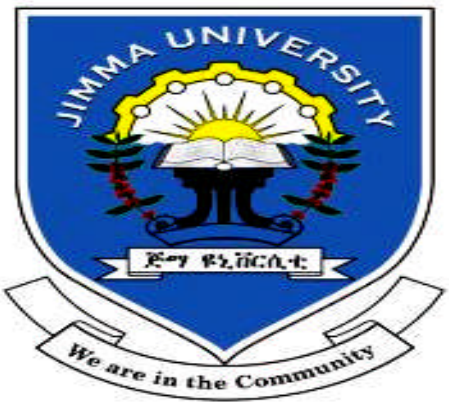
A COMMUNITY-BASED CROSS-SECTIONAL STUDY OF SOIL-TRANSMITTED HELMINTH INFECTIONS AND ASSOCIATED FACTORS AMONG PRESCHOOL CHILDREN IN BUTAJIRA TOWN, SOUTHERN ETHIOPIA



BY

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COLLEGE OF PUBLIC HEALTH AND MEDICAL SCIENCES DEPARTMENT OF MEDICAL LABORATORY SCIENCES AND PATHOLOGY

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ABSTRACT

Introduction: *Soil-transmitted helminths remain a major public health problem, particularly in tropical and subtropical regions of the world. Preschool aged children are among people at risk of these infections. Epidemiological information on the prevalence and infection intensity of soil-transmitted helminths in area is a prerequisite for development and evaluation of sound control strategies.*

Objective: *The aim of this study was to determine prevalence and infection intensity of soil-transmitted helminths and associated factors among preschool children in Butajira Town, Southern Ethiopia.*

Methods: *Community based cross sectional study was conducted from May 3 to June 23, 2014 in Butajira Town. A total of three hundred and seventy seven preschool children, selected by systematic sampling method had complete data for this study. Data were collected by house-to-house visit. Questionnaire data on associated factors of soil-transmitted helminths were collected by using semi-structured questionnaire. Moreover, fresh stool samples were collected using clean, dry and wide mouthed labeled stool cups. It was processed by McMaster egg counting technique at Butajira General Hospital laboratory. Peripheral blood samples were also collected and hemoglobin was measured by HemoCue Hb 301. Data were entered and analysed using* Statistical Package for Social Sciences-*16 version and p-value < 0.05 considered statistically significant.*

Results*: Out of 377 study participants, 88 (23.3%) were infected with one or more soil-transmitted helminths. Ascaris lumbricoides was the predominant parasite(14.9%) followed by Trichuris trichiura (6.4%). The overall infection intensity of soil-transmitted helminth expressed as geometric mean among the study participants for Ascaris lumbricoides, Trichuris trichiura and hookworms were 229, 178, and 154 EPG, respectively. Multivariate analysis confirmed that age group between 36-47 months (AOR, 2.501, 95%CI, 1.189 -5.26, p=0.016), untrimmed hands finger nail(AOR, 3.198, 95% CI, 1.849-5.53,p=0.000), and not washing hands before meal(AOR, 3.01, 95%CI, 1.671-5.433,p=0.000) were a significant predictor for soil-transmitted helminth infections in these children. Out of soil-transmitted helminth infected children, 4(4.5%) children had anemia where as only one child had anemia among non infected children.*

Conclusion and recommendation*: Soil-transmitted helminth infections were prevalent with light to moderate infection intensity in the study area. Thus, this study highlights the need for preventive chemotherapy of at least once annually. The existing health education program should also be strengthed by focusing on personal hygiene of these children to have a lasting impact on transmission.*

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LIST OF ABBREVIATIONS and Acronyms

CDC – Center for Diseases Control and Prevention

DALYs – Disability Adjusted Life Years

EPG – Egg Per Gram

ETB – Ethiopian Birr

EOS – Enhanced Outreach Strategy

Hbg – Hemoglobin

NTDs – Neglected Tropical Diseases

PSAC – Pre -School-Age-Children

STHs – Soil-Transmitted- Helminths

SAC – School-Age-Children

SSA – Sub Saharan Africa

SPSS – Statistical Package for Social Sciences

WHO – World Health Organization

YLDs – Years lived with Disability

CHAPTER ONE: INTRODUCTION

1.1. Background

Soil-transmitted helminths(STHs) are intestinal parasitic worms that are classified by the World Health Organization (WHO) as a neglected tropical disease (NTD). Soil-transmitted helminth infections are among the most common infections worldwide and affect the poorest communities. The STHs of major concern to humans are *Ascaris lumbricoides(A.lumbricoides), Trichuris trichiura(T.trichiura)* and the hookworm, *Necator americanus* (*N.americanus*) *and Ancylostoma duodenale*(*A.duodenale*)[1, 2].

Humans are the definitive host of STHs. Life cycles follow; *A.lumbricoides* larvae undergo an extensive migration through a series of host tissues and organs, while *T.trichiura* larvae develop entirely in the gut. The adults of both species inhabit the intestinal tract; *A.lumbricoides* parasitizes the entire small intestine, whereas *T.trichiura* lives in the large intestine. Following host entry, the larvae of hook worms undergo a journey through the vasculature, enter the airways, are swallowed, and finally reach the intestine, where hookworms larvae moult twice to become adult male and female. Soil-transmitted helminths reproduce sexually and produce eggs, which are passed in human stools and deposited in the external environment [3, 4].

The soil plays an indispensable role in the transmission of STHs. It is necessary for the incubation of *A.lumbricoides* and *T. trichiura* eggs and larvae of hook worms to infective stages. In areas where inadequate sanitation and poor personal hygiene prevails, STHs transmission occurs through contamination of soil with stool. This can happen in several ways, when contamination of soil with human stool containing the worms' eggs occurs and by subsequent accidental ingestion of the contaminated soil with food or hands, or when worm larvae penetrate into the skin and body of humans [2].

Globally, STH infections are endemic in 166 countries, including all countries in Asia (Central, east, south and south-east), Oceania, Latin America and the Caribbean, North Africa and the Middle East and Sub-Saharan Africa (SSA)[5, 6]. More than 2 billion people are infected with STHs[1], and up to 5.3 billion are at risk of infection with at least one species of STH[6]. Over 270 million Preschool aged children (PSAC) and over 600 million school aged children(SAC) live in areas where these parasites are intensively transmitted[2].

The geographical distribution of STHs is influenced by various factors like, poor environmental sanitation, lack of personal hygiene and use of unsafe water[2], and other factors including age, socio-economic status and occupation[7]. Ethiopia has one of the lowest quality drinking water supply and latrine coverage in the world[8], only half of Ethiopians(54%) have access to an improved source of drinking water, and overall, 38 percent of households have no latrine facility and only 8 percent of households use improved toilet facilities[9]. Hence, intestinal parasites including STHs have been widespread and causes significant morbidity in the country[10].

Formol-ether concentration technique, McMaster egg counting technique, FLOTAC technique, and Kato-Katz technique are commonly used laboratory techniques in epidemiological and clinical diagnosis of STHs [11-13].

Albendazole and Mebendazole are recommended treatment for STHs by WHO. Periodic de-worming with these drugs, complemented by health education, basic sanitation and clean water, is considered the most cost-effective approach to control the morbidity caused by STH infections[2].

1.2. Statement of the problem

Soil-transmitted helminth infections remain a major public health problem. According to Center for Diseases Control and Prevention(CDC) estimation, up to 807-1,221 million people are infected with *A.lumbricoides* , about 576-740 million and 604-795 million people of the world are infected with hookworms and *T.trichiura* respectively[14]. Preschool children are among people at risk for STH infections [2], and comprise between 10% and 20% of the 3.5 billion people living in STHs-endemic areas[15]. It is estimated that, up to 122 million PSAC are infected with *A. lumbricoides* , about 21 million and 86 million PSAC of the world are infected with hook worms and *T.trichiura*, respectively[15].

Globally, STHs infections cause as high as 39 million Disability Adjusted Life Years (DALYs). It is estimated that years lived with disability (YLDs) due to *A.lumbricoides* is about 1,110,600, *T,trichiura* about 638,200 and 3,230,800 due to hookworms. Morbidity attributable to STH infections falling between 0.6 and 1.4 YLD per 1000 people[16]. An estimated number of 60,000 deaths due to *A. lumbricoides*, 65,000 deaths due to hookworms, and 10,000 deaths due to *T. trichiura* per year[17], and an estimated number of 878 million SAC and 386 million PSAC are at risk [5].

Soil-transmitted helminths are highly abundant in Ethiopia; hookworms infects 11 million people, thus Ethiopia bears 5.6% which is the third highest burden in SSA and *T.trichiura*, with 21 million people, which is the 4th highest (13%) of the diseases burden in SSA [18]. Similarly *A.lumbricoides* estimated to infect 26 million people which is the second highest burden (15%) of the overall burden in SSA [19].

Morbidity due to STHs infection and the rate of transmission are related to the number of worms harboured by the host[2]. Acute complications such as appendicitis, duodenal ulcer, bowel obstruction, obstructive jaundice and hepatic abscesses may occur during *A.lumbricoides* infection and also causes anemia especially hookworms infection. Soil-transmitted helminths have also been associated with stunted growth and impaired cognitive function in children, and it is an important factor contributing to malnutrition in PSAC and SAC, as they rob the host of nutrients and micronutrients. In chronic infections, it compromise physical fitness, and iron status[20], and affect the immune response of infected children [21].

Soil-transmitted helminths infection and the chronic morbidity they cause persist wherever access to effective sanitation is lacking; poor hygiene, crowded household conditions, law education level of the community mark their day-to-day life [3, 22]. In developing countries, where access to improved sanitation are low, control measures are often difficult to implement though STHs remain a significant health problem[23]. Ethiopia is one of the developing countries, endemic for many NTDs including STHs[10], and levels of access to improved sanitation are low[8], making control of STHs difficult.

The global efforts towards controlling STH by targeting the de-worming of 75% of children living in endemic areas by the year 2010 was not reached and therefore, STH infections remain prevalent especially in areas of developing countries[1]. Chemotherapy is the main stay of controlling STH, in Ethiopia regular de-worming is not yet implemented, though mass de-worming as a component of the Enhanced Outreach Strategy (EOS) targeting under five children introduced in 325 drought prone districts only in 2004[24]. However, information on this age group is scarce. Thus, it is unclear whether the infection status of PSAC warrants regular preventive chemotherapy.

Children are more vulnerable to parasitic infections including STH infections, since their hygienic habits have not been fully developed. Control of STH infections is of central importance to improve PSAC health because these infections can have long lasting consequences on growth and development. Epidemiological information on the prevalence and infection intensity of STHs in different regions is a prerequisite for development and evaluation of sound control strategies.

CHAPTER TWO: LITERATURE REVIEW

Several epidemiological studies have been conducted on STHs in different countries mainly focusing on SAC. In Ethiopia too, several studies documented high prevalence of STHs in SAC with scarce data on the burden of STHs in PSAC. Some of the available literatures on the global burden of STHs, its epidemiology and factors associated with acquisition of STHs in PSAC is reviewed as follows.

Studies have shown that the prevalence of STHs in PSAC and SAC is high. A cross-sectional study conducted in Orang Asli, Malaysia children aged ≤15 years indicated prevalence of *T. trichiura*, *A.lumbricoides* and hookworms infections were 71.7%, 37.4% and 17.6%, respectively[7]. Similar study conducted in same country among PSAC showed overall prevalence of STHs infection was 76.5%, *T.trichiura*(71.5%), and *A.lumbricoides*(41.6%)[25]. Another cross-sectional study conducted in China among PSAC and SAC, 21.2% of PSAC and 22.9% of SAC were infected with at least one of the three types of STHs[26]. In addition, study from Lao People's Democratic Republic among PSAC showed prevalence of *A.lumbricoides, T. trichiura* and hookworms were 27.4%, 10.9% and 10.9%, respectively[27].

Study from Nigeria among PSAC and SAC indicated the overall prevalence of STHs infection was 34.4%, and prevalence of *A.lumbricoides, T.trichiura* and hookworms were 33.2%, 3.7% and 0.9%, respectively. The most common type of mixed infection observed according to this study was the combination of *A.lumbricoides and T.trichiura* (6.8%) [28]. Moreover, study conducted in the same country among PSAC the overall prevalence of STHs infection was 50.5% and *A. lumbricoides* was the predominant STH infection with 47.6%, where as 3.7% of the children were infected with *T. trichiura*, and 4.3% with hookworms[29]. According to study conducted in Cameroon among PSAC and SAC, 42.4% harbored at least one STH, of which *A. lumbricoides* (26.4%), *T.trichiura* (31.0%) and *N.americanus* (1.4%) [30].

A cross-sectional study conducted in Gorgora, Ethiopia showed 36.8% children were positive for single or multiple parasitic infection and the most prevalent STH was *A.lumbricoides* (16.60%), hookworms (5.50%) and *T.trichiura* (4.60%) [31]. Similarly, study conducted in Wondo Genet, Ethiopia among under five children, 85.1% were found to be infected with one or more intestinal parasites. Of those, prevalence of *T.trichiura* was 74.7%, *A. lumbricoides* 25.7%, and hookworms 5.9% [32]. Furthermore, a cross-sectional study conducted in Southern Ethiopia

among asymptomatic children showed 41.9% were infected with single and double intestinal parasite. Of these *A.lumbricoides* was dominant 59%, and *T. trichiura* 9% and hookworms 2.7%. However, only wet mount laboratory method was utilized which may underestimate the exact figure [33].

A number of studies conducted in different countries showed various factors contributing to STH infections. Among those listed factors; absence of toilet at households, source of water for drinking were significantly associated with STHs infection [7, 26, 34]. Whereas, study from Bangladesh among children showed disposal of child stool in a closed space resulted in a 35% and use of tube well water in a 48% reduction in helminths infections[35]. On the other hand, study conducted in Delta State, Nigeria showed drinking from well and surface tank was risk factors for *A. lumbricoides* and *T. trichiura* infections [36]. Study conducted in Zanzibar showed STHs infection was found to be negatively associated with having access to a household latrine[37].

Study conducted in China showed maternal education associated with STHs infection [26]. Number of people in household also contributed significantly to STHs infection[7, 34], Study conducted in Lao People's Democratic Republic among PSAC showed children in a household with more than 10 people had a 2.73 fold increased risk for any STH infections compared with those households with less than 4 people[27]. Different study conducted in different countries among PSAC and SAC showed prevalence and infection intensity of *A. lumbricoides* rose with age [28, 29, 37]. Study which was conducted in Jimma, Ethiopia also showed prevalence rate of STH infections were rose with child's age[38].

Studies showed personal hygienic practice of child like, playing in the soil, not washing hands before meal, and not washing hands after defecation were significantly associated with STHs infections[7, 34]. In addition, regular trimming of hands fingernail may contribute for hand-to mouth route in the transmission of STHs. Study conducted in India showed STHs worm burden was significantly higher in those who have unhygienic hands nail, habit of hands nail biting and thump sucking[39]. According to study from Nigeria thump sucking was risk factors for *A. lumbricoides* and *T.trichiura* infections [36]. Study conducted in Bahir Dar, Ethiopia also showed having dirty hands fingernail and untrimmed hands fingernail were positively associated with the prevalence of intestinal helminths infection [40].

Study from Nigeria showed walking barefoot was the risk factor for hookworms infection [36]. On the other hand study conducted in Zanzibar showed STHs infection was found to be negatively associated with wearing shoes [37]. Study conducted in Babile Town, Ethiopia also showed Prevalence of hookworms infection rate was significantly lower in children who wore shoes [41].

A number studies showed association between STHs infection and anemia. Study conducted in Malaysia among PSAC showed STH infections were found to be significantly associated with anemia[25]. Another study conducted in Kashmir Valley, India showed STHs infected children had significantly lower values of hemoglobin than uninfected children [42].

Study conducted in Nigeria confirmed intestinal parasites are associated with anemia irrespective of gender and age in children[43]. According to study conducted in Kenyan Coast among PSAC showed significantly higher proportion of anemia between children infected with hookworms and those uninfected, children who had an egg count of greater than 200 EPG were anemic compared to uninfected children and a greater proportion were severely anemic (8.6% vs. 2.1%). The mean hemoglobin concentration was also significantly lower among children with heavy hookworms infection compared to children uninfected with hookworms(83.9 g/L vs. 96.1 g/L)[44]. Study conducted in Oromiya Region, Ethiopia among children also showed significant association between STH infections and anemia [45].

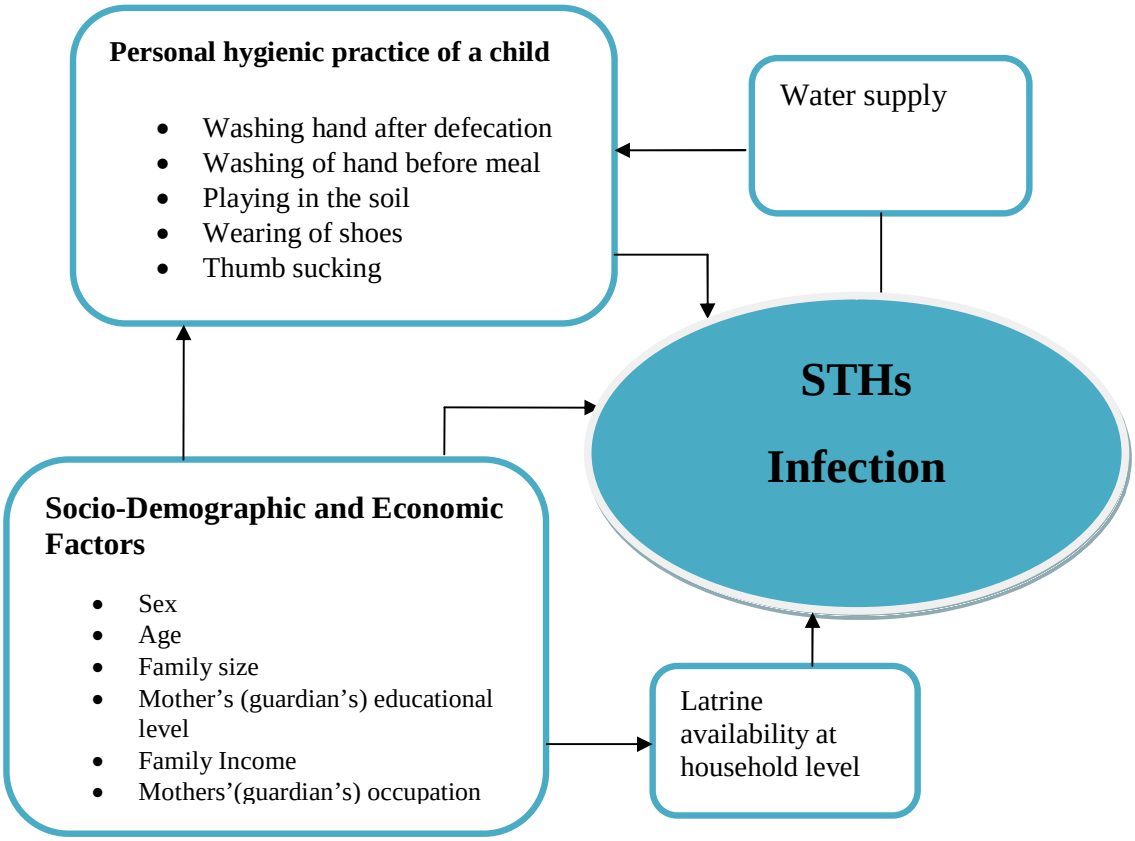

Figure 1: Conceptual framework of factors associated with soil-transmitted helminth infections.

2.1. Significance of the study

Soil-transmitted helminths are major public health problems in several tropical and subtropical developing countries including Ethiopia, where the socio-economic status is poor. To respond to this resolution, adequate information on the distribution and extent of STH infections in a given community is required especially among PSAC since they are among the groups at highest risk of morbidity due to these infections. Few studies have reported the magnitude of STH infections among PSAC in Ethiopia. Moreover,no documented studies on the epidemiology of STHs in PSAC in the study area. Therefore the present study makes an effort to find out the prevalence of STHs with respect to prevalence, infection intensity and associated factors among PSAC in Butajira Town. The finding of this study serves as a baseline data to carry out further studies. The output of this study helps zonal and local health offices, nongovernmental organizations, policy makers and other health planners; to undertake targeted interventions in the control of STHs in PSAC.

CHAPTER THREE: OBJECTIVE

3.1. General objective

To determine prevalence and infection intensity of soil-transmitted helminths and associated factors among preschool children in Butajira Town, Southern Ethiopia

3.2. Specific objectives

1. To determine prevalence of STH infections among the pre-school children
2. To determine infection intensity of STHs among the pre-school children
3. To assess associated factors with STH infections among the pre-school children
4. To measure hemoglobin level among the pre-school children

CHAPTER FOUR: METHODS AND MATERIALS

4.1. Study area and period

The study was conducted from May to June 2014, in Butajira Town. The Town is found in Gurage Zone, Southern Nations Nationalities, and People's Region. It is located 135 kms South of Addis Ababa, the capital of Ethiopia. Geographically, the town is located at 7°41' N latitude and 36° 50'E longitude. The town is found in an area of average altitude of about 2,100 meter above sea level. It lies in the climatic zone locally known as *Woyna Dega*. The dominant agricultural product in the area are maize, *teff* (Eragrostos tef), pepper, the stimulant *khat* (Catha edulis forskal) and *enset*(false banana). The mean maximum and minimum annual temperature of the town is 30°C and 14°C respectively. The annual rainfall ranges from 1138 mm to 1690 mm. According to Butajira Administration Family Health and Population Office, the total population of the town in 2013 was estimated to be 46,382, 51% being females. In the study year there were a total of 8060 households (average household family size is 5.7) in the town. From the total population of the town, 11.7% are PSAC. Butajira Town has five *Kebeles*(the smallest administrative units). Currently there are 2 hospitals (1 governmental and 1 nongovernmental), 1 health center, and 3 higher private clinics in the town.

4.2. Study design

A community-based cross sectional study design was conducted.

4.3. Population

4.3.1. Source population

All PSAC living in Butajira Town during the study period .

4.3.2. Study population

All systematically selected PSAC living in the town who fulfilled the inclusion criteria.

4.4. Inclusion and exclusion criteria

4.4.1. Inclusion criteria

Children whose parents or legal guardians signed a written informed consent .
Children aged between 12 and 59 months and both sex (males and females).

4.4.2. Exclusion criteria

Children who were on anti helminthic drug or treated within one month prior to data collection .
Children who had diarrhea at the time of sampling .
Children who were unable to provide stool sample at the time of sampling.

4.5. Sample size determination and sampling technique

4.5.1. Sample size

The required sample size for this study was estimated using the general formula for single population proportion[46] considering 50% prevalence rate in the population 95% confidence level and 5% margin of error. Accordingly the following formula was applied:

$$n = \frac{Z^2 P(1-P)}{d^2}$$

$= (1.96)^2\, 0.5(1\text{-}0.5) / (0.05)^2 \quad = \quad 384$

Assumption

P = Prevalence rate of 50%

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

Total number of PSAC in study area was 5,425 and sampling was considered from a finite population. Hence, n was calculated by applying finite population correction formula as follows

$$n = \frac{n_0}{\left(1+\frac{n_0}{N}\right)}$$

$= 384/\ 1+384/5425 = 358$

Where; n=sample size calculated

$n_{o=}$ minimum sample size calculated

N= total number of PSAC in study area

Considering 10% for anticipated non-response rate, the final sample size calculated was 393.

4.5.2. Sampling technique

Systematic sampling method was employed to select the study participants. A list of all the PSAC (the sampling frame) found in each household and names of household's head from all *Kebeles* was prepared in a preliminary census type survey in collaboration with health extension worker. The study participants were selected from all Butajira Town administrative *Kebeles*. Proportionate sampling was used to determine the number of PSAC recruited from each *Kebeles*. List of PSAC in each *Kebele* taking as sampling frame study participants were recruited systematically. Figure 2 below shows haw study participants were recruited.

Since proportionate sampling was used, all *Kebeles* had the same sample interval (K).

$$k = \frac{\text{Total number of PSAC found in particular kebele}}{\text{Sample size calculated in particular kebele}} \approx 12$$

Therefore every 12^{th} PSAC interval, the study subject was selected until a total of sample recruited in each *Kebele* attained.

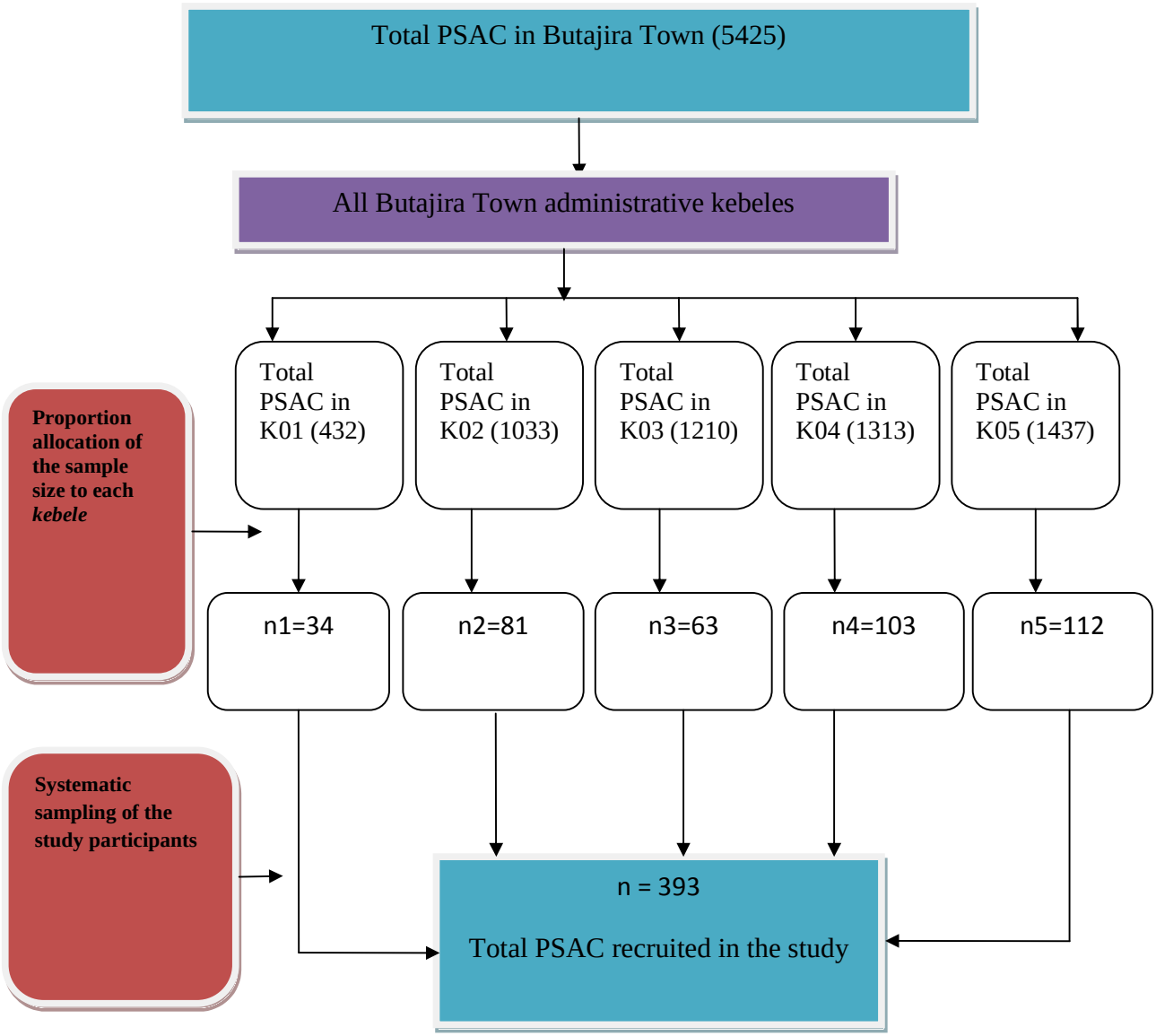

Figure 2: Flow chart of study participants sampling technique hierarchy

4.6. Data collection

4.6.1. Questionnaire data or Socio-demographic characteristics and associated factors

House-to-house visits were made to collect data. Children who were not at home at the time of the survey visit were revisited on the next day. Semi-structured questionnaire having both closed and open ended questions was used to gather information on socio-demographic and factors related to STH infections in PSAC. The questionnaire was initially prepared in English and then

translated in to Amharic and translated back into English to check its consistency by the principal investigator. The socio-demographic and economic data collected includes age, sex, family size, family income, mother's (guardian's) educational level, and mother's (guardian's) occupation. Moreover, questionnaire to associated factors of STH infections in PSAC included; habit of hands nail biting, habit of washing hands after defecation, habit of washing hands before meal, habit of playing in the soil, availability of latrine at household, and main source of water for drinking (Annex-VII). The questionnaire data were collected by urban health extension workers (nurses) who can speak both Amharic and the local language (*Guraghaegna*).

4.6.2. Laboratory Examination

Laboratory analysis was done for STHs identification and hemoglobin (Hgb) measurement. Hence, fresh stool sample was collected from each study participants using clean, dry and wide mouthed labeled stool cups. Stool samples were processed by McMaster egg Counting technique as described[11] at Butajira General Hospital laboratory. Briefly, the technique depends on microscopic counting of helminths eggs in a special counting chamber after suspension of known weight(2 gram) of stool is prepared in floatation fluid(density of 1.2). This technique detects ≥ 50 eggs (having analytical sensitivity of 50 eggs per gram of stool (EPG)) for detection and enumeration of STHs.

Stool sample were reported as positive if STHs eggs were detected by McMaster egg counting technique. The number of eggs counted for each STH species is then multiplied by a factor of 50(Annex-I). Infection intensity of STHs recorded and graded as light, moderate or heavy based on EPG according to WHO threshold[1], for *A. lumbricoides*, EPG of 1-4,999, 5000-49,999 and EPG ≥ 50,000 was considered light, moderate and heavy, respectively. For *T. trichiura:* light, 1–999 EPG; moderate,1000–9999 EPG; and heavy,≥10 000 EPG; and hook worms, EPG of 1-1,999, 2,000- 3,999 and EPG ≥ 4,000 was considered light, moderate and heavy, respectively.

In addition to the stool examination, Hgb of the children were measured using HemoCue Hb 301 system (**S**weden). It is designed for quantitative point-of-care whole blood Hgb determination in primary care or blood donation settings [47]. The measurement takes place in the analyzer (Annex-I). Severity of anemia was classified according to WHO guideline[48], non- anemic, mild, moderate and severe, when Hgb of greater than10g/dl, 10-10.9 g/dl,7-9.9 g/dl and lower

than 7g/dl, respectively. All laboratory analyses were carried out by two laboratory technologists together with the principal investigator.

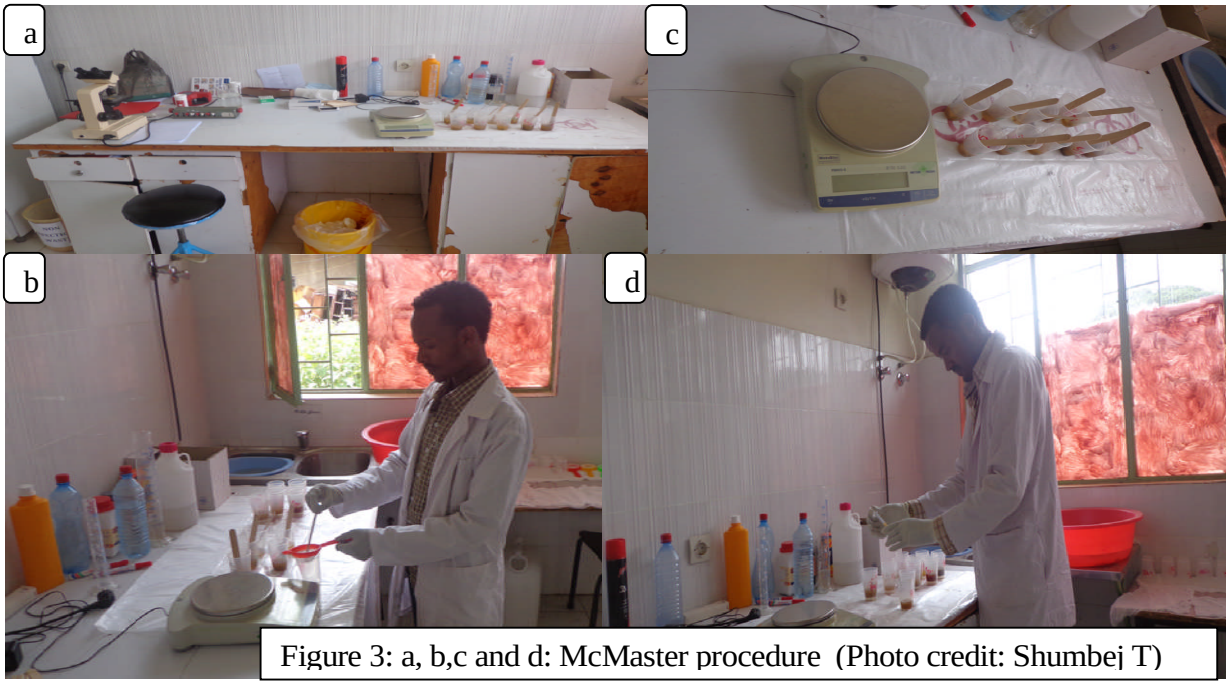

Figure 3: a, b,c and d: McMaster procedure (Photo credit: Shumbej T)

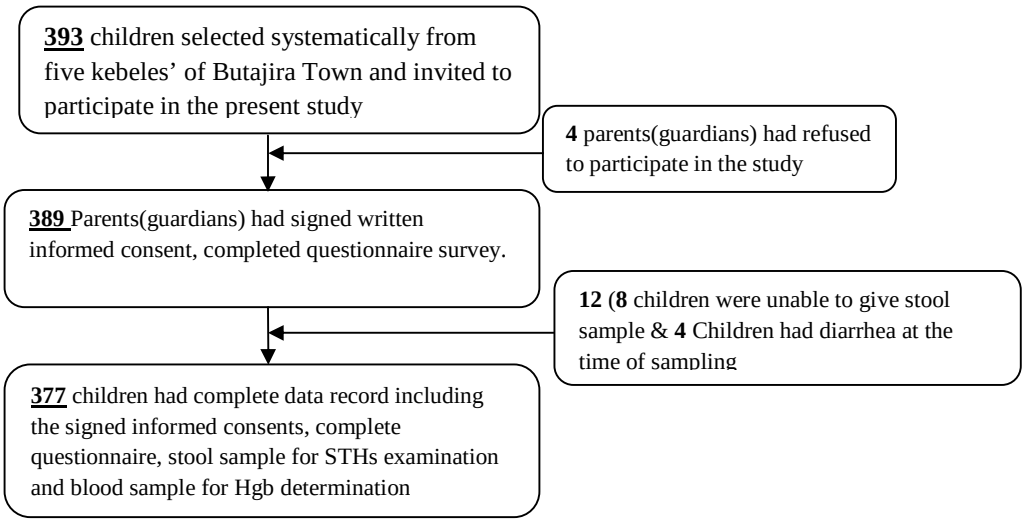

Figure 4: Flow chart of the participation and compliance in the present study

4.7. Study variables

4.7.1. Dependent variable

- STH infections

4.7.2. Independent variables

- Sex
- Age
- Family size
- Family Income
- Mothers'(guardians') occupation
- Mothers' (guardians') educational level
- Wearing of shoes
- Thumb sucking
- Habit of washing hands after defecation
- Habit of washing hands before meal
- Habit of playing in the soil
- Availability of a latrine at household
- Main source of water for drinking
- Hemoglobin

4.8. Ethical clearance

Ethical clearance was obtained from Jimma University ethical review board. Permission was obtained from Butajira Town Administration Health Office and each *Kebele's* administration. Moreover, informed written consent was obtained from parents (guardians) of the study participants. Data collected from each study participant and results of laboratory tests were kept confidential. Children with positive stools for intestinal parasite infections were treated with 100 mg Mebendazole tablets, according to Ethiopian medicines formulary recommendations[49] in collaboration with Butajira Administration Health Office. Children who had anemia were referred to Butajira General Hospital for further management.

4.9. Quality assurance

Pretest was done in Aka-Muja *Kebele* prior to the actual study in 5% of the sample size before the actual research begins. Urban Health extension workers were trained on data collection procedure for this particular study to attain standardization and maximize interviewer reliability. Data collected using the questionnaire was checked for completeness at the end of each day. Data collectors were regularly supervised by the principal investigator for proper data collection. Laboratory technologists who involved in this particular study obtained training on McMaster egg counting technique. To reduce human error, duplicate McMaster slides was prepared from each sample and the slides were read by two different microscopists. Standard operating procedures were followed in every step of the analysis of samples.

4.10. Data processing and statistical analysis

After data collection process, the data were checked for completeness. Then the result of laboratory examination was recorded on prepared format. The data were entered into a computer and analyzed using Statistical Package for Social Sciences(SPSS) for windows version 16 (Chicago, USA). Outputs were presented using tables and graphs. Descriptive statistics were used to summarize the socio-demographic characteristics. Bivariate analysis was used to see the associations of STHs infections with independent variables. P value less than 0.05 was considered statistically significant. All variables with P<0.25 in the bivariate analysis were analyzed using multivariate logistic regression model.

4.11. Operational definition

Aneamia: is defined according to WHO as a Hgb concentration < 11 g/dL in PSAC[48].

Pre-school age children: These refer to children aged between 12 months and 59 months[1].

Soil transmitted helminths: Refers to intestinal parasitic worms, which includes *A. lumbricoides, T. trichiura* and the hookworms *N. americanus and A. duodenale.*

Trimmed fingernails: Refer to children whose length of both right and left hands fingernail are less than two millimeter[50].

Untrimmed fingernails: Refer to children whose length of right, left or both hands fingernail are greater than or equal to two millimeter[50].

CHAPTER FIVE: RESULTS

5.1. Demographic characteristics of the study participants

Three hundred and seventy seven (96%) of the targeted 393 PSAC were participated in the study. The age of studied children ranges from 12 to 59 months with median age of 36 months. The age-group distribution showed that 31.8% were in the age group of 24-35 months while 10.9% were in range of 48-59 months. More than half (56.2%) were females and 43.8% males making the female to male ratio 1.3:1.0 and 64.5% of the households had family size of below five. About half of children mothers (guardians) had primary education and merchant by occupation. Almost half (48.3%) of the children were from families with estimated monthly income of 500 to 1000Ethiopian Birr (ETB) and 77.7% are Guraghea by ethnicity (Table 1).

5.2. Prevalence of Soil-transmitted helminths

Overall, at least one species of intestinal helminth was detected in 104 (27.6%) of the children (Table 1). The most frequent intestinal helminth encountered in the present study was *A. lumbricoides*(14.9%). The least encountered were *Enterobius vermicularis*(*E.vermicularis*) 2(0.5%)(Figure 5). Most of (90.4 %) the infected children had single infection, while 9.6% had double infections (Table 3).

Table 1: Intestinal helminth infections in relation to socio demographic characteristics of the preschool children, Butajira, Southern Ethiopia,2014.

Variables		**Intestinal helminths**		**Total examined No (%)**	**X^2-test**	**P-value**
		Positive No (%)	Negative No (%)			
Sex	Male	51(30.9)	114(69.1)	165 (43.8)	1.622	0.203
	Female	53(25)	159(75)	212 (56.2)		
Age in months	12-23	16(15)	91(85)	107 (28.4)	26.303	0.000**
	24-35	26(21.7)	94(78.3)	120 (31.8)		
	36-47	48(44)	61(56)	109 (28.9)		
	48-59	14(34.1)	27(65.9)	41 (10.9)		
Family Size	Below 5	59(24.3)	184(75.7)	243 (64.5)	3.741	0.053
	5 and Higher	45(33.6)	89(66.4)	134 (35.5)		
Monthly Income	<500	18(24.3)	56(75.7)	74 (19.4)	0.869	0.648
	500-1000	54(29.7)	128(70.3)	182 (48.3)		
	>1000	32(26.4)	89(73.6)	121 (32.1)		
Mother's(guardian's) Education	No formal education	42(42.9)	56(57.1)	98 (26)	17.246	0.001**
	Primary	39(21.3)	144(78.7)	183 (48.5)		
	Secondary	9(18.4)	40(81.6)	49 (13)		
	Above secondary	14(29.8)	33(70.2)	47 (12.5)		
Mother's(guardian's) Occupation	Merchant	51(27)	138(73)	189 (50.1)	0.259	0.968
	Employed	17(30.4)	39(69.6)	56 (14.9)		
	House wives	32(27.4)	85(72.6)	117 (31)		
	Others	4(26.7)	11(73.3)	15 (4)		

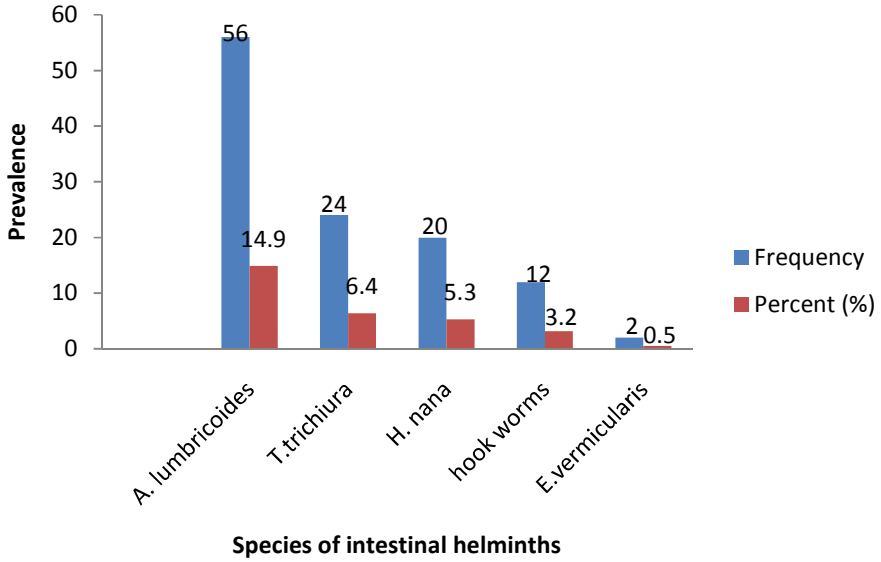

Figure 5: Prevalence of intestinal helminth infections by species among the preschool children, Butajira, Southern Ethiopia,2014.

The overall prevalence rate for one or multiple STHs was 23.3 (88/377). The result as shown in Figure 5, indicated that the predominant STH infection was *A. lumbricoides*, detected in 14.9% of the PSAC, followed by *T. trichiura*(6.4%). Majority, of the children participated in this study were in the age group of 24-35 months, with STH prevalence of 21.7%. Prevalence of STH infection was highest (33%) in the age group of 36-47 months (Table 2).

There was significant association of STH infection with age (P=0.01). Similarly, there was a significant difference (P=0.001) in STH infection of the children with educational status of the mothers (guardians). Almost half of the children were from families with estimated monthly income of 500 to 1000ETB, with STH prevalence of 26.4%. There was no significant difference of STH infection with family income and family size (Table 2).

Table 2: Soil transmitted helminth infections in relation to socio demographic characteristics of the preschool children, Butajira, Southern Ethiopia,2014.

Variables		Soil Transmitted helminths		Total examined No (%)	X^2-test	P-value
		Positive No (%)	Negative No (%)			
Sex	Male	41(24.8)	124(75.2)	165 (43.8)	0.372	0.542
	Female	47(22.2)	165(77.8)	212 (56.2)		
Age in months	12-23	15(14)	92(86)	107 (28.4)	11.379	0.01**
	24-35	26(21.7)	94(78.3)	120 (31.8)		
	36-47	36(33)	73(67)	109 (28.9)		
	48-59	11(26.8)	30(73.2)	41 (10.9)		
Family Size	Below 5	53(21.8)	190(78.2)	243 (64.5)	0.896	0.344
	5 and Higher	35(26.1)	99(73.9)	134 (35.5)		
Monthly Income	<500	16(21.6)	58(78.4)	74 (19.4)	1.889	0.389
	500-1000	48(26.4)	134(73.6)	182 (48.3)		
	>1000	24(19.8)	97(80.2)	121 (32.1)		
Mother's(guardian's) Education	No formal education	37(37.8)	61(62.2)	98 (26)	16.496	0.001**
	Primary	37(20.2)	146(79.8)	183 (48.5)		
	Secondary	7(14.3)	42(85.7)	49 (13)		
	Above secondary	7(14.1)	40(85.1)	47 (12.5)		
Mother's(guardian's) Occupation	Merchant	45(23.8)	144(76.2)	189 (50.1)	NA	0.54*
	Employed	9(16.1)	47(83.9)	56 (14.9)		
	House wife	30(25.6)	87(74.4)	117 (31)		
	Others[b]	4(26.7)	11(73.3)	15 (4)		

[b] student, farmer, daily laborer, *Fisher's exact,**chi-square test.

Table 3: Magnitude of double intestinal helminth infections of the preschool children, Butajira,Southern Ethiopia, 2014.

Categories of infection	Intestinal helminths	Frequency (No)
Double Infection		
	A. lumbricoides + hookworms	2
	A. lumbricoides+ *H. nana*	3
	T. trichiura+ *H. nana*	4
	T. trichiura+ *E.vermicularis*	1

Of the 56 children infected with *A.lumbricoides* 19(33.9%) were in the age group of 24-35months, of 24 children with *T.trichiura* 15(62.5%) were in the age group of 36-47months. Thirty three out of the 56 children (58.9%) infected with *A.lumbricoides*, and 9(75%) out of 12 with hookworms infection were females, whereas 16 (66.7%) out of 24 with *T.trichiura* were males (Table 4).

Table 4: Soil-transmitted helminth infections by age and sex among pre-children in Butajira, Southern Ethiopia, 2014.

Variables		*A. lumbricoides* No (%)	*T. trichiura* No (%)	hookworms No (%)
Age in Months				
	12-23	12(21.4)	4(16.7)	0
	24-35	19(33.9)	2(8.3)	7(58.3)
	36-47	18(32.1)	15(62.5)	4(33.3)
	48-59	7(12.5)	3(12.5)	1(8.3)
Sex				
	Male	23(41.1)	16(66.7)	3(25)
	Female	33(58.9)	8(33.3)	9(75)

5.3. Infection Intensity of Soil-transmitted helminths

The overall infection intensity of STHs expressed as geometric mean among the study participants for *A.lumbricoides*, *T.trichiura* and hookworms was 229, 178, and 154 EPG, respectively. Most of the children had light infections. No heavy infection intensity in any of the STHs was obtained (Table 5).

Table 5: Infection intensity with *A.lumbricoides*, *T.trichiura* and hookworms among the infected children, Butajira, Southern Ethiopia,2014.

Infections intensity	Soil transmitted helminths		
	A.lumbricoides	*T. trichiura*	hookworms
	No (%)	No (%)	No (%)
Light	55(98)	23(95.8)	11(91.6)
Moderate	1(2)	1(4.2)	1(8.4)
Geometric mean(EPG)	229	178	154
Total	56	24	12

5. 4. Factors associated with Soil-transmitted helminth infections

Variables like, latrine availability and main water source for drinking were excluded from logistic regression analysis because source of drinking water of all of the study participants was reported to be pipe water and most (96.6%) of the houses had toilets. By the bivariate analysis, children within age group 36 -47 months (OR, 3.025, 95%CI, 1.538-5.947) and whose mother or guardian had no formal education (OR, 3.466, 95%CI, 1.466-8.533) had significantly higher prevalence of the STHs (Table 6).

Prevalence of STH infections was also significantly higher in children infrequently wearing shoes (OR, 2.169, 95%CI, 1.305-3.606) and those always playing in the soil (OR, 6.733, 95%CI, 1.982-22.871). Similarly, significantly higher prevalence of STHs infection was observed in children with untrimmed hands fingernail (OR, 4.413, 95%CI, 2.662-7.314) compared to their trimmed counterparts (Table 6).

Moreover, STHs infection was significantly associated with hands washing habit after defecation with higher infection seen for infrequently hands washing habit after defecation (OR, 2.431, 95%CI, 1.421-4.159) and those who do not wash their hands after defecation (OR, 3.262, 95%CI, 1.628-6.54) when compared to those who practice hands washing after defecation regularly. In addition, not regular hands washing habit before meal was increased children's odds for STHs infection (OR, 4.428, 95%CI, 2.564-7.646) when compared to those always wash their hands before meal (Table 6).

After adjusting for other variables, age group within 36 - 47 months (AOR, 2.501, 95%CI, 1.189-5.26), not hands washing habit before meal (AOR, 3.01, 95%CI, 1.671-5.433) and untrimmed hands fingernail (AOR, 3.198, 95%CI,1.849-5.53) were predictors of STH infections(Table 6).

Table 6: Factors associated with soil-transmitted helminths infection among the preschool children, Butajira, Southern Ethiopia, 2014.

Variables		Soil Transmitted helminthiasis		COR (95% CI)	P-value	AOR (95% CI)	P-value
		Positive No (%)	Negative No (%)				
Sex	Male	41 (24.8)	124 (75.2)	1.161 (0.719-1.875)	0.542		
	Female	47 (22.2)	165 (77.8)	1		-	-
Age in months	12-23	15 (14)	92 (86)	1		1	
	24-35	26 (21.7)	94 (78.3)	1.696 (0.845-3.408)	0.137	1.341 (0.622-2.890)	0.454
	36-47	36 (33)	73 (67)	3.025 (1.538-5.947)	0.001**	2.501 (1.189-5.26)	0.016**
	48-59	11 (26.8)	30 (73.2)	2.249 (0.932-5.424)	0.071	2.435 (0.905-6.552)	0.78
Family Size	Below 5	53 (21.8)	190 (78.2)	1			
	5 and Higher	35 (26.1)	99 (73.9)	1.267 (0.776-2.071)	0.34	-	-
Monthly Income	<500	16 (21.6)	58 (78.4)	1.115 (0.547-2.271)	0.764		
	500-1000	48 (26.4)	134 (73.6)	1.448 (0.831-2.523)	0.192		
	>1000	24 (19.8)	97 (80.2)	1		-	-
Mother's (guardian's) Education	No formal education	37 (37.8)	61 (62.2)	3.466 (1.408-8.533)	0.007**	1.977 (0.68-5.744)	0.21
	Primary	37 (20.2)	146 (79.8)	1.448 (0.6-3.492)	0.41	1.001 (0.366-2.734)	0.999
	Secondary	7 (14.3)	42 (85.7)	0.952 (0.307-2.959)	0.933	1.015 (0.279-3.698)	0.982
	Above secondary	7 (14.1)	40 (85.1)	1		1	
Mother's (guardian's) Occupation	Merchant	45 (23.8)	144 (76.2)	1			
	Employed	9 (16.1)	47 (83.9)	0.613 (0.279-1.347)	0.223	-	-
	House wives	30 (25.6)	87 (74.4)	1.103 (0.643-1.881)	0.717		
	Others*	4 (26.7)	11 (73.3)	1.164 (0.353-3.834)	0.803		

* Student, farmer, daily laborer.

Continued…

Variables		Soil Transmitted helminthiasis		OR(95% CI)	P-value	AOR (95% CI)	P-value
		Positive	Negative				
		No (%)	No (%)				
Shoe Wearing habit	Never	7 (29.2)	17 (70.8)	2.072 (0.793-5.116)	0.137	1.256(0.354-4.454)	0.724
	Some-times	50 (30.1)	116(69.9)	2.169(1.305-3.606)	0.003**	1.21(0.63-2.324)	0.566
	Regularly	31 (16.7)	156(83.4)	1		1	
Hands washing habit after defecation	Never	18 (37.5)	30(62.5)	3.262(1.628-6.540)	0.001**	0.801(0.318-2.016)	0.637
	Some-times	38 (30.9)	85(69.1)	2.431(1.421-4.159)	0.001**	1.198(0.611-2.35)	0.599
	Regularly	32 (15.5)	174(84.5)	1		1	
Hands washing habit before meal	Some-times	67 (36)	119(64)	4.428(2.564-7.646)	0.000**	3.013(1.671-5.433)	0.000**
	Regularly	21 (11)	170(89)	1		1	
Habit of playing in the soil	Never	3.4 (8.1)	34(91.9)	1		1	
	Some-times	25 (14)	154(86)	1.84(0.525-6.446)	0.341	0.774(0.208-2.889)	0.704
	Regularly	60 (37.3)	101(62.7)	6.733(1.982-22.871)	0.002**	2.277(0.623-8.318)	0.213
Habit of hands nail biting	Never	75 (22.9)	252(77.1)	1		1	
	Some-times	10 (22.7)	34(77.3)	0.988(0.466-2.094)	0.975	0.666(0.274-1.621)	0.37
	Regularly	3 (50)	3(50)	3.36(0.664-16.994)	0.143	2.261(0.34-15.038)	0.399
Hands finger nail status	Trimmed	31 (13.2)	204(86.8)	1		1	
	Untrimmed	57 (40.1)	85(59.9)	4.413(2.662-7.314)	0.000**	3.198(1.849-5.53)	0.000**

COR: Crude odd ratio, AOR: adjusted odd ratio, CI: 95% confidence interval

5.5. Anemia

Hemoglobin was measured in all children. Of these, 5(1.3%) had anemia. Out of STHs infected children, 4(4.5%) children had anemia where as only 1(0.3%) child had anemia among non infected children. Moreover, out of STHs infected children, 1 (1.1%) and 3(3.4%) had moderate and mild anemia, respectively (Table 8). The mean and minimum values of hemoglobin were 13.5 and 9.8g/dl, respectively. Generally infected children had lower values of mean hemoglobin than uninfected children. It was also observed that children infected with hookworms had lower mean hemoglobin values than children infected by *A.lumbricoides* and *T.trichiura* (Table 7).

Table 7: Mean hemoglobin values (g/dl) and soil-transmitted helminth infections status among the children, Butajira, Southern Ethiopia, 2014.

STH infection status	**Hgb mean ± SD**	**Range**
Not infected	13.92 ± 0.9112	10.8 -16.0
Infected	12.10 ± 0.8435	9.8 - 14.8
Double-species infection	12.08 ± 0.7376	11 - 13.2
Infection by A. lumbricoides	12.25 ± 0.7915	10.4 - 14.0
Infection by T. trichiura	12.06 ± 0.9127	10.8 - 14.8
Infection by Hookworms	11.34 ± 0.641	12.8 - 9.8

Table 8: Anemia in infected and uninfected preschool children, Butajira, Southern Ethiopia, 2014.

Anemia	**Children Infected by STH No (%)**	**Children non infected by STH No (%)**
Non -Anemic	84 (95.5)	288 (99.7)
Mild	3 (3.4)	1 (0.3)
Moderate	1 (1.1)	0

CHAPTER SIX: DISCUSSION

In this study, overall, prevalence of STH infection was 23.3%. The predominant parasite was *A.lumbricoides* (14.9%) followed by *T.trichiura* (6.4%) and, hookworms (3.2%). Nearly one in four of the children in this study were infected with at least one species of STHs. In the absence of effective control and preventive measures, STH infections have devastating consequences, public health implications in the communities and result in significant nutritional and cognitive deficit in children[2, 20].

World health organization strategy for control of STH infections is to control morbidity through de-warming of at-risk people living in endemic areas. Endemic communities for STHs are classified into three transmission categories based on the prevalece for the adoption of treatment strategy in preventive chemotherapy; category I (high), category II (medium), and category III (low)[1, 2]. Based on this classification, the present study area fall within the second category (moderate risk communities), with STH prevalence of more than 20%. Hence, this highlight that prevalence calls for interventions (preventive chemotherapy of at least once annually) in this study area.

The overall prevalence in the present study lower compared with study conducted Nigeria[28] and Cameroon[30] but in line with study conducted China[26]. Even though there was a slight difference in the infection rate, STH species prevalence consistent with the reports from cross-sectional study conducted among children in Gorgora, Ethiopia[31], where the rate of *A. lumbricoides* (16.60%), hookworms (5.50%) and *T. trichiura* (4.60%). However, these species prevalence lower when compared to other studies conducted on STH among PSAC in SNNRP regions of Ethiopia[33], Cameroon[30], and Lao People's Democratic Republic[27].

The differences in prevalence and distribution of these STHs among the different communities might be due to difference in both host-specific and environmental factors that may affect acquiring of STH infections. These include, time of study, methods of examination used, personal hygiene practices, climate and altitude.

In the present study, *A.lumbricoides* was the most common STH. On the contrary, a study conducted in Wondo Genet, Ethiopia[32] reported that the predominant parasites was *T.trichiura* (74.7%). The finding was also On the contrary with other study conducted in Malaysia[7, 25], where *T.trichiura was the* predominant STH. However, this finding was in agreement with study conducted in Nigeria[28, 29] and study conducted among PSAC in Lao People's Democratic Republic[27]. This STH prevalence variation might be due to differences in environmental factors like climate, topography, surface temperature, altitude, soil type and rainfall which have a great impact on the distribution of STHs.

Prevalence of STHs in the present study increased with age. This trend was also observed in study conducted among children in Jimma, Ethiopia[38], and elsewhere[28, 37]. This phenomenon probably reflects age related change in exposure to STHs infection, though, most children do start to walk by the age of 13 months, they might not be strong enough to go out and get contaminated until the age of 2 years and more active for playing on soil. This developmental factor might be the reason for the slightly lower prevalence in those who are 12-23 months of age; and an increasing trend thereafter.

In this study, double intestinal helminths infections were seen in only 2.6% study participants. This figure is very low compared to study conducted among PSAC in Jimma, Ethiopia[38] and in Orang Asli, Malaysia[7] . However, the finding of the present study is comparable from study conducted in SNNRP, Ethiopia[33] and in Bangladesh[35]. Sample size and methods used could attribute to this observed difference in detections of various parasites. Furthermore, only a single stool sample was collected on each child in this study, this may underestimate the exact infection in the study area, due to the fact that a single stool sample misses STHs infection in an individual because of the temporal variation in egg excretion over hours and day[51].

In this study, most of the STH infected children were with light infection. In several other studies conducted among PSAC [27, 31, 34], most of the infections with the STHs was light infection. This high proportion of light infections may have implications for transmission of the parasites. As symptoms may not be obvious in light STH infections[2], such asymptomatic individuals may contaminate the environment, ultimately contributing for transmission of STHs in the community.

Studies conducted in different area of Ethiopia[38, 40] and abroad[7, 34, 36, 39] have investigated risk factors of intestinal parasitic infections and found that poor personal hygiene practice as a significant risk factor of intestinal parasitic infections. This is likely to be related the infective stages of these STHs are found in soil, good personal hygiene help in preventing these infections especially among children who love to play with soil. Similarly, untrimmed hands finger nail and not hands washing before meal were the key factors significantly associated with STH infections in the present study; making it in agreement with these studies conducted in Ethiopia and abroad.

In addition to periodic de-worming, provision of adequate sanitation on personal hygiene practice important for integrated control of morbidity attributed to STH infections[2]. Untrimmed hands finger nail and not washing hands before meal were the key associated factors in the present study, these alarms to strengthen the existing health education on hygienic practices in the study area. Children developmental factors, such as crawling from 5 months of age and mouthing objects from 9 months could be important for the acquisition of STH infections[35], therefore trimming hands fingernails and washing hands before meal crucial to decrease the burden of STHs in preschool children and to assure long-term benefits.

In the present study, infected children had lower values of mean hemoglobin than uninfected children. This is in agreement with study conducted in Kenyan Coast [44] and study conducted in Kashmir Valley, India[42]. Despite anemia is confounded by different factors which are not addressed by the present study, higher proportion of children with STH infections was anemic. However, the observed anemia might not be only due to STH infections. Hence, further investigations are required to confirm these conjectures in study area.

Limitations of the study

The limitation of the present study was, first, the findings were based only on single point data collection, i.e., cross-sectional study, and may therefore fail to identify direct casual association between STH infections and it determinants. Secondly, malaria, weight, height and dietary habit of children were not included in the variables during the data collection to see association of anemia with STH infections.

CHAPTER SEVEN: CONCLUSION AND RECOMMENDATION

Conclusion

In conclusion, the results of the present study revealed that STH infections were prevalent among PSAC in the study area. The infection intensity generally fall within light category for all the three STH infections. The prevalence rate of infection increased with age of the child. Poor personal hygiene like not washing hands before meal and untrimmed hands fingernail were the key factors significantly associated with STH infections in the studied population.

Recommendation

Based on these findings, it is recommended that the existing health education program should be strengthened, since providing proper health education on mode of transmission of STHs and on personal-hygiene practices is pertinent to prevent acquisition of, re-infestation with and spread of STH infections in these communities. Moreover, as WHO recommends periodic drug treatment should be given once a year when the prevalence of STH infections in the community is over 20%, this study highlights the need for de-worming (preventive chemotherapy of at least once annually) to control child morbidity associated with STH infections in the study area. On the other hand, further studies should be conducted to address factors other than factors addressed by this study.

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ANNEXES

Annex–I: Laboratory Investigation Procedures

A. McMaster Egg Counting Technique

Procedure

Flotation solution is prepared 24 hours before processing samples

1. Heat 5 litter of water to 50 °C
2. Gently add NaCI while stirring the suspension
3. Stop adding NaCI when a 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 NaCI solution
6. Homogenize and pour the faecal suspension three times through a tea strainer to withhold 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 100x magnification. Count all the eggs under the two separate grids (representing a volume of 2 x 0.15 ml). If the slides are read before 2 min, the eggs may not have reached the surface of the slide
10. Calculate the number of eggs per gram of faeces by multiplying the total number of eggs under the two grids by 50. This is done for each parasite species

B. Hemoglobin Measurement by HemoCue 301 Analyzer

Blood Sample

The preferred site for collection of capillary blood sample is from the middle or ring finger of children. Blood obtained by finger stick (lancet) must be free flowing and not forced; do not "milk" the finger to get sufficient blood. Wipe away the first and second drop with a clean, dry gauze or lint- free tissue and then collect the third drop of blood for analysis. Do not use cotton balls since cotton fibers interfere with the test.

Test procedure

1. Seat the child comfortably. Use the middle finger or the ring finger for sampling.
2. If cold, warm children fingers with warm water. The children' fingers should be straight but not tense, to avoid stasis
3. Remove a microcuvette from the vial and recap immediately
4. Clean site for blood collection with alcohol - soaked gauze or a newly - opened alcohol pledget
5. Using your thumb, lightly press the finger from the top knuckle to the tip to stimulate flow of blood to the sampling point. For the best blood flow and the least pain, sample at the side of the fingertip, not the center
6. Position the lancet device so that the puncture will be made across the whorls (lines) of the fingerprint. Press the lancet firmly off -center on the fingertip prior to activating the lancet to aid in obtaining a good sample
7. Activate the lancet to puncture the fingertip. Discard the lancet in an approved sharps container
8. Wipe away the first two large drops of blood. This stimulates the blood flow and lessens the likelihood of a dilutional effect by interstitial fluid. If necessary, apply light pressure again, until another drop of blood appears. Avoid "milking of the finger"
9. Make sure the third drop of blood is big enough to fill the microcuvette completely. Hold the microcuvette at the "wing" end and touch the tip into the middle of the drop of blood from above the finger. Keep the microcuvette in contact with the blood and fill in one continuous process. Do not refill a partially filled microcuvette

10. Wipe any residual control material from the sides of the microcuvette with a piece of gauze. Do not touch the opened end with the gauze since this may draw blood out of the microcuvette

11. Visually inspect for air bubbles in the center of the cuvette eye. If bubbles are present in the cuvette eye, discard the microcuvette and obtain another blood sample

12. The filled microcuvette should be analyzed within three minutes after loading. Filled microcuvettes are to be kept in the horizontal position. Place the filled microcuvette into the cuvette holder and gently slide the holder into the measuring position

13. The Hemoglobin value displayed in g/dL after approximately 30-50 seconds.

14. Record the result before removing the microcuvette from the instrument

15. Dispose of the microcuvette in the biohazard waste container

16. If an "ERROR" code is displayed, refer to the manufacturer's "Troubleshooting Guide" found on the Hemocue operating manual

17. Remove gloves and wash hands

Annex–II: Information Sheet (English version)

Title of the research project: A community based cross-sectional study of soil-transmitted helminth infections and associated factors among preschool children in Butajira Town, Southern Ethiopia

Name of Principal Investigator: Teha Shumbej

Name of the Organization: Jimma University College of Public Health and Medical Sciences Department of Medical Laboratory Sciences and Pathology

Purpose of the study: The aim of this study is to determine prevalence and infection intensity of soil-transmitted helminths and assess associated factors among preschool children in Butajira Town

Procedures: In order to undertake the aforementioned study, some questions related with the topic; blood and stool sample are taken for laboratory investigation. Permission was processed from the Jimma University and Butajira Town Adminstration. Hence, you are expected to give required samples and information related with the study.

Risk and/or Discomfort: There is no any possible risk. During blood sample collection the participants may feel discomfort but this does not produces any serious pain.

Benefit of the study: Study results are able to create awareness among policy makers to strengthen/integrate existing programs that take actions on STHs. Based on laboratory result the participants get treatement.

Confidentiality: The information given by participants and laboratory results are kept confidential. Any information about the participants that are collected from the study are stored in a file that are not bear a name on it, but only a number code assigned to it instead.

Right to Refusal or Withdraw: Participant has the full right to refuse from participating and to withdraw at any step in this research. If you have any question you may contact the following individuals.

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Dr. Zeleke Mekonene Tel:+251911073748 email-zeleke-mekonnen@ju.edu.et

Annex– III. Information Sheet (Amharic version)

የምርምሩ ተሳታፊዎች ጥናት ማብራሪያ ቅፅ-አማርኛ ቅጂ

የጥናቱ ርዕስ፡ ማህበረሰብ ተኮር የሆድ ውስጥ ተህዋስያን ወይም ትላትል መለከፍ እና ከሌሎች ጉዳዮች ጋር ያላቸው ቁርኝት ማጥናት።

የተመራማሪዉ ስም ፤ ጠሐ ሹምበጅ

የድርጅቱ ስም፤ በጅማ ዩኒቨርስቲ የህክምና እና የሕብረተሰብ ጤና ሳይንስ ፋካሊቲ የላቦራቶሪ እና ፓቶሎጂ ትምርት ክፍል::

የጥናቱ ዓላማ፡ በሕጻናት የሆድ ውስጥ ተህዋስያን ወይም ትላትል መለከፍ እና ከሌሎች ጉዳዮች ጋር ያላቸው ቁርኝት ማወቅና የበሽታዉ ስርጭት ማጥናት።

የሥራው/የአካሄድ ቅደም ተከተል፡ ከላይ የተጠቀሰውን የጥናት አላማ ለማሳካት ለጥናቱ የሚያስፈልጉ መረጃዎች እንዲሁም የደም እና የሰገራ ናሙና በመዉሰድ አስፈላጊዉን የላቦራቶሪ ምርመራ ይደረጋል።

አላስፈላጊ ጉዳት: ከጣት ደም ሲወሰድ ከሚሰማ ቀለል ያለ የህመም ስሜት በስተቀር ምንም አይነት ጉዳት አይኖረዉም።

የጥናቱ ጥቅም፡ የሆድ ውስጥ ተህዋስያን ወይም ትላትል የመለከፍ እና ከሌሎች ጉዳዮች ጋር ያላቸው ቁርኝት በማጥናት በእነዚህ ተህዋስያን ምክንያት የሚከሰቱትን በሽታዎች ለመቀነስ ግንዛቤ እንዲያዳብር በማድረግ በሽታ መከላከል ይረዳል። በሽታው የተገኘባቸው ተሳታፊዎች ተገቢውን ህክምና እንዲያገኙ ይደረጋል።

የሚስጢር አጠባበቅ፡ በዚህ ምርምር የሚገኝ ማንኛውም መረጃ በሚስጢር የሚጠበቅ ይሆናል። የሚሰበሰበው ማንኛውም መረጃ በስም እንዳይሆን ይደረጋል። ይህ የሚደረገው ለእያንዳንዱ የጥናት ተሳታፊ የተለየ ቁጥር በመስጠት ይሆናል።

በጥናቱ ያለመሳተፍ መብት: በዚህ ጥናት መሳተፍ በፍቃደኝነት ላይ የተመሠረተ ብቻ ነው።በተጨማሪ ተሳታፊዎች በማነኛውም ጊዜ ያለምንም ችግር ተሳትፎውን ማቆም ይችላሉ።ተጨማሪ መረጃ ከፈለጉ ዋናውን ተመራማሪ ወይንም አማካሪዎች በማንኛውም ሰአት ማነጋገር ይችላሉ።

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Annex–IV: Consent Form (English Version)

Greeting!

Study Code number _____

Explanation on procedures and condition of the agreement

We are from Jimma University, College of Public Health and Medical Sciences, Department of Medical Laboratory Sciences and Pathology. We are here to study about problem of soil-transmitted helminths. The overall objective of this study is to assess epidemiological information of soil-transmitted helminths and associated factors among preschool children. The information generated from this study provides the current status of soil-transmitted helminths and asses associated factors in the study area. The investigation involves collection of stool for parasitological examination, blood for Hgb measurement, and interview through semi-structured questionnaire for demographic and STHs related factors.

If the investigation is confirmed for intestinal parasite you have get treatment. We assure you the confidentially of all collected information in the questionnaire and laboratory investigation. If you have any questions regarding the purpose of the study, you have the right to ask question and get clarification. It is your right to withdraw from this study if you are not interested to participate in this study. Finally, if you have understood the explanation very well, we are asking you kindly to participate in this study, and put your signature as illustrated below.

It is with full understanding of the situation that I agreed on the behalf of my child and my self to give the informed consent voluntarily to the researcher

Name of participant _____ Signature _____ Date _____

Name of data collector_____ Signature _____ Date _____

Name of principal investigator_____ Signature _____ Date _____

Annex–V: Consent Form (Amharic Version)

የስምምነት መጠየቂያ ቅፅ-አማርኛ ቅጂ

ሰላምታ!

የጥናቱ ተካፋይ መለያ ቁጥር _____

አጠቃላይ መመርያ

የመጣነዉ ከጅማ ዩኒቨርሲቲ የሕክምና እና የሕብረተሰብ ጤና ሳይንስ ፋካሊቲ የላቦራቶሪ እና ፓቶሎጂ ትምርት ክፍል ነዉ:: የመጣነውም በዚህ አካባቢ በሕጻናት የሆድ ውስጥ ተህዋስያን ወይም ትላትል መለከፍ እና ከሌሎች ጉዳዮች ጋር ያላቸው ቁርኝት ማወቅና የበሽታዉ ስርጭት በማጥናት በእነዚህ ተህዋስያን ምክንያት የሚከሰቱትን በሽታዎች ግንዛቤ እንዲዳብር ለማስቻል ነው።ከላይ የተጠቀሰውን የጥናት አላማ ለማሳካት ለጥናቱ የሚያስፈልጉ መረጃዎች እንዲሁም የደምና የሰገራ ናሙና በመዉሰድ አስፈላጊዉን የላቦራቶሪ ምርመራ ይደረጋል፡ ፡

በሚገኘው ውጤት መሠረት የሆድ ዉስጥ ተህዋሲያን ከተገኘቦት ተገቢውን የሕክምና አገልግሎት እንዲያገኙ ይደረጋል:: በመጠይቁም ላይ ስሞ ን ወይም የእርስ ን ማንነት የሚገልፅ ማንኛውንም ነገር አይጠቀስም ወይም አይያያዝም:: የሚሰጡትም መረጃም ሆነ ናሙና ከዚህ ጥናት ውጭ ለሌላ ጥቅም በፍፁም አይውልም::

የሚካሄደው ጥናታዊ ፅሁፍ ላይ ለመሳተፍ ስጠየቅ ልጄን በመወከል በጥናቱ መሳተፍ ሙሉበሙሉ በፍቃደኝነት ላይ የተመሰረተ መሆኑና ስለጥናቱ አላማና ይዘት፣ ያለው ጥቅምና ስጋት እንዳዉቀዉ የተደረገ ሲሆን ካልፈለግሁ በማነኛዉም ጊዜ ከጥናቱ እራሴን ማግለል እንደምችል ስለተገለፀልኝ በጥናቱ ለመሳተፍ ሙሉፈቃደኛ መሆኔን እገልፃለሁ። በተጨማሪም ለሚጠይቁኝ መጠይቅ ተገቢውን ምላሽ እና የላቦራቶሪ ናሙና ለመስጠት እኔና ልጄን በመወከል ፍቃደኛ መሆኔን በፊርማዬ አረጋግጣለሁ።

የጥናቱ ተካፋይ ስም_____ ፊርማ_____ ቀን _____

የመረጃ ሰብሳቢው ስም_____ ፊርማ_____ ቀን _____

የተመራማሪዉ ስም_____ ፊርማ_____ ቀን _____

Annex–VI: Consent Form (Guraghaegna Version)

የሰሣዋል ወሰል ቅፅ -በጉራግኛ ቅጂ

ሰላምታ

የጥናተውታን ተካፋይ መለየ ቁጥር_____

ሀወንመውታ መማርያ

የቸንነ ከጅማ ዩኒቨርሲቲ ህክምና እና በህብረትብ ጤና ሳይንስ ፋካልቲ በላብራቶሪም ፓቶሎጂ ክፍሉ። የቸንነ በአሁ አካባቢ በጠቆንት የደን ችረ ዌም ወለከፍ እና ተህንዋ ጉዳዬች ጋር ያነኖ ቁርኝት ወሃርና የቢሸቃዲ ኽማ ላዋቸሉ ። በነኔ የጠቃሺዬ የጥናት አላማ የዋሣካ የጥናት ያኬሶ መረጃዎች እንዲሁም የደሞና ሰገራ ናሙና በወሰድ ያኬሽ የላብራቶሪ ምርመራ ይሸክይ ።

ቢትራከቢ ውጤት መሰረት የደን ውስት ችረ ችግር በትረከበካሁ ይትጌባጊ የህክዋና አገልግሎት ትራህቦኽይ ይሸክት ። በመጠይቂ ፎር ኤያጥባብጥ ። ቲበይሚ መረጃ እና ያሙና በዚ ጥናት ውስጥ የሌላ ጥቅም ፍፅሞ ኤይወል።

ቢይካሔዲ ጥናታዊ ፅሁፉ ፎር ለማሣተፉ ትንጤየቅ ኽርጃኛ በወወከወይ በጥናት መሳተፉ ሙሉ በሙሉ በፍቃደኝነት ፎር የትምህርቱ በወኽነውቶ ስለጠናቲ አላማና ይዘት ፥ የነዲ ጥቅምና ስጋት ኽሂንኽማ የሸክቺ ቲኽን ፥ ባንሸው በማንም ግዝየ በትናቲ እራስኛ ዋግልል ኽችልኽማ ስለጎለጭኒ ፥ በጥናቲ ፅወሣተፉ ሙሉ ፉቃደኛ ወህነኝ ኽገልፀ ።

በተጨማሪ ሓጤይቂኒ መጠይቅ ተገቢ ሞላሽና የላብራቶሪ ናሙና በዋብ ፍቃደኛ ወህንኛ በፍርማኛ አረጋገጥሁም ።

የጥናት ተማፍይሽም _____ ፊርማ _____ ከነ _____

የመረጃ ስባሣቢዬ ሽም _____ ፊርማ _____ ከነ_____

የተመርማሪዬ ሽም _____ ፊርማ _____ ከነ_____

Annex–VII: Questionnaire (English Version)

If you agree to participate in this study, I have start my questions by asking general identification point. The interview takes about 15 minutes.

1. Socio demographic data

1.1 Study code number _____

1.2 Name of child _____

1.3 Age of the child _____

1.4 Sex A. Male B. Female

1.5. Address, Kebele _____ House number _____

1.6. Ethnicity_____

1.7. Religion _____

1.8. Family size _____

1.9. Family income per month _____ ETB

1.10. Mathers' (Guardians') highest level of schooling have ever attended _____

A. No formal education B. Primary 1 – 8 C. Secondary 9 -12 D. 12+

1.11. Mothers' (Guardians') occupation ……

A. Farmer B. Merchant C. Employed (waged)

D. House wife E. Student F. Daily laborer G. Others specify_____

2. To assess associated risk factors of soil-transmitted helminth infections

2.1 From where do you mainly fetch water for drinking?

A. From the river B. From the pipe

C. If other specify_____

2.2 Do you have latrine? A. Yes B. No If yes, skip question No 2.3

2.3 If no to No 2.2, where do you defecate and dispose the feces?

A. Pit B. Open filled C. If other specify_____

2.4 Does the child wearing shoes? A. Yes B. No If No, skip question No 2.5

2.5 If yes to No 2.4, how often?

A. Sometimes B. Regularly

2.6 Does the child wash his/her hand after defecation? A. Yes B. No

If No, skip question No 2.7

2.7 If yes to No.2.6, haw often?

A. Sometimes B. Regularly

2.8 Does the child wash his/her hand before eating food? A. Yes B. No

If No, skip question No 2.9

2.9 If yes to No.2.8, haw often?

A. Sometimes B. Regularly

2.10 Does the child play in the soil? A. Yes B. No If No, skip question No 2.11

2.11 If yes to No.2.10, haw often?

A. Sometimes B. Regularly

2.12 Does the child have nail biting or/and thump sucking habit? A. Yes B. No If No, skip question No 2.13

2.13 If yes to No.2.12, haw often?

A. Sometimes B. Regularly

2.14 Does the child have untrimmed finger nails? (Interviewer measure right and left hands finger nail) A. Yes, _____mm B. No

Annex–VIII: Questionnaire (Amharic Version)

ዉድ ተሳታፊዎች በጥናቱ ለመሳተፍ ፍቃደኛ ከሆናችሁ ለጥናቱ ይጠቅማሉ በሚባሉ ጥያቄዎች እንጀምራለን። እነዚህን መረጃዎች ለመዉሰድ የሚፈጀዉ ጊዜ 15 ደቂቃ ብቻ ነዉ።

1. **ማሕበራዊ ጉዳዮች**

1.1 **የጥናቱ ተካፋይ መለያ ቁጥር** _____

1.2 **የጥናቱ ተካፋይ ስም** _____

1.3 **የህፃኑ ዕድሜ ስንት ነው** _____

1.4 **ጾታ** **ሀ. ወንድ** **ለ . ሴት**

1.5 **አድራሻ, ቀበሌ** _____ **የቤት ቁጥር** _____

1.6.**ብሄር** _____

1.7.**ሀይማኖት** _____

1.8 **የቤተሰብ ብዛት ስንት ነዉ(በተሳታፊዉ ቤት ዉስጥ እሚኖር ሰዉ ብዛት)** _____

1.9 **የወር ገቢዎ ስንት ነው** _____ **የኢትዮጵያ ብር**

1.10 . **የእናቱ ወይንም ያሳዳጊዉ የትምርት ደረጃ** _____

ሀ. ምንም ያልተማረ **ለ . 1-8ኛ** **ሐ . 9-12ኛ** **መ . ከ12ኛ በላይ**

1.11 **የእናቱ ወይንም ያሳዳጊዉ ስራ ምንድን ነዉ;**_____

ሀ. አርሶ አደር **ለ. ነጋዴ** **ሐ . የ መንግስት (የግል ቀሚ) ሰራተኛ** **መ የ ቤት እማቤት**

ሠ. ተማሪ **ረ. ሌላ ካለ ይጠቀስ**_____

2. **ከሆድ ውስጥ ተህዋስያን ወይም ትላትል መለከፍ ጋር የተያያዙ ሌሎች ጠቃሚ መረጃዎች**

2 .1 **ለመጠጥ እሚሆን ውሀ በዋናነት ከየት ነው የምታገኙት?**

ሀ. ከወንዝ **ለ. ባንባ** **ሐ. ሌላ ካለ ይጥቀሱ**_____

2. 2 **ሽንት ቤት ዐላችሁ? ሀ. ዐዎ ለ. የለንም መልሱ አዎ ከሆነ ጥያቄ ቁጥር 2.3 ይታለፍ**

2 .3 **የጥያቄ ቁጥር 2.2 መልሱ የለንም ከሆነ የት ነው የምትጸዳዱት?**

ሀ. ጉደዳድ ውስጥ **ለ. ሜዳ ላይ** **ሐ . ሌላ ካለ ይጥቀሱ**_____

2 .4 ሕጻኑ ጫማ ይለብሳል ? ሀ. ዐዎ ለ .ዐይለብስም መልሱ ዐይለብስም ከሆነ ጥያቄ ቁጥር 2.5 ይታለፍ

2. 5 የጥያቄ ቁጥር 2. 4 መልሱ ዐዎ ከሆነ ምን ያሕል ያዘወትራል?

ሀ. አንዳንዴ ለ. ሑሌም

2 .6 ሕጻኑ ከሽንት ቤት መለስ እጁን ይታጠባል ወይም ያጥቡታል? ሀ. ዐዎ ለ. ዐይታጠብም መልሱ ዐይታጠብም ከሆነ ጥያቄ ቁጥር 2.7 ይታለፍ

2 .7 የጥያቄ ቁጥር 2.6 መልሱ ዐዎ ከሆነ ምን ያሕል ያዘወትራል?

ሀ. አንዳንዴ ለ. ሑሌም

2 .8 ሕጻኑ ከምግብ በፊት እጁን ይታጠባል ወይም ያጥቡታል? ሀ. ዐዎ ለ. ዐይታጠብም መልሱ ዐይታጠብም ከሆነ ጥያቄ ቁጥር 2.9 ይታለፍ

2 .9 የጥያቄ ቁጥር 2.8 መልሱ ዐዎ ከሆነምን ያሕል ያዘወትራል?

ሀ. አንዳንዴ ለ. ሑሌም

2. 10 ሕጻኑ በዐፈር ይጫወታል? ሀ. ዐዎ ለ. ዐይጫወትም መልሱ ዐይጫወትም ከሆነ ጥያቄ ቁጥር 2.11 ይታለፍ

2. 11 የጥያቄ ቁጥር 2.10 መልሱ ዐዎ ከሆነ ምን ያሕል ያዘወትራል?

ሀ. አንዳንዴ ለ. ሑሌም

2 .12 ሕጻኑ ጥፍር የመብላት ወይንም የመጥባት ባሕሪ ዐለዉ? ሀ. ዐዎ ለ. የለዉም መልሱ የለዉም ከሆነጥያቄ ቁጥር 2.13 ይታለፍ

2. 13 የጥያቄ ቁጥር 2.12 መልሱ ዐዎ ከሆነ ምን ያሕል ያዘወትራል?

ሀ. አንዳንዴ ለ. ሑሌም

2. 14 ሕጻኑ ያልተቆረጠ ጥፍር ዐለዉ? ቀኝና ግራ እጁን ይመልከቱ

ሀ. ዐዎ, _____ሚሜ ለ. የለዉም

Annex–IX: Questionnaire (Guraghaegna Version)

የተወደድሁ ተሳታፊዎች በጥናቲ ተወሳተፉ ፈቃደኛ በኽንኩ የጥናቲ ይጠቅም የቧርይ ጥያቄዎች ንቀርሰነ። ነዚ መረዳዎች የወውስጥ ይፎጅን ግዝያ 15 ደቂቃ ብቻው።

1. **ማህበራዊ ጉዳዮች**
   1.1. **ጥናቲ ተካፋይ መለያ ቁጥር** _____
   1.2. **የጥናቲ ተካፋይ ሽም**_____
   1.3. **የትከታዬ ዕድሜ ምናህሩ**_____
   1.4. **ዖታ ሀ/ ኧርጅ ለ/ ገረድ**
   1.5. **አድራሻ ቀበሌ** _____ **የቤት ቁጥር** _____
   1.6. **ብሔር** _____
   1.7. **አይማኖት** _____
   1.8. **የቤተሰብ ብዛት ምናህሩ (በተሳታፊ ቤት ያነ ሰብ ብዛት)**_____
   1.9. **የወር ገቢ ምናህሩ** _____**የኢትዮጵያ ብር**
   1.10. **የዳኮታ ወይም ያሳዳጊውታ የትምህርት ደረጃ** _____

   ሀ/ አቸም አንትማረ ለ/ 1-8ኛ ሐ/ 9-12ኛ መ/ ከ12ኛ በፎር

   1.11. **የባኮ ወይም ያሳዳጊ ሽራ ምቁሩ** _____

   ሀ/ አርሶ አደር ለ/ ነጋዴ ሐ/ የመንግስት(የግል ቀሚ) ሰራተኛ

   መ/ የቤት እመቤት ሠ/ ተማሪ ረ/ ሌላ በላ የጥቁሽ

2. **የደን ውስጥ ተዋሲያን ወይም ችረ ተወለከፋጌ የጥባበ ሌሎች መረጃዎች**
   2.1. **የመጠጥ ኧጋ ቤቴው ተረህቦ**

   ሀ/ በዲያ ለ/ በቧንቧ ሐ/ ሌላበነ የጥቁሺ

   2.2. **ሽን ቤት ነነያሁ ሀ/ ኤክ ለ/ ኤነ መለሲ ኤክ በኧነ ጥያቄዉ ቁጥር** 2.3. **የልፊ**
   2.3. **ጥያቄ ቁጥር** 2.2. **መልስ ኤነ በሽነ ቤታው ትዕዳዶ**

   ሀ/ በጎጀ ውስጥ ለ/ በሜዳ ፎር ሐ/ ሌላ በነ የጥቁሺ

   2.4. **ትከዩ ጫማ ያግድ ሀ/ ኤክ ለ/ ኤያግድ መልሴ ኤያግድ በሽነ ትያቄ ቁጥር** 2.5 **የልፊ**
   2.5. **የትያቄ ቁጥር** 2.4 **መልስ ኤክ በሽነ ምን ቅጨ ያዝወትር**

   ሀ/ አታትጌ ለ/ እንምዴ

   2.6. **ትከዩ በሽንት ቤት መልስ ኧጀሁ ይታጠብ ወላሽ ቆጥቢ**

ሀ/ ኤክ ለ/ ኤያጥ ቢ መልሲ ኤያጥቢ በኽነ ጥያቄ ቁጥር 2.7 የልፊ

2.7. የጥያቄ ቁጥር 2.6. መልስ ኤክለኽነ ምንቅጫ ያዝወትር
ሀ/ አታትጌ ለ/ እንምዴ
2.8. ትካዩ ምግብ ኢፋቱ አጀሁ ይታጠብ ወላሽ ያጥቡ
ሀ/ ኤክ ለ/ አያጥቢ መልሲ ኤያጥቢ በኽነ ጥያቄ ቁጥር 2.9 የልፊ
2.9. የጥያቄ ቁጥር 2.8. መልሲ ኤክ በኽነ ምንቅጫ ያዝወትር
ሀ/ አታትዴ ለ/ እንምዴ
2.10. ትብዩ በአፈር ይጫወት ሀ/ ኤክ ለ/ ኤነጫወት መልሲ ኤነጫወት በኽነ ጥያቄ ቁጥር 2.11 የልፊ
2.11. ጥያቄ ቁጥር 2.10 መልስ ኤክ በኽነ ምንቅጫ ያዘውትር;
ሀ/ አታትጌ ለ/ እንምዴ
2.12. ትከዩ ጥፎር የወከራ ወይም የወምጥጥ ባህሪ ነረን
ሀ/ ኤክ ለ/ ኤነን መልሲ ኤነን በኽነ ጥያቄ ቁጥር 2.13 የልፊ
2.13. የጥያቄ ቁጥር 2.12 መልስ ኤክ በኽ ምንቅጫ ያዝወትር
ሀ/ አታትጌ ለ/ እንምዴ
2.14. ትከዩ ያረገጪ ጥፍር ነረን በገና ጎራ ኧጀሁ የገ
ሀ/ ኤክ,_____ ሚሜ ለ/ ኤነን

Annex–X: Laboratory data record format.

Study Code number_____

1. Hgb value _____ g/dL

2. Microscopic Examinations

2.1. McMaster egg counting technique

A. No ova of intestinal parasite seen

B. Intestinal parasite seen

Type and the number of eggs per gram of stool

(I) *A.lumbricoides,* _____

(II) *T. trichiura,* _____

(III) hook worms, _____

(IV) Others _____

Name of Laboratory Technologist _____

Signature _____

Date ___/ ____/ _____

Declaration

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

Name: Teha shumbej

Signature: _____

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

Date of Submission:

This thesis has been submitted with my approval as an advisor.

Name	**Signature**
1. Endalew Zemene (BSc, MSc)	_____
2. Tariku Belay (BSc, MSc)	_____
3. Zeleke Mekonnen (PhD)	_____

This thesis has been submitted with my approval as an examiner.

Examiner:

Name	Signature	Date
1. _____	_____	_____