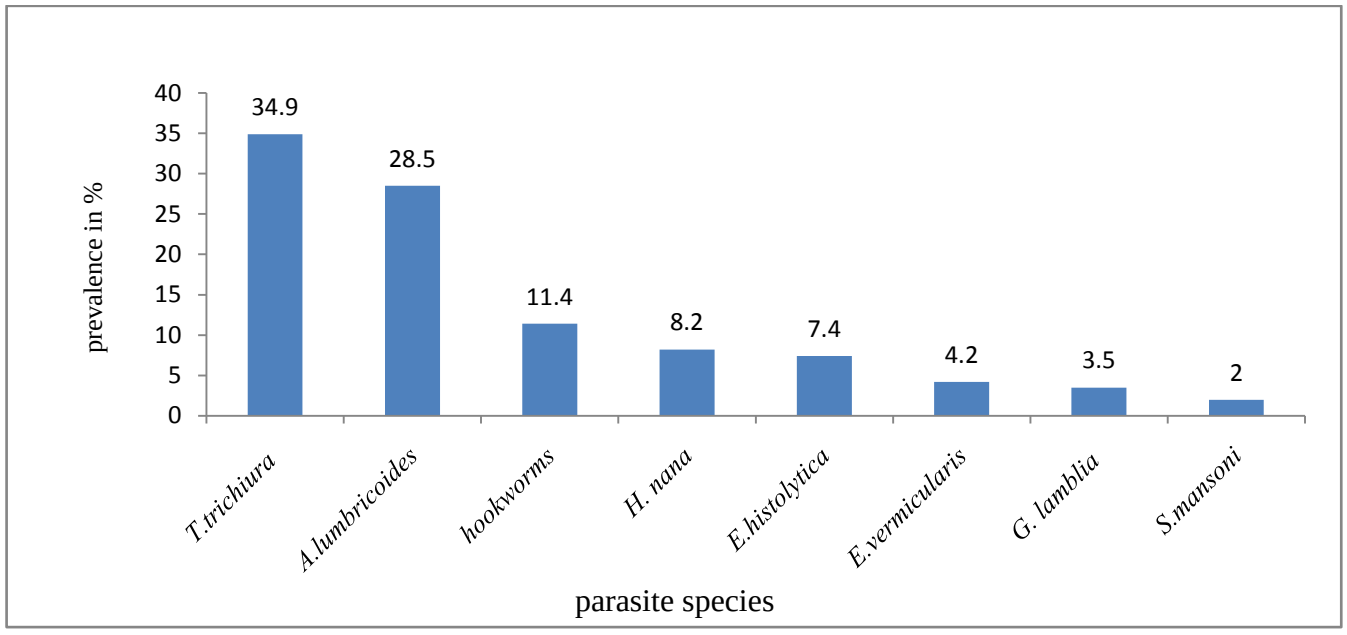

Figure 4: Prevalence of each species of intestinal parasites among the elementary schoolchildren in Jimma Town, Southwest Ethiopia, April to May 2014.

5.3 Intensity of soil transmitted helminthes

The McMaster slide result showed that majority of the children infected with *A. lumbricoides*, hookworms and *T. trichiura* had light infections intensity, accounting for 79 (68.7%), 43 (93.5%) and 128 (90.8%), respectively. Nine (7.8%) and one (0.7%) of the children had heavy infection with *A. lumbricoides* and *T. trichiura*, respectively (Table 2).

Table 2: Infection intensity of soil transmitted helminthes identified among the schoolchildren in Jimma Town, Southwest Ethiopia, April to May 2014.

Soil-transmitted helminthes	Infection intensity			Total
	Light n (%)	Moderate n (%)	Heavy n (%)	n (%)
A. lumbricoides	79 (68.7)	27 (23.5)	9 (7.8)	115 (38.1)
hookworms	43 (93.5)	3 (6.5)	0 (0)	46 (15.2)
T. trichiura	128 (90.8%)	12 (8.5%)	1 (0.7%)	141 (46.7)

n= number

The prevalence of single, double, triple infection were 166 (41.1%), 87 (21.5%) and 24 (6.0%), respectively (Figure 5).

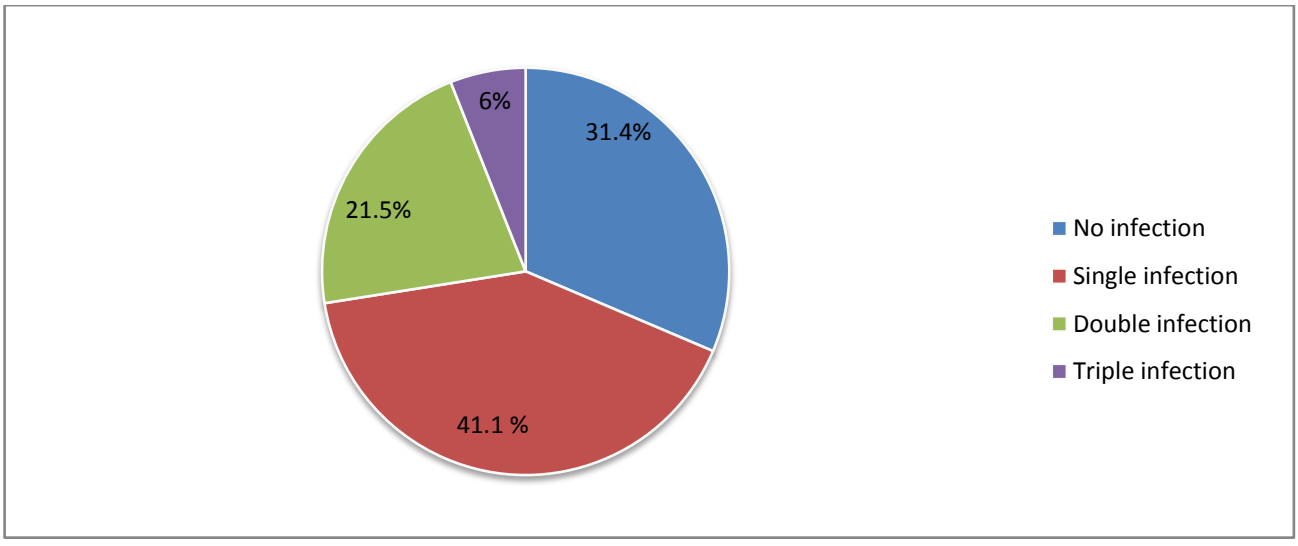

Figure 5: Prevalence of single, double and triple parasitic infections identified among schoolchildren in Jimma Town, Southwest Ethiopia, April to May 2014.

5.4. Factors associated with intestinal parasitic infections

After adjusting for possible confounding variables (Table 3), multivariate analysis showed that age between 10-14 years [AOR=1.152, 95% CI; (1.149-2.261)], place of bathing [AOR =2.576, 95% CI; (1.141-6.375)] and shoe wearing habit [AOR= 1.643, 95% CI; (1.104-2.598)] were predictors of IPIs.

Table 3: Factors associated with intestinal parasitic infections among the elementary schoolchildren in Jimma Town, Southwest Ethiopia, April - May 2014.

Variables	Total n (%)	Intestinal parasites		COR (95% CI)	P	AOR (95%CI)	P
		Positive n (%)	Negative n (%)				
Age group in years							
5-9	123 (30.4)	73 (59.3)	50 (40.7)	1			
10-14	281 (69.6)	204 (72.6)	77 (27.4)	1.163 (1.153-2.832)	0.009*	1.152 (1.149-2.261)	0.009*
Sex							
Female	217 (53.7)	148 (68.2)	69 (31.8)	1			
Male	187 (46.3)	129 (69.0)	58 (31.0)	1.037 (0.680-1.580)	0.866		
Fathers education							
No formal education	60 (14.9)	41 (68.3)	19 (31.7)	1.162 (0.570-2.368)	0.679		
Primary	165 (40.8)	120 (72.7)	45 (27.3)	1.436 (0.810-2.547)	0.216		
Secondary	99 (24.5)	64 (64.8)	35 (35.4)	0.985 (0.531-1.825)	0.961		
Above secondary	80 (19.8)	52 (65.0)	28 (35.0)	1			
Mothers/guardians education							
No formal education	157 (38.9)	104 (66.2)	53 (33.8)	1.047 (0.524-2.089)	0.897		
Primary	134 (33.2)	96 (71.6)	38 (28.4)	1.347 (0.660-2.750)	0.413		
Secondary	67 (16.6)	47 (70.1)	20 (29.9)	1.253 (0.562-2.793)	0.581		
Above secondary	46 (11.3)	30 (65.2)	16 (34.8)	1			
Mothers/guardians occupation							
House wife	181 (44.8)	117 (64.6)	64 (35.4)	1			
Merchant	53 (13.1)	40 (75.5)	3 (24.5)	1.683 (0.839-3.376)	0.143	1.575 (0.768-3.229)	0.215
Gov. employee	74 (18.3)	53 (71.6)	21 (28.4)	1.381 (0.765-2.491)	0.284	1.459 (0.776-2.742)	0.240
Private employee	55 (13.6)	40 (72.7)	15 (27.3)	1.055 (0.517-2.154)	0.883	1.094 (0.522-2.297)	0.811
Daily labor	41 (10.2)	27 (65.9)	14 (34.1)	1.459 (0.749-2.842)	0.267	1.260 (0.621-2.555)	0.522
Fathers occupation							
Private employee	67 (16.5)	44 (65.7)	23 (43.3)	1			
Farmer	28 (6.9)	23 (82.1)	5 (17.9)	2.405 (0.808-7.157)	0.115		
Merchant	54 (13.4)	29 (53.7)	25 (46.3)	0.606 (0.291-1.265)	0.182		
Gov. employee	138 (34.2)	96 (69.6)	42 (30.4)	1.195 (0.642-2.224)	0.574		
Daily labor	117 (29.0)	85 (72.6)	32 (27.4)	1.388 (0.726-2.654)	0.321		
Source of water for drinking							
Protected	370 (91.6)	251(67.8)	119 (32.2)	1			
Unprotected	34 (8.4)	26 (76.5)	8 (23.5)	1.541 (0.677-3.505)	0.303		
Finger nail status							
Trimmed	320 (79.2)	221 (69.1)	99 (30.9)	1			
Untrimmed	84 (20.8)	56 (66.7)	28 (33.3)	1.116(0.669-1.862)	0.674		
Place of bathing							
At home	363 (89.9)	242 (66.7)	121 (33.3)	1			
River	41 (10.1)	35 (85.4	6 (14.6)	2.917 (1.194-7.124)	0.019*	2.576 (1.141-6.375)	0.041*
Shoe wearing habit							
Always	248 (61.4)	159 (64.1)	89 (35.9)	1			
Sometimes	156 (38.6)	118 (75.6)	38 (24.4)	1.738 (1.110-2.721)	0.016*	1.643 (1.104-2.598)	0.033*
Hand washing habit before meal							
Water only	242 (59.9)	173 (71.5)	69 (28.5)	1.398 (0.914-2.140)	0.123	1.364 (0.874-2.128)	0.172
Soap and water	162 (40.1)	104 (64.2)	58 (35.8)	1			
Family size							
< 5	263 (65.1)	178 (67.7)	85 (32.3)	1			
≥ 5	141 (34.9)	99 (70.2)	42 (29.8)	1.126 (0.722-1.755)	0.601		

*Statistically significant at P < 0.05, COR = Crude odds ratio, AOR = Adjusted odds ratio, adjusted for other factors shown in the table, CI = Confidence Interval, P= P-value, gov. employee =government employee

5.5 Nutritional status of the schoolchildren

Out of the total children, 112 (27.7%) were malnourished. Among this, 53 (28.3%) were males and 59 were (27.2%) females. Two hundred and seventy six (68.3%) study subjects were having high dietary diversity score of which 77 (27.9%) were malnourished. From 277 (68.6%) study subjects who were positive for IPs, 79 (28.5%) were malnourished with no statistical significant difference noted (P= 0.597). The Variable presence of edema of the feet and face was excluded from the logistic analysis because all of the schoolchildren (100%) had no edema (Table 4).

Table 4: Association of selected variables on nutritional status among the elementary schoolchildren in Jimma Town, Southwest Ethiopia, April to May 2014.

Variables	Total n (%)	Nutritional status		P
		Malnourished n (%)	Normal n (%)	
Age group in years				
5-9	123 (30.4)	32 (26.0)	91 (74.0)	0.612
10-14	281 (69.6)	80 (28.5)	201 (71.5)	
Sex				
Female	217 (53.7)	59 (27.2)	158 (72.8)	0.796
Male	187 (46.3)	53 (28.3)	134 (71.7)	
Dietary diversity Score				
Poor	128 (31.7)	35 (27.3)	93 (72.7)	0.908
High	276 (68.3)	77 (27.9)	199 (72.1)	
Intestinal parasites				
Present	277 (68.7)	79 (28.5)	198 (71.5)	0.597
Absent	127 (31.3)	33 (26.0)	94 (74.0)	

P= P-value, n= number

5.5.1 Prevalence of stunting, wasting and underweight in schoolchildren by sex and age group

The prevalence of stunting among age group 5-9 years was 27 (22 %) of which, 13 (24.1%) were males and 14 (20.3%) were females. Five (9.3%) of males and six (8.7%) of females were severely stunting. On the other hand, six (4.9 %) of schoolchildren were underweight, of which five (9.3%) were males and one (1.4%) was female. Severe underweight was seen among two (3.7%) of males but not among females. The extent of wasting was 10 (8.1%) of which males and females were seven (13%) and three (4.3%), respectively. There was no significant association in prevalence of stunting, underweight and wasting between males and females among age group 5-9 years (P>0.05) (Table 5).

Table 5: Prevalence of stunting, underweight and wasting status by sex, within age group 5-9 among the elementary schoolchildren in Jimma Town, Southwest Ethiopia, April to May 2014.

Sex	Total n (%)	Nutritional status				X^2	P
		Normal n (%)	Mild n (%)	Moderate n (%)	Severe n (%)		
Height of age (stunting)							
Male	54 (43.9)	24 (44.4)	17 (31.5)	8 (14.8)	5 (9.3)	0.253	0.615
Female	69 (56.1)	38 (55.1)	17 (24.6)	8 (11.6)	6 (8.7)		
Total	123 (100)	62 (50.5)	34 (27.6)	16 (13.0)	11 (8.9)		
Weight-for-age (Underweight)							
Male	54 (43.9)	44 (81.5)	5 (9.3)	3 (5.5)	2 (3.7)		
Female	69 (56.1)	63 (91.3)	5 (7.3)	1 (1.4)	0 (0)	7.112	0.068
Total	123 (100)	97 (78.8)	20 (16.3)	4 (3.3)	2 (1.6)		
Weight-for-height (wasting)							
Male	54 (43.9)	30 (55.5)	17 (31.5)	6 (11.1)	1 (1.9)		
Female	69 (56.1)	37 (53.7)	29 (42.0)	3 (4.3)	0 (0)	3.010	0.083
Total	123 (100)	67 (54.5)	46 (37.4)	9 (7.3)	1 (0.8)		

<-1 Z score –mild, <-2 Z score – moderate, <-3Z score –severe, P= P- value, X^2 =chi-square

The overall prevalence of stunting among age group 10 -14 years was 63 (22.4%). Of which 29 (21.8%) were males and 34 (23%) were females. Severe stunting was seen among 17 (11.5%) of females and eight (6%) of males. On the other hand, 22 (7.8%) of schoolchildren were wasted, of which 10 (7.5%) were males and 12 (8.1%) were females. Two (1.5%) of males and four (2.7%) of females were severely wasted. There was a significant association between stunting and sex among 10-14 years age group (p=0.031) (Table 6).

Table 6: Prevalence of stunting, wasting by sex, within age group 10 -14 years among the elementary schoolchildren in Jimma Town, Southwest Ethiopia, April to May 2014.

Sex	Total n (%)	Nutritional status				X^2	P
		Normal n (%)	Mild n (%)	Moderate n (%)	Severe n (%)		
Height- for- age (stunting)							
Male	133 (47.3)	71 (53.4)	33 (24.8)	21 (15.8)	8 (6.0)		
Female	148 (52.7)	60 (40.5)	54 (36.5)	17 (11.5)	17 (11.5)	8.878	0.031*
Total	281 (100)	131 (46.6)	87 (31.0)	38 (13.5)	25 (8.9)		
Weight-for-height (wasting)							
Male	133 (47.3)	104 (78.2)	19 (14.3)	8 (6.0)	2 (1.5)		
Female	148 (52.7)	116 (78.4)	20 (13.5)	8 (5.4)	4 (2.7)	7.112	0.068
Total	281 (100)	220 (78.3)	39 (13.9)	16 (5.7)	6 (2.1)		

*Statistically significant at P < 0.05, <-1 Z score = mild, <-2Z score = moderate, <-3Z score = severe, P= P-value, X^2=chi-square

5.6 Intestinal parasitic infections and nutritional status

Among schoolchildren infected with IPs, 79 (28.5%) were malnourished. Out of *T. trichiura, A. lumbricoides*, hookworms, *E. vermicularis, H. nana, E. histolytica/dispar/moshkovskii, G. lamblia* and *S. mansoni* infected schoolchildren, 45 (31.9%), 34 (29.6%), 12 (26.1%), 2 (11.8%), 9 (27.3%), 6 (20%), 4 (28.6%) and 5 (62.5%) were malnourished, respectively (Figure 6).

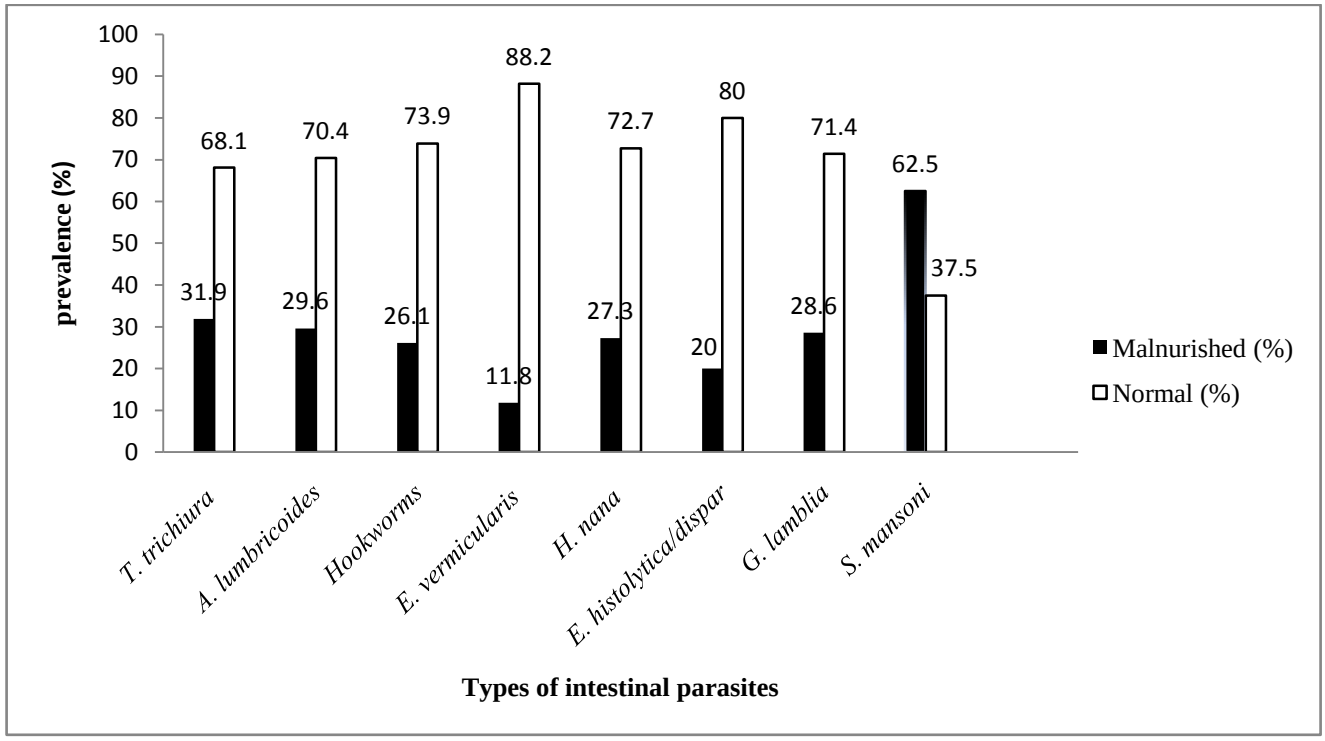

Figure 6: Prevalence of malnutrition among intestinal parasite infected schoolchildren in Jimma Town, Southwest Ethiopia, April to May 2014.

Among IPIs *T. trichiura* showed significant association with both stunting (p=0.022) and wasting (p = 0.035). However, the other IPs (*A. lumbricoides,* hookworms, *E. histolytica/dispar/moshkovskii, E. vermicularis, H. nana, G. lamblia and S. mansoni*) had no significant association with stunting and wasting (Table 7).

Table 7: Association of stunting and wasting with parasite species among the elementary schoolchildren in Jimma Town, Southwest Ethiopia, April to May 2014

Parasites	Total n (5%)	Stunting		P	Wasting		P
		Yes n (%)	No n (%)		Yes n (%)	No n (%)	
T. trichiura							
Yes	141 (34.9)	40 (28.4)	101 (71.6)	0.022*	5 (3.5)	136 (96.5)	0.035*
No	263 (65.1)	50 (19.0)	213 (81.0)		23 (8.7)	240 (91.3)	
A. lumbricoides							
Yes	115 (28.5)	27 (23.5)	88 (76.5)	0.404	9 (7.8)	106 (92.2)	0.399
No	289 (71.5)	63 (21.8)	226 (78.2)		19 (6.6)	270 (93.4)	
Hookworms							
Yes	46 (11.4)	10 (21.7)	36 (78.3)	0.548	2 (4.3)	44 (95.7)	0359
No	358 (88.6)	80 (22.3)	278 (77.7)		26 (7.3)	332 (92.7)	
E. vermicularis							
Yes	17 (4.2)	2 (11.8)	15 (88.2)	0.229	0	17 (100)	0.287**
No	387 (95.8)	88 (22.7)	299 (77.3)		28 (7.3)	359 (92.8)	
H. nana							
Yes	33 (8.2)	8 (24.2)	25 (75.8)	0.461	1 (3.0)	32 (97.0)	0.311
No	371 (91.8)	82 (22.1)	289 (77.9)		27 (7.3)	344 (92.7)	
E. histolytica							
Yes	30 (7.4)	4 (13.3)	26 (86.7)	0.160	2(6.7)	28 (93.3)	0.655**
No	374(92.6)	86 (23.0)	288 (77.0)		26 (7.0)	348 (93.0)	
G. lamblia							
Yes	14(3.5)	4 (28.6)	10 (71.4)	0.381	0	14 (100)	0.655**
No	390(96.5)	86 (22.1)	304 (77.9)		28 (7.2)	362 (92.8)	
S. mansoni							
Yes	8(2.0)	3 (37.5)	5 (62.5)	0.254	2(25)	6 (75)	0.100**
No	396 (98.0)	87 (22.0)	309(78.0)		26 (6.6)	370 (93.4)	

*Statistically significant at P < 0.05, ** Fishers exact value, P= P-value

After adjusting for possible confounding variables (Table 8), the multivariate analysis result showed that mother`s occupation and wealth index had significant association with nutritional status.

Children whose mother`s occupation was merchant had 2 times more likely increased risk of malnutrition compared with house wives [AOR = 2.095, 95%, CI; (1.545-4.199)]. Wealth index has also significant association with malnutrition [AOR= 0.566, 95%, CI; (0.320-0.901)] (Table 8).

Table 8: Factors associated with nutritional status among the elementary schoolchildren in Jimma Town, Southwest Ethiopia, April to May 2014.

Variables	Total n (%)	Nutritional status		COR (95% CI)	P	AOR (95% CI)	P
		Malnourished n (%)	Normal n (%)				
Sex							
Female	217 (53.7)	59 (27.2)	158 (72.8)	1			
Male	187 (46.3)	53 (28.3)	134 (71.7)	1.059 (0.685-1.639)	0.796		
Age group in years							
5-9	123 (30.4)	32 (26.0)	91 (74.0)	1			
10-14	281 (69.6)	80 (28.5)	20 (71.5)	1.132 (0.701-1.827)	0.612		
Intestinal parasitic infections							
Present	277 (68.6)	79 (28.5)	198 (71.5)	1.137 (0.707-1.827)	0.597	0.973 (0.585-1.618)	0.916
Absent	127 (31.4)	33 (26.0)	94 (74.0)	1			
Father education							
No formal education	60 (14.9)	16 (26.7)	44 (73.3)	1.091 (0.508-2.342)	0.823		
Primary	165 (40.8)	48 (29.1)	117 (70.9)	1.231 (0.670-2.259)	0.503		
Secondary	99 (24.5)	28 (28.3)	71 (71.7)	1.183 (0.606-2.309)	0.622		
Above secondary	80 (19.8)	20 (25.0)	60 (75.0)	1			
Mothers education							
No formal education	157 (38.9)	34 (21.7)	123 (78.3)	0.518 (0.253-1.060)	0.072	0.516 (0.249-1.071)	0.076
Primary	134 (33.2)	36 (26.9)	98 (73.1)	0.689 (0.336-1.411)	0.308	0.708 (0.341-1.472)	0.355
Secondary	67 (16.6)	26 (38.8)	41 (61.2)	1.189 (0.545-2.596)	0.664	1.238 (0.558-2.748)	0.600
Above secondary	46 (11.3)	16 (34.8)	30 (65.2)	1		1	
Mothers occupation							
House wife	181 (44.8)	46 (24.9)	136 (75.1)	1		1	
Merchant	53 (13.1)	19 (35.8)	34 (64.2)	1.689 (0.877-3.251)	0.117	2.095 (1.545-4.199)	0.037*
Gov. employee	74 (18.3)	19 (25.7)	55 (74.3)	1.044 (0.561-1.943)	0.892	0.444 (0.345-1.677)	0.863
Private employee	41 (10.2)	15 (36.6)	26 (63.4)	1.744 (0.849-3.580)	0.130	1.441 (0.680-3.055)	0.341
Daily labor	55 (13.6)	14 (25.5)	41 (74.5)	1.032 (0.516-2.066)	1.032	1.083 (0.523-2.078)	0.830
Father occupation							
Farmer	28 (6.9)	3 (10.7)	25 (89.3)	0.303 (0.82-1.124)	0.074	0.350 (0.093-1.315)	0.120
Merchant	54 (13.4)	10 (18.5)	44 (81.5)	0.574 (0.241-1.368)	0.210	0.577 (0.239-1.391)	0.221
Gov. employee	138 (34.2)	39 (28.3)	99 (71.7)	0.995 (0.521-1.902)	0.995	1.041 (0.536-2.020)	0.906
Daily labor	117 (29.0)	41 (35.0)	76 (65.0)	1.363 (0.709-2.619)	1.363	1.506 (0.771-2.939)	0.230
Private employee	67 (16.7)	19 (28.4)	48 (71.6)	1		1	
Household Wealth							
Poor	141 (34.9)	41 (29.1)	100 (70.9)	0.599 (0.344-1.042)	0.070	0.566 (0.320-0.901)	0.050*
Medium	128 (31.7)	28 (21.9)	100 (78.1)	0.877 (0.525-1.465)	0.617	0.811 (0.473-1.390)	0.446
Rich	135 (33.4)	43 (31.9)	92 (68.1)	1		1	
Family size							
< 5	263 (65.1)	74 (28.1)	189 (71.9)	1		1	
≥ 5	141 (34.9)	38 (27.0)	103 (73.0)	0.942 (0.595-1.491	0.800	0.917 (0.564-1.492)	0.728
Dietary diversity score							
Poor	128 (31.7)	35 (27.3)	93 (72.7)	0.973 (0.608-1.555)	0.908	0.903 (0.550-1.482)	0.686
High	276 (68.3)	77 (27.9)	199 (72.1)	1		1	

*Statistically significant at P < 0.05, COR = Crude Odds Ratio, AOR = Adjusted Odds Ratio, adjusted for other factors shown in the table, CI = Confidence Interval, P= P-value, n= Number

CHAPTER SIX

DISCUSSION

The major objective of this study was to determine the prevalence of IPIs and assess their association with nutritional status of public elementary schoolchildren in Jimma Town. Accordingly, the overall prevalence of IPIs in this study was 68.6% among the schoolchildren. This shows that IPIs are still a significant health problem among the schoolchildren. IPIs, particularly the STHs, may result in nutritional deficit in children. In this study, *T. trichiura* had significant association with nutritional indicator (stunting).

The overall prevalence of IPIs in this study is comparable with study conducted in Nigeria (67.4%) [49]. However the prevalence of IPIs in the study area was very high compared to the finding of studies conducted in Adama (35.5%) [29] and Gondar (22.7%) [12]. This might be due to the difference in the climate condition of the study areas. The prevalence was lower compared to the study conducted in Dagi primary school in Amara region (77.9%) [34]. Variation in socio-economic factors, personal hygienic practices, climatic and geographical factors may affect the epidemiology of intestinal parasites.

In the current study, 55% of the schoolchildren were infected with the STHs. Prevalence of *T. trichiura*, *A. lumbricoides* and hookworms were 34.9%, 28.5% and 11.4%, respectively. This finding was consistent with the finding of previous study conducted in Jimma Town, in which *T. trichiura*, *A. lumbricoides* and hookworms were predominate IPs [33]. The prevalence of *T. trichiura* (34.9%) was lower than with the previous report from Malaysia (71.7%) [39]. However, it was higher than the national survey among schoolchildren (20.7%) [45]. These variations could be due to difference in sample size, socio-economic, geography and environmental differences between the study participants.

The second most prevalent parasite in this study was *A. lumbricoides* (28.5%). Its prevalence was lower than prevalence rate reported in Cuba (40.5%) [36], Malaysia (37.4%) [39] and Nigeria (42.5%) [40] but higher than prevalence rate in India (1.5%) [55]. This could be due to the differences in the health care system, socio-economic status and ecological factors.

The prevalence of hookworms in this study was 11.4%, which is higher than report in Adama (2.2%) [29], Babile (6.7%) [56], Cuba (5.5%) [36] and India (5.3%) [55]. Similarly, the prevalence of hookworms in the present study was lower than prevalence reported from Dagi primary school in north

Ethiopia (23.6%) [34], Asendabo (25.5%) [35], Nigeria (26.4%) [40] and Malaysia (17.6%) [39]. This variation might be due to differences in environmental factors like climate, surface temperature, altitude, soil type and rainfall that may have an impact on the distribution of the parasite.

Age group had significant association with IPIs, children with in the age group 10-14 years had 1.2 times more likely increased risk of acquiring IPIs compared to the other age groups. This result was consistent with a study conducted in Jimma Town among schoolchildren [33]. This could be due to that, most children whose age groups 10-14 years do contact with soil contaminated with parasite egg while playing and running.

Intestinal parasites enter the body through different roots, skin penetration being one of the roots. The hookworms in particular penetrate the skin of susceptible host, those who are barefooted. The result of this study revealed that children who sometimes wear shoes were 1.6 times more likely to be infected with IPs compared to those who wear always. A similar finding was reported in Dagi primary school in Amhara region [34].

Place of bathing and IPIs had significant association. Schoolchildren who had the habit of washing their body in the river was two times more likely to be infected with IPIs. This could be due to that the water may be contaminated with the infective stage for parasite.

The fact that high prevalence of IPs observed in this study strengthens arguments to include school based de-worming preprograms in the health care package. This will enable the achievement of the millennium development goals (MDGs) related to child health and education [57].

It was also found that malnutrition is a considerable health problem with prevalence ranging 4 - 46% in developing countries [58]. In the present study, the overall prevalence of malnutrition among schoolchildren was 27.7%. The prevalence of stunting was 22.3%, which is consistent with the national study (22.3%)[45]. Also, it was lower compared to previous findings in north west Ethiopia (30.7%) [44] and in Nigeria (29.7%) [49].This difference might be due to differences in the study setups and behavior change communications at the grassroots level, which is expected to be better in the study setup due to the presence of health extension workers within the villages.

The prevalence of underweight in the present study (6.9%) was lower than the prevalence of underweight (37.2%) reported from Dagi primary school in Amhara region [44]. On the other hand, it was higher than the prevalence reported for schoolchildren in Uganda (5.3%) [48]. The variations may be probably due to differences in nutrition and types of staple food the communities live upon.

In this study there was a significant association between stunting and age group 10-14 years (p=0.031). However, this result contradicts with study in Angulale [50] and Adama [29] in which there is no association was reported.

Although causes of malnutrition are multi-factorial, IPIs have been associated with impaired growth [59, 60] and stunting [61]. There are several mechanisms by which intestinal parasites may cause or aggravate malnutrition including, impaired nutrient absorption resulting from infection and reduced appetite [62]. Adult helminthic worms residing in the small intestine interfere with their host nutrition and can induce damage to the intestinal mucosa that may reduce a person's ability to extract and absorb nutrient from food. IPIs can cause vomiting, diarrhea, anorexia, abdominal pain and nausea that may result in reduced food intake, thereby further reducing nutrient availability [63]. Also mild to moderate intensity helminthes infection during childhood have been associated with under nutrition and reduced physical fitness [64]. A study on nutritional impact of intestinal helminthiasis showed that growth and development during childhood could be diminished by ascariasis, trichiuriasis and hookworms infection [65].

Multivariate analysis of this study showed that schoolchildren whose mothers occupation was merchant had 2 times more likely malnourished compared to house wife. In addition to this, wealth index had significant association with malnutrition. Schoolchildren whose parents wealth status was poor was 56% less likely malnourished compared to rich.

In the present study, no significant association between IPIs and malnutrition was obtained inconsistent with the studies conducted in Mexican [37], Thailand [11], Brazil [66] and in Malaysia [67] which showed associations between IPIs and nutritional status among schoolchildren. Other factors, which were not assessed in this study, may also contribute to IPIs and malnutrition.

Intestinal parasitic infections affect childhood development and morbidity in many developing countries. Reducing the prevalence of parasitic infections in schoolchildren, may be of tremendous benefit on child growth, development and educational outcome. We also found that *T. trichiura* infection was associated with stunting. This finding implies that school based de-worming programs could contribute to the government's strategy of accelerated stunting reduction in Ethiopia[68].

LIMITATION OF THE STUDY

- Age determination was difficult as there were no birth certification cards for each child.
- One of the outcomes of IPIs was anemia but due to limitation of resource, it was not determined.
- Financial constraints made it difficult to check for false negatives slides for *S. mansoni* infection using a more sensitive method like Kato Katz. Therefore, there could be some false negatives, thus underestimating the prevalence.

CHAPTER SEVEN

CONCLUSION AND RECOMMENDATIONS

7.1 Conclusion

- The results of this study showed that the prevalence of intestinal parasites was high in the study area; IPIs was associated with age, shoe wearing habit and place of bathing. Taking bath at home and wearing shoes reduce risk of IPI.
- *T. trichiura* was the predominating parasitic infection among SAC of Jimma Town. In majority of schoolchildren infected with STH, the intensity of infection was light.
- Age, shoe wearing habit and place of bathing were factors significantly associated with IPIs among SAC.
- Even though no associations were observed with intestinal parasitic infections and malnutrition, *T. trichiura* in particular had significant association with nutritional indicator (stunting). The observed stunting may be due to a prolonged shortage of a balanced diet.
- Household wealth and mothers/guardians occupation were found to be predictors of malnutrition.

7.2 Recommendations

- The existing health information program should be strengthen so as to provide proper health information on prevention and control of IPIs.
- High prevalence of *T. trichiura* infection in the present study calls for behavior change on personal and environmental hygiene to reduce the burden of parasitic infections.
- School health programme for the assessment of malnutrition and health information for parents/ guardians on how to prevent malnutrition should be provided.
- Moreover, this study highlights the need for school based de-worming program to achieve accelerated stunting reduction.
- As malnutrition is a multi- factorial problem, detailed studies are required to investigate the association of IPI and malnutrition.

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ANNEXES

ANNEX I: Parasitological investigation procedures

Standard operating procedures for parasitological investigation of samples collected from the elementary schoolchildren at Jimma University Soil Transmitted Helminthes Laboratory

A. Direct examination of faecal specimens / wet mount smear preparations

Procedure

1. Using pencil or marker label the slide by student's code number.
2. Place one drop of 0.85% NaCl/ normal saline on 1 side and one drop of iodine solution on the other side of the slide.
3. Take a small amount (approximately size of mach stick head) of faecal specimen and thoroughly emulsify the stool in saline and the iodine.
4. Cover the preparation with cover slip at an angle in to the edge of the emulsified faecal drop. Push the cover slip across the drop before allowing it to fall into place.
5. Systematically scan the entire 22mm cover slip with overlapping fields with the 10x objective with the condenser closed sufficiently to give good contrast.
6. Switch to high (40X objective) for more detailed study of any suspect eggs or trophozoite or cysts.

B. McMaster Counting Technique

Procedure

Flotation solution (prepared 24 h before processing samples):

1. Heat 5 l water to 50 °C.
2. Gently add NaCl while stirring the suspension.
3. Stop adding NaCl when sediment appears.
4. Keep the solution at room temperature.

McMaster egg counting method

1. Place a 60-ml container on the electric scale.
2. Tare the scale (the display should show 0.00 g).
3. Homogenize the stool with a wooden spatula.
4. Weigh exactly 2 g of stool on the scale.

5. Add 30 ml of saturated NaCl.
6. Homogenize and pour the faecal suspension three times through tea strainer to with hold large debris. During the last sieving step, the filtrate must be squeezed dry
7. Rinse the McMaster slide and tap it on a hard surface
8. Homogenize the suspension filtrate by pouring it 10 times from one beaker to another, and fill one chamber of a regular McMaster slide using a Pasteur pipette. Repeat for the other side. Minimize the time between taking the suspension up in the pipette and transferring it into one of the chambers of the McMaster slide
9. Allow the McMaster slide to stand for 2 min, place under a light microscope and examine with 10X10 magnifications. Count all the eggs under the two separate
10. Calculate EPG of faeces by multiplying the total number of eggs within the grid of each chamber, ignoring those outside the squares; multiply the total count by 50 for each parasite species.

ANNEX II: Information sheet (English version)

Study Title: Intestinal parasitic infection and nutritional status among elementary schoolchildren in Jimma Town, Southwest Ethiopia.

Principal investigator: Derartu Hassen

Organization: Department of Medical Laboratory Sciences and Pathology College of Public Health and Medical sciences, Jimma University

Purpose of the research: IPI is common among school-aged children in Ethiopia. It is also very common here in Jimma Town. The aim of this study will be to determine prevalence of IPI and nutritional status among the elementary schoolchildren in Jimma Town.

Procedures: In order to undertake the above-mentioned study, some questions related with the topic, anthropometric measurement and faecal sample will be taken for laboratory investigation. Permission will be obtained from Jimma University and from each school administrative. So you are kindly asked to give required samples and information related with the study.

Safety: There is no any possible risk or discomfort during faecal sample collection and anthropometry measurement.

Benefits: Study result will able to create awareness among health professionals and policy makers to strengthen existing programs that take actions on IPIs. Based on their laboratory result the participant will be treated appropriately.

Confidentiality: The information obtained during this study will remain confidential. Disclosure of any of the data to third parties other than those allowed in the informed consent form will not be permitted. Records will remain confidential and the results of the tests will be coded to prevent identification of the volunteers. Stool samples collected will not be used for other research purposes and will be safely disposed after the completion of the study.

Right to refuse or withdraw: We assure you that our best care will be taken for your child if you agree to let him/her take part in the study. You should also know that you are free to withdraw your child from the study at any time and that he/she will not be discriminated in any form for education or health services.

Whom to Contact: If you have any questions about the study at any time, you contact Derartu Hassen (PI of the study) Tel: +251 917562727 (Mobile)

Email: deriabamecha@gmail.com

ANNEX III: Information sheet (Afan Oromo version)

Guca haayyama hirmaannaa

Ibsa haayyama hirmaannaa warraaf/kunuunsitoota ijoollee manneen barnoota mottumma sadarkaa 1ffaa keessaa filatamanii qorannoo kana keessatti hirmaataniif.

- **Qorataan duraa**: Daraartu Hasan
- **Dhaabbata**: Yuunivarsiitii Jimma
- **Mata dureen projeektii**: Sakatta faalama raamolee/maxxanne marimanii fi sirna sorataa ijoollee manneen barnoota mottumma sadarkaa 1ffaa baratan, magaala Jimmaa, Itiyoopiyaa.

Dhimmi qorannichaa: Ragaan akka mulisutti ijoolleen manneen barumsaa Itiyoophiyaa barataan raammolee garaa/marimaanitiin ni faalamu. Kunis as magaala Jimma keessatis baayyee kan mulatuu dha. Dhimmi qoranno kana Sakatta faalama raamolee/ maxxanne marimanii fi sirna sorataa ijoollee manneen barnoota motumma,sadarkaa 1ffaa magaala Jimmaa sakatta`uu dha.

Adeemsa: Akka ijoolleen keessan irratti hirmaatan eeyyamtanii booda,qorannoo kana gaggessuuf wantootni barbachisan kan akka bobbaa ho'aa, hanga dherinaa fi ulfina isaani yaliidhaaf ni fudhanna. Eyamni yuniivarsitii Jimmaa fi itti gafatamaa mannen baruumsa yaliin kun ittii gagefamuu hundarra ni fudhatama.

Midhaa fi Dhukkubbii: Iddattoo boobbaa kennuu jaraatiin miidhaa fi dhukkubbi jara irra gahuu hin jiraatu.

Faayidaawwan: Ijoleen kana keessatti hirmaatan raamolee marriimaanii/ maxxanne irraa bilisa akka ta'anii fi hin taane qoratamuufi wala'ansa barbaachisaa argachuun ni fayyadamu. Ijoolleen dhuma irrattis raamootiin qabamanis haala isaanii irratti hunda'uun yaalii atattamaa ni argatu. Bu'aan qoranichaa Ipiidomoolojii raamolee maariimaanii beekuu, mammile polisii basaniif akka bu`aa tokkotti ni gargaara.

Icitii: Odeeffannoon yommuu qorannoo kanaa argamu icitii dhaan eegama. odeeffannoon argame kun qaama biraaf dabarfame hin kennamuu. Iciitii kana eeguudhaaf, firiin qorannoo taasifamuu kun koodiin itti kennamee akka eenyummaan namoota fedhiitiin hirmatamanii akka hin beekamnne ta'a. Bobaa funaanamu haala protokolii keessaatti ibsameen alatti qo'annoo biraatiif osoo hin ooliin haala miidhaa hin finneen qo'annoon kun erga dhumee booda ni gatama.

Mirga diduu fi addan kutuu: Yoo akka ijoolleen keessan qorannoo kana keesatti akka hirmaatan eeyyamtan, of eegannoo guddoo akka isaanii goonu isin beeksisina. Akkasumas yeroo barbaadanii irratti mucaa keessaan hirmanaa qoranichaa akka addan kutu/kuttuu gochuuf mirga guutuu qabdu. Kanaaf immoo miidhaan/ loogiin mucaa keessaniira kara barnootaa fi waalansaa irra ga'u hin jiru.

Eenyuun akka qunnamtan: Yoo gaaffii qabaatan gaafachuu barbaadan, adde Daraartu hasan yunivarsiitti Jimmaatti qaamaan ykn kara lakk.bilbilila +251-917-562727 tiin dubbisuu ni dandeessu. Email: deriabamecha@gmail.com

ANNEX IV: Information sheet (Amharic version)

የምርምሩ ተሳታፊዎች ጥናት ማብራሪያ ቅፅ

<u>የጥናቱ ርዕስ</u>፡ የሆድ ውስጥ ተህዋስያን ወይም ትላትል መለከፍ እና ከስነ ምግብ ሁኔታ በጅማ ኣንደኛ ደርጃ ት/ቤት፡፡

<u>የተመራማሪዉ ስም</u> ፤ ደረርቱ ሀሰን

<u>የድርጅቱ ስም</u>፤ በጅማ ዩኒቨርስቲ የህክምና እና የሕብረተሰብ ጤና ሳይንስ ፋካሊቲ የላቦራቶሪ ትምርት ክፍል::

<u>የጥናቱ ዓላማ</u> ፡በሕጻናት የሆድ ውስጥ ተህዋስያን ወይም ትላትል መለከፍ እና ከስነ ምግብ ጥናት ጋር ያላቸው ቁርኝት ማወቅና የበሽታው ስርጭት ማጥናት፡፡

<u>የሥራው/የአካሄድ ቅደም ተከተል፡</u> ከላይ የተጠቀሰውን የጥናት አላማ ለማሳካት ለጥናቱ የምያስፈልጉ መረጃዎች እና ግብኣቶች፡ የሰገራ ናሙና፡ የቁመት፡የሰውነት ክብደት በመውሰድ አስፈላጊውን የላቦራቶሪ ምርመራ ይደረጋል፡፡

<u>አላስፈላጊ ጉዳት</u> : የሰገራ ናሙና ሲወሰድ ምንም አይነት ጉዳት አይኖረውም፡፡

<u>የጥናቱ ጥቅም፡</u> የሆድ ውስጥ ተህዋስያን ወይም ትላትል መለከፍ እና ከስነ ምግብ ሁኔታ ጋር ያላቸው ቁርኝት የሚያመጣው ተጽዕኖ በማጥናት በእነዚህ ተህዋስያን ምክንያት የሚከሰቱትን በሽታዎች ለመቀነስና የጤና ባለሙያዎችን ግንዛቤ እንዲያዳብር በማድረግ በሽታ መከላከልና ታማሚዎችንም ተገቢውን ህክምና እንዲያገኙ ያስችላል፡፡

<u>የሚስጢር አጠባበቅ፡</u> በዚህ ምርምር የሚገኝ ማንኛውም መረጃ በሚስጢር የሚጠበቅ ይሆናል፡፡ የሚሰበሰበው ማንኛውም መረጃ በስም እንዳይሆን ይደረጋል፡፡ ይህ የሚደረገው ለእያንዳንዱ የጥናት ተሳታፊ የተለየ ቁጥር በመስጠት ይሆናል፡፡በጥናቱ ወቅት የተወሰደው ናሙና ከተወሰደበት አላማ በስተቀር ለሌላ ጥናት አገልግሎት አይውልም ::

<u>በጥናቱ ያለመሳተፍ</u> **:**በዚህ ጥናት መሳተፍ በፍቃኝነት ላይ የተመሠረተ ብቻ ነው፡፡በተጨማሪ ተሳታፊዎች በማነኛውም ግዜ ያለምንም ችግር ተሳትፎውን ማቆም ይችላሉ፡፡ተጨማሪ መረጃ ከፈለጉ ዋናውን ተመራማሪ ወይንም አማካሪዎች በማንኛውም ሰአት ማነጋገር ይችላሉ፡፡ **<u>አድራሻ፡</u>** ደረርቱ ሀሰን ስልክ: +251917562727

ኢ-ሜል deriabamecha@gmail.com

ANNEX V: Consent form

For parents/guardians of children participating in the research study

I have read the information above, or it has been read to me. I have been given the opportunity to ask questions and my questions have been answered to my satisfaction. I voluntarily consent that my child participates in this study.

I agree to enroll my child in this study:

Print name of subject, date and signature or thumb impression of subject

_____,____/____/____ (dd/mm/yy)

If had no formal education

Print name of independent literate witness, date and signature of witness

_____, ____/____/____ (dd/mm/yy)

Print name of researcher, date and signature of researcher

_____,____/____/____ (dd/mm/yy)

Additional separate consent form for children older than 12 years of age: Participating in the following research

For children participating in the research study

I have read the information above. I have been given the opportunity to ask questions and my questions have been answered to my satisfaction. I voluntarily consent to participate in this study.

I agree to enroll in this study:

Print name of student, date and signature of student

_____,____/____/____ (dd/mm/yy)

Print name of researcher, date and signature of researcher

_____,____/____/____ (dd/mm/yy)

ANNEX VI: Consent form (Afan Oromo version)

Waraqaa raga Heeyyamaa

Odeefannoo armaan olii dubbiseera ykn naa dubbisameera carraan gaafii gaafachuu naakennameera gaaffiikootifisi deebii gahaan argadheera. Fedhii kootiin mucaan koo akka qorannoo kana keessatti hirmaatu/hirmaattu heeyyamee:

Iddattoo bobbaa sakatta'a fi to'anna faalama ramollee marri'imaaniif akka keennuu/kennifu
Fi akkasumas yoon barbaade akka addaan kuutuun danda'amu hubadheera.

Maqaa maatii hirmaata _____Mallato _____

guyyaa _____ g/j/w

Kan dubisuufi barressu hin dandenyeef

Maqaa nama barate adda kan raga ta'uu, guyyaa fi mallattoo

_____ Guuyyaa (Jia/waggaa)

Maqaa qorataa guyyaa fi mallattoo qorataa _____guu/j/w

Eeyyama hirmaanna dabalataa ijoollee umuriin isanii waggaa 12 ol ta'ee qorannicha keessatti hirmaataniif

Odeefannoo armaan olii dubbiseera.Carraan gaafii gaafachuu naakennameera gaaffiikootifisi deebii gahaan argadheera. Fedhii kootiin qorannoo kana keessatti hirmaachuuf nan fedhaa.

Iddattoo bobbaa sakatta'a fi to'anna faalama ramollee marri'imaaniif akka keennuu,hanga ulfina koo fi dhabbi nan madaalama.
Akkasumas yoon barbaade akka addaan kuutuun danda'amu hubadheera.

Maqaa hirmaata _____Mallato _____

guyyaa _____ g/j/w

Maqaa qorataa guyyaa fi mallattoo qorataa _____guu/j/w

ANNEX VII: Consent form (Amharic version)

□ተሳታፊዎች የስምምነት ሰነድ

በጥናት ምርምሩ ላ□ ል□ ተሳታ□ እንድሆን □ሪ ቀርቦልኛል፡፡ ከላይ የተገለፁትን ነገሮች በሙሉ አንብቤያለው ወይም ተነቦልኛል፡፡ ግልፅ ያልሆነልኝ ነገር ጥያቄዎች እንድጠይቅ እእዕድል ተሰቶኛል፡፡ በሙሉ ፍቃደኝነት ልጀ በዚህ ጥናት ላይእንዲሳተፍ ፈቅጀ ተስማምቻለው፡፡

□ተሳታፊ ስም፡ ቀን፡ ፊርመ/የጣት አሻራ

ቀን----------□ር----------ኢአ

ማንብብና መጻፍ የማይችሉ ከሆነ

□□ለልተኛ ምስክር ስም፡ ቀንና ፊርማ

----------ቀን----------□ር---------- ኢአ

የጥናትና ምርምር አድራጊው ወይም አስተባባሪዉ ስም፡ ቀንና ፊርማ

----------ቀን----------□ር---------- ኢአ

ዕድሜያቸው ከ12 ዓመት በላይ የሆኑትና በጥናቱ ላይ በሚሳተፉት ተማሪዎች የሚሞላ ተጨማሪ የስምምነት ቅፅ

በጥናት ምርምሩ ላ□ ተሳታ□ እንድሆን □ሪ ቀርቦልኛል፡፡ ከላይ የተገለፁትን ነገሮች በሙሉ አንብቤያለው ፡፡ ግልፅ ያልሆነልኝ ነገር ጥያቄዎች ንድጠይቅ ዕድል ተሰቶኛል፡፡ በሙሉ ፍቃደኝነት በዚህ ጥናት ላይእንድሳተፍ ፈቅጀ ተስማምቻለው፡፡

□ተሳታፊ ስም፡ ቀን፡ ፊርማ

ቀን----------□ር----------ኢ.አ

□ጥናትና ምርምር አድራጊው ወይም አስተባባሪዉ ስም፡ ቀንና ፊርማ

----------ቀን----------□ር---------- ኢ.አ

ANNEX VIII: Questionnaire

Jimma University,

Collage of Public Health & Medical sciences,

Department of Medical Laboratory Sciences and Pathology

This is a questionnaire set to gather information on the students among elementary schoolchildren in Jimma Town, Southwest Ethiopia.

Students code number _____

School code number _____

Time of sample collection _____

Date of sample collection _____

Grade & section _____

Name of interviewer_____ _____Sign _____ Date _____

Part 1: Students school record and socio-demographic information

1. Students name _____ Age (to the nearest year) _____
   Sex: A. Male_____ B. Female_____
2. Residence: A. Rural____ B. Urban ____

Part 2 Students socio-demographic data

3. What is your mother occupation?

A. House wife
B. Merchant
C. Government employee
D. Private employee
E. daily laborer
F. Others _____

4. What is your fathers occupation?

A. Farmer
B. Merchant
C. Government employee
D. daily laborer
E. private employee
F. Others _____

5. What is your mother education level?

A. No formal education C. secondary

B. primary D. Above secondary

6. What is your fathers education level?

A. No formal education C. Secondary

B. Primary D. Above secondry

7. What is the number of your family?

A. 1 E. 5

B. 2 F. 6

C. 3 G. 7

D. 4 H. >7

8. From where do you get water for drinking?

A. From tap B. From protected/ cleaned spring /well

C. From unprotected stream/well E. Other specify_____

D. From river

9. Do your parents have latrine?

A. Yes B. No

10. If yes to Q.NO 9 how often do you use the latrine.

A. Always C. Never use

B. Sometimes

11. If no to Q. No 9 where do you defecate and dispose the faeces?

A. Near the river D. others _____

B. Away from the river

C. Open filled

12. Do you wear shoes?

A. Yes

B. No

13. If yes to No 12, how often?

A. Sometimes B. Always

14. Where do you bath?

A. River

B. At home

15. Do you wash your hands before you eat?

A. Yes B. No

16. If yes to Q. No 15, how often?

A. Always B. Some times

17. Do you wash your hand after going to latrine?

A. yes B. No

18. If yes to Q. No 17, how often

A. Always B. Some times

19. Is there dirty materials in their fingernails, Interviewer inspect it

A. Yes B. No

Part 3: Medical history, diseases and symptoms interview questionnaire to be filled by a nurse interviewer.

20. Observation, inspect the student against the questions below

A. Facial/ pedal edema? 1. Yes 2. No

B. Wearing shoes? 1. Yes 2. No

C. Other gross abnormalities _____

Part 4: Wealth index

No	Does the household have any of the following properties or animals?	Yes	No
1.	Functioning radio/Tape recorder/CD player		
2.	Functioning Television		
3.	Gas Stove		
4.	Electric stove		
5.	Motor Cycle		
6.	Cart/Gari		
7.	Car		
8.	Mobile phone		
9.	Sofa		
10.	Spring mattress		
11.	Sponge/Foam mattress		
12.	Cotton mattress		
13.	Grass Mattress		
14.	Oxen		
15.	Cows		
16.	Horse/mules		
17.	Goats/Sheep		
18.	Chickens		

Part 5. Food diversity index

Now, I would like to ask you about the foods that you have eaten over the last twenty-four hours (from Sunrise yesterday to sunrise today)

Food group	Morning (sunrise yesterday to ~11:30),	Afternoon (~11:30-sunset)	Evening/night time (sunset to just before sunrise this morning)	Was this shared?
1. Cereal and grains	Corn/maize, rice, wheat, sorghum, millet, oats, teff	Corn/maize, rice, wheat, sorghum, millet, oats, teff	Corn/maize, rice, wheat, sorghum, millet, oats, teff	1.Yes 2.No 3.DR
2.Fruits	Mango, avocado, orange, papaya, banana, apple, jack fruit, grape, pineapple, passion fruits, peaches, watermelon, strawberry, guava, others	Mango, avocado, orange, papaya, banana, apple, jack fruit, grape, pineapple, passion fruits, peaches, watermelon, strawberry, guava, others	Mango, avocado, orange, papaya, banana, apple, jack fruit, grape, pineapple, passion fruits, peaches, watermelon, strawberry, guava, others	1.Yes 2.No 3.DR
3.Vegetables	Tomato, broccoli, carrots, squash, sweet potato, potato, kale beet root, onion, eggplant, leeks green pepper, dark green lettuce, lettuce, cabbage, cucumber, ginger mushrooms, shallot pumpkin, zuchinni other_____	Tomato, broccoli, carrots, squash, sweet potato, potato, kale beet root, onion, eggplant, leeks green pepper, dark green lettuce, lettuce, cabbage, cucumber, ginger mushrooms, shallot pumpkin, zuchinni other_____	Tomato, broccoli, carrots, squash, sweet potato, potato, kale, beet root, onion, eggplant, leeks green pepper, dark green lettuce, lettuce, cabbage, cucumber, ginger mushrooms, shallot pumpkin, zuchinni other_____	1.Yes 2.No 3.DR
4.protien rich foods	Meat, beans egg, fish, chicken nuts and seeds lentils other _____	Meat, beans egg, fish, chicken nuts and seeds lentils other_____	Meat, beans egg, fish, chicken nuts and seeds lentils other _____	1.Yes 2.No 3.DR
5. Dairy products	Milk, yogurt, cheese	Milk, yogurt, cheese	Milk, yogurt, cheese	1.Yes 2.No 3.DR
6.Oil and fat	Butter, animal fat, vegetable oil, commercial oil	Butter, animal fat, vegetable oil, commercial oil	Butter, animal fat, vegetable oil, commercial oil	1.Yes 2.No 3.DR
7.Discretionary calorie foods	Sugar, honey, Soft drink, juice drinks, Chocolates, Candies, Cookies, Cakes, Other_____	Sugar, honey, Soft drink, juice drinks, Chocolates, Candies, Cookies, Cakes, Other_____	Sugar, honey, Soft drink, juice drinks, Chocolates, Candies, Cookies, Cakes, Other_____	1.Yes 2.No 3.DR

DR – don't remember

ANNEX VIIII: Questionnaire (Afaan Oromo version)

Lakk.barata _____

Lakk.mana barumsa _____

Yeroo iddattoon itti fudhamee_____

Guyya eddatoon itti fudhame_____

Kuta _____

Maqa nama gafii gafatee _____malatoo _____Guyya _____

Kuta 1. ffaa

1. Maqaa _____ Umurii_____
2. Saala A. Dhira B. Dhalaa
3. Bakka jirenyaa

   A. Magalaa B. Badiyya

Kutaa 2.ffaa

4. Hojiin hadha ketii maali ?

   A. Hadha mana C. Hojettu motumma

   B. Daldaltuu D. Hojettu dhunfaa
5. Hojiin abba ketii malii ?

   A. Qoonaan bulaa C. Hojettu motumma

   B. Daldaltuu D. Hojettu dhunfaa

   E. dafqaan bula F.kan bira_____
6. Harmeen ke barumsa hamma meqatti baratetti?

   A. Hin baranne C. sadarkaa 2ffaa

   B. Sadarkaa 1ffaa D. sadarkaa 2ffaa ol
7. Abban kee barumsa hamma meqatti baratetti?

   A. Hin baranne C. Sadarka 2ffaa

   B. Sadarka 1ffaa D. Sadarkaa 2ffaa ol

8. Bayyinii matii ketii hangamii ?

A. 1 B. 2 C. 3 D. 4 E. 5

F. 6 G. 7 H. >7

9. Bishaan dhugatii essa argattu?

A. Bonbaa irra B. Bishaan bollo

C. Lagaa D. Bishaan bolla qulqulluman isa egamuu

10. Mana fincanii qabduu

A. Eyyen B. Hin qabnuu

11. Yoo debiin gafii 10^{ffaa} hin qabnuu ta`ee essatii fayadamtuu ?

A. Nannoo laga B. Kara darii

C. Lagarra faganee

12. Yoo debiin gafii 10^{ffaa} eyye ta`ee hamam fayadamtuu

A. Yeroo hunda C. Fayadamee hin bekuu

B. Yeroo tokko tokko

13. Kophee ni kawatta ?

A. Eyyen B. Hin kewadhuu

14. Yoo eyyen ta`ee hangam ?

A. Yeroo mara B. Al tokko tokko

15. Qamaa kee essatti dhiqatta ?

A. Manattti B. Lagatti

16. Nyaata osoo hin nyatiin harka kee ni dhiqatta ?

A. Eyyen B. Hin dhiqadhuu

17. Yoo debiin gafii 16^{ffaa} eyye ta`ee hangam?

A. Yeroo mara B. Al tokko tokko

18. Mana fincanitii yemuu debitaan harka kessan ni dhiqattuu?

A. Eyyen B. Hin dhiqadhuu

19. Yoo debiin gafii 18^{ffaa} eyyen ta`ee hangam

A. Yeroo hunda B. Al tokko tokko

20. Qensaa baratta kessa xuriin jira ?ilalii

A. Jira B. Hin jiruu

Kutaa 3ffaa

21. Gafilee fayya ilaalchisee

A. Fulli ykn fanni milaa isa /ishee dhita`eera ? A. Eyye B. Hin dhitoofne

B. Kophee kawatera/ttii? A. Eyyen B. Hin kewanne

C. Rakko bira _____

Kutaa 4 ffaa

Lakk	Mana kessan kesa meshaleen armaan gadii fi beladdoni armaan gadi jiru?	Qabna	Hin qabnu
1.	Radiyoo hojetu/tepppi/DVD		
2.	Televiziinii		
3.	Istoovii gaziin hojetuu		
4.	Istoovii elektrikiin hojetuu		
5.	Duqduqqee		
6.	Garii		
7.	Konkolaataa		
8.	Bilbilaa mobayilaa		
9.	Sofaa		
10.	Firashii cisichaa ispiringii		
11.	Firashii cisichaa ispoonjii		
12.	Firashii cisichaa jirbii		
13.	Firashii cisichaa margaan hojetamee		
14.	Sangaa		
15.	Sa`aa		
16.	Fardaa/Harree		
17.	Holaa /Re`ee		
18.	Hindaqoo		

Unkaa akakuule nyata

Akaakuwwan nyaataa	Kalessa ganama baha biiftuu eegalee hanga sa'aa 5:30	Sa'atii 5:30 hanga galgala lixa aduu	Halkan lixa aduurraa hanga barii har'aa	Qophaa mo nama biraa waliin nyaatte?
1.Calla midhaanii	Boqolloo, ruuzii, garbuu, misingaa, qamadii, atara, xaafii, kan biroo	Boqolloo, ruuzii, garbuu, misingaa, qamadii, atara, xaafii, kan biroo	Boqolloo, ruuzii, garbuu, misingaa, qamadii, atara, xaafii, kan biroo	a. Eeyyeen b. Lakki c.hinyaadadhu
2.fuduraa	Maangoo abukaadoo, , burtukaana, paapayaa, muuzii, aplii, jaak frutii, waynii, anaanasii, injoorrii, zaytuunaa, kan biro	Maangoo, abukaadoo, burtukaana, paapayaa, muuzii, aplii, jaak frutii, waynii, anaanasii, injoorrii, zaytuunaa, kan biro	Maangoo, abukaadoo, burtukaana, paapayaa, muuzii, aplii, jaak frutii, waynii, anaanasii, injoorrii, zaytuunaa, kan biro	a. Eeyyeen b. Lakki c. hinyaadadhu
3.muduraa	Timaatima Salaaxaa, kaarotii, Dinicha, sukar dinichii Hundee diimaa, qaaraa, shunkurta, qullubbii, raafuu gurraacha, rafuu maramaa, jinjibila, zukunii Kan biro	Timaatima Salaaxaa, kaarotii, Dinicha, sukar dinichii Hundee diimaa, qaaraa, shunkurta, qullubbii, raafuu gurraacha, rafuu maramaa, jinjibila, zukunii Kan biro	Timaatima Salaaxaa, kaarotii, Dinicha, sukar dinichii Hundee diimaa, qaaraa, shunkurta, qullubbii, raafuu gurraacha, rafuu maramaa, jinjibila, zukunii Kan biro	a. Eeyyeen b. Lakki c. hinyaadadhu
4.nyaata prootinaa	Foon Baaqela Killee Qurxumii Hindaaaqoo	Foon Baaqela Killee Qurxumii Hindaaaqoo	Foon Baaqela Killee Qurxumii Hindaaaqoo	a. Eeyyeen b. Lakki c. hinyaadadhu
5.bu'aa aannanii	Aannan Urgoo Ayiba Kanneen biro	Aannan Urgoo Ayiba Kanneen biro	Aannan Urgoo Ayiba Kanneen biro	a. Eeyyeen b. Lakki c. hinyaadadhu
6.zayitaafi faatii	Dhadhaa, cooma, Zayita nyaataaa, Zayita muduraa Kan biroo	Dhadhaa, cooma, Zayita nyaataaa, Zayita muduraa Kan biroo	Dhadhaa, cooma, Zayita nyaataaa, Zayita muduraa Kan biroo	a. Eeyyeen b. Lakki c. hinyaadadhu
7.nyaata sukkaaraa	Sukkaara Damma Dhugaatii lallaafaa Dhugaatii cuunfaa Karameellaa Keekii Kan biroo	Sukkaara Damma Dhugaatii lallaafaa Dhugaatii cuunfaa Karameellaa Keekii Kan biroo	Sukkaara Damma Dhugaatii lallaafaa Dhugaatii cuunfaa Karameellaa Keekii Kan biroo	a. Eeyyeen b. Lakki c. hinyaadadhu

ANNEX X: Questionnaire (Amharic version)

በጅማ ዩኒቨርስቲ

የህክምና እና የሕብረተሰብ ጤና ሳይንስ ፋካሊቲ

የላቦራቶሪ ትምርት ክፍል

የጥናቱ ተካፋይ መለያ ቁጥር _____

የትምህርት ቤቱ መለያ ቁጥር_____

ናሙና የተሰጠበት ቀንና ሰአት_____

ክፍል_____

የጠያቂው ስምና ፊርማ _____

ክፍል 1.

1) የጥናቱ ተካፋይ ስም _____

ዕድሜህ/ሽ ስንት ነው;_____

ጾታ ሀ. ወንድ ለ . ሴት

2) ዐድራሻ

ሀ. ከተማ ለ. ገጠር

ክፍል 2

3) የእናቱ ወይንም ያሳዳጊዉ ስራ ምንድን ነው

ሀ.የቤት እመቤት መ. የግል ሰርተኛ

ለ.ነጋዴ ሰ. የጉልበት ሰራተኛ

ሐ. የመንግስት ሰርተኛ

4) የአባትህ/ሽ ስራ ምንድንው

ሀ.አርሶ አደር መ. የግል ሰርተኛ

ለ. ነጋዴ ሰ. የጉልበት ሰራተኛ

ሐ. የመንግስት ሰርተኛ

5) የእናቱ ወይንም ያሳዳጊዉ የትምርት ደረጃ;

ሀ. መደበኛ ትምህርት የላትም ሐ. 2ኛ ደረርጃ

ለ. 1ኛ ደርጃ መ. ከ 2ኛ ደረጃ በላይ

6) የአባትህ/ሽ የትምርት ደረጃ

ሀ. መደበኛ ትምህርት የላትም
ለ. 1ኛ ደርጃ
ሐ. 2ኛ ደረርጃ
መ. ከ 2ኛ ደረጃ በላይ

7) የቤተሰብ ብዛት ስንት ነው?

ሀ. 1
ለ. 2
ሐ. 3
መ. 4
ሰ. 5
ረ. 6
ሸ. 7
ቀ. >7

8) ለመጠጥ ውሀ ከየት ነው የምታገኙት?

ሀ. ባንባ
ለ. ከወንዝ
ሐ. ከምንጭ
ሰ. ንፅህናው የተጠበቀ ምንጭ/የጉድጋድ ውሃ
መ. ከጉርንድ

9) ሽንት ቤት ዐላችሑ? ሀ. ዐዎ ለ. የለንም

10) የጥያቄ ቁጥር 9 መልሱ የለንም ከሆነ የት ነው የምትጸዳዱት?

ሀ. ወንዥዮ ኣካባቢ ለ. ሜዳ ላይ ሐ . ሌላ ካለ ይጥቀሱ

11) የጥያቄ ቁጥር 9 መልሱ ዐለ ከኖነ ምን የህል ጊዜ የጠቀማሉ

ሀ. ሁልጊዜ
ሐ.በጭርሽ ተጠቅሜ አላውቅም
ለ.አንዳንዴ

12) ጫማ ትለብሳልህ/ሽ ? ሀ. ዐዎ ለ .ዐይለብስም

13) የጥያቄ ቁጥር 12 መልሱ ዐዎ ከሆነ ምን ያሕል ታዘወትራልህ/ሽ?

ሀ. አንዳንዴ ለ. ሑሌም

14) ገላህን/ሽን የት ነው የምትታጠበው/ቢው

ሀ.ወንዝ
ለ.ቤት

15) ምግብ ከመመገብህ/ሽ በፊት እጅህን/ሽን ትታጠባልህ/ሽ

ሀ. ዐዎ ለ. ዐልታጠብም

16) የጥያቄ ቁጥር 15 መልሱ ዐዎ ከሆነ ምን ያሕል ያዘወትራል?

ሀ. አንዳንዴ ለ. ሑሌም

17) ከሽንት ቤት መለስ እጅህንሽን ትታጠባልህ/ሽ ወይም ?

ሀ. ዐዎ ለ. ዐልታጠብም

18) የጥያቄ ቁጥር 17 መልሱ ዐዎ ከሆነ ምን ያሕል ያዘወትራል?

ሀ. አንዳንዴ ለ. ሑሌም

19) ያልበሰለ ስጋ ትበላለህ/ሽ ?

ሀ. ዐዎ ለ. ዐልበላም

20) ያልበሰለ አትክልት ትበላለህ/ሽ ?

ሀ. ዐዎ ለ. ዐልበላም

ክፍል 3 የጥናቱ ተካፋይ የጤና ሁኔታ በጤያቂው የሚሞላ ::የጥናቱን ተካፋይ በመመልከት የሚቀጥሉጥትን ሙላ/ሙዩ

21) የተሳታፊው ጥፍር ውስጥ ቆሻሻ ዐለዉ? ሀ. ዐዎ ለ. የለዉም

የፊት /የእግር እብጠት አለው/ላት ሀ.ዐዎ ለ. የለዉም

ልላ የጤና ችግር አለ ሀ.ዐዎ ለ. የለዉም

ክፍል 4.

No	የሚከተሉትን እቃ ዐላችኑ	ዐለን	የለንም
1.	የሚሰር ቴፕ/ሬዲዮ/ሚዲ ማጫወቻ		
2.	ቲቪ		
3.	በጋዘ የሚሰራ እስቶቭ		
4.	በኤሌትሪክ የሚሰራ እስቶቭ		
5.	ሞተር ሳይክል		
6.	ጋሪ		
7.	መኪና		
8.	ሞባይል		
9.	ሶፋ		
10.	የእስፕሪንግ ፌራሽ		
11.	የእስፖንጅ ፌራሽ		
12.	የጥጥ ፌራሽ		
13.	የሳር ፌራሽ		
14.	በሬ		
15.	ላም		
16.	ፈርስ/አህያ		
17.	በግ/ፍየል		
18.	ዶሮ		

የ 24 ሰአት አመጋግብ ሁኔታ በማስታወስ የሚመለስ

□ህል ክፍሎች	ከ ጠዋት-ረ□□ 5:30	ከ ሰዓት በሁላ ከ 5:30 -- □ሃ□ መፅቢ□	ከጸሃይ መግቢያ ስከ ዛሬ ጠዋት	□ዚህን ከ ሌሎች □ር ተ□ርተሃል?
1. □ህልና □ራ□ሬ	በቆሎ: ሩዝ: ስንዴ: ማሽላ አተር: ጤፍ ሌሎች	በቆሎ: ሩዝ: ስንዴ: ማሽላ አተር: ጤፍ ሌሎች	በቆሎ: ሩዝ: ስንዴ: ማሽላ አተር: ጤፍ ሌሎች	1. አዎ 2. አይደለም 3. አላስታ□ስም
2. □ራ□ሬ	ማንጎ: አቡካዶ:ብርቱካን:ፓፓያ: ሙዝ: አፕል: ጃክ □ሩት: ወይን: አናናስ: ዘይቱን: ኢነጆሪ: ሌሎች	ማንጎ: አቡካዶ:ብርቱካን:ፓፓያ: ሙዝ: አፕል: ጃክ ፍሩት: ወይን: አናናስ: ዘይቱን: ኢነጆሪ: ሌሎች	ማንጎ: አቡካዶ:ብርቱካን:ፓፓ ያ: ሙዝ: አፕል: ጃክ □ሩት: ወይን: አናናስ: ዘይቱን: ኢነጆሪ: ሌሎች	1. አዎ 2. አይደለም 3. አላስታ□ስም
3. አትክልት	ቲማቲም: ካሮት ሽንርት: ስካር ድንች: ድንች: ቀይ ስር: ጥቁር ጎመን: ጥቅልል ጎመን: □ንጉዳይ: ከከምበር: ዝንጅብል: ዝኩኒ: ቆምጣጤ: ነጭሽንኩርት:	ቲማቲም: ካሮት ሽንርት: ስካር ድንች: ድንች: ቀይ ስር: ጥቁር ጎመን: ጥቅልል ጎመን: □ንጉዳይ: ከከምበር: ዝንጅብል: ዝኩኒ: ቆምጣጤ: ነጭሽንኩርት:	ቲማቲም: ካሮት ሽንርት: ስካር ድንች: ድንች: ቀይ ስር: ጥቁር ጎመን: ጥቅልል ጎመን: □ንጉዳይ: ከከምበር: ዝንጅብል: ዝኩኒ: ቆምጣጤ: ነጭሽንኩርት:	1. አዎ 2. አይደለም 3. አላስታ□ስም
3. በፕሮቲን □በለ□ እህሎች	ስ□: ባቄላ: እንቁላል: ኣሳ: ዶሮ:	ስ□: ባቄላ: እንቁላል: ኣሳ: □ሮ:	ስ□: ባቄላ: እንቁላል: ኣሳ: ዶሮ:	1. አዎ 2. አይደለም 3. አላስታ□ስም
4. የወተት ተ□□ኦ	ወተት ኡርጎ አይብ	ወተት ኡርጎ አይብ	ወተት ኡርጎ አይብ	1. አዎ 2. አይደለም 3. አላስታ□ስም
5. ዘይትና ቅባት	ቅቤ □ ማ ዘይት የአትክልት ዘይት:	ቅቤ □ ማ ዘይት የአትክልት ዘይት:	ቅቤ □ ማ ዘይት የአትክልት ዘይት:	1. አዎ 2. አይደለም 3. አላስታ□ስም
6. ሀ□ል ሰ□ ምግቦች	ስካር ማር ለስላሳ መጠጦች □ ማቂ ቸኮሌት ከረሜላ ኬክ ሌሎች	ስካር ማር ለስላሳ መጠጦች □ ማቂ ቸኮሌት ከረሜላ ኬክ ሌሎች	ስካር ማር ለስላሳ መጠጦች □ ማቂ ቸኮሌት ከረሜላ ኬክ ሌሎች	1. አዎ 2. አይደለም 3. አላስታ□ስም

ANNEX XI: Laboratory requesting and recording format

For parasitological investigation in elementary schoolchildren in Jimma Town, Southwest Ethiopia.

1. Personal data

1.1 Student and school code _____,_____

1.2. Date of sample collection ____/ _____/ _____

2. Laboratory data

2.1. Macroscopic Examinations

Consistency_____

2.2 Direct smear microscopic result

A. No ova of parasite seen

B. Intestinal parasite seen

_____, _____, _____

_____, _____, _____

2.3 McMaster counting technique

A. No ova of parasite seen

B. Ova of parasite seen

Type of parasite seen

(I)_____

(II)_____

(III)_____

(IV)_____

5 Anthropometry

Anthropometry				
		Reading 1	Reading 2	Average
1	Height			
2	Weight			

Name of P.I

_____

Signature _____ Date _____/ _____/ _____

Declaration

I, the undersigned declare that this thesis is my own work and that all sources of materials used for the thesis have been fully acknowledged.

Principal investigator

Derartu Hassen (BSc, MSc Candidate; Jimma University)

Signature _____ Date _____

Place of submission: Jimma University College of Public Health and Medical Sciences Department of Medical Laboratory Sciences and Pathology.

Advisors:

Name	Signature	Date
1. Miss. Serkadis Debalke (BSc, MSc)	_____	_____
2. Mr. Endalew Zemene (BSc, MSc)	_____	_____
3. Prof. Tefera Belachew (MD, MSc, PhD)	_____	_____
4. Mr.Zeleke Mekonnen (Associate professor)	_____	_____

Examiner:

Name	Signature	Date
1._____	_____	_____