NUTRITIONAL STATUS, INTESTINAL PARASITE INFECTION AND THEIR ASSOCIATED FACTORS AMONG SCHOOLCHILDREN IN ARBA MINCH TOWN, SOUTHERN ETHIOPIA

Tagel Getachew

Research Thesis Submitted to the Department of Epidemiology, College of Public Health and Medical Sciences, Jimma University, in Partial Fulfillment of the Requirements for the Degree of Master of Public Health

June 2014,
Jimma University

Nutritional Status, Intestinal Parasite Infection and their Associated Factors among Schoolchildren in Arba Minch Town, Southern Ethiopia

By:

Tagel Getachew (BSc.PH)

Advisors:

1. Mr. Henok Asefa (MSc.)

2. Mr. Tsegaye Tewelde (MPH)

June 2014,
Jimma University

ABSTRACT

Background: Malnutrition and intestinal parasitic infections are major public health problems for children in developing countries, with negative implications for child survival, growth and development. However, little is known about the health and nutritional status of Ethiopian schoolchildren. Moreover, to the best of our knowledge until now no separate prior studies have been conducted to elucidate nutritional status, intestinal parasite infection and their predictors in schoolchildren in the study area.

Objectives: To determine the prevalence and associated factors of undernutrition and intestinal parasitic infections among schoolchildren in Arba Minch town.

Methods: Cross-sectional study was employed to assess nutritional status and IPIs among 532 students in primary schools of Arba Minch town in March and April 2014. A two-stage sampling procedure was applied, where in the first-stage, PPS sampling to select study schools, followed by SRS to select study subjects. Background characteristics were collected using a structured questionnaire by interviewing parents. Household food insecurity and child dietary diversity were measured as FAO/FANTA guidelines. Anthropometric measurements were made according to WHO standardized procedure. Parasitological examinations were performed according to the WHO Bench aids. Multivariable logistic regression analysis was employed for determining the relative contribution of each independent variable to a single outcome.

Results: The prevalence rates of stunting, thinness and underweight were 26.0 % (95%CI: 22.2, 29.8%), 19.9% (95%CI: 14.1, 25.7%) and 11.7% (95%CI: 8.9, 14.5%), respectively. Low level of maternal education [AOR (95%CI): 4.4(1.7, 11.3)], polyparasitism [AOR (95%CI): 5.1(1.6, 15.7)], and intensity of STH infection [AOR (95%CI): 0.01(0.001, 0.09)] were independent factors associated with stunting, whereas polyparasitism[AOR(95%CI):3.6(1.21,10.8)], Amoebiasis[AOR(95%CI):7.3(1.8,30.8)], Giardiasis[AOR(95%CI):4.3(1.2,15.1)],and reported illness in the last two weeks[AOR(95%CI):2.9(1.04,7.9)] were significantly associated with thinness. Polyparasitism [AOR (95%CI):8.8(2.6, 29.6)], reported illness in the last two weeks [AOR (95%CI):7.6(2.2, 26.1)], household food insecurity [AOR (95%CI):3.5(1.03, 11.6)] and maternal unemployment [AOR (95%CI):5.6(1.4, 22.1)] were associated with being underweight. While the prevalence of intestinal parasite infection was 55.8% (95%CI: 51.5, 60.1%). The prevalence of any STH (Path) was 62.96%, and 47% were moderate-to-heavy intensity. Low household wealth [AOR (95%CI):2.4(1.2,4.7)], maternal unemployment [AOR (95%CI): 2.4(1.2,4.7)], low child dietary diversity [AOR (95%CI):10.1(5.5,18.5)], never hand washing with soap after defecation [AOR (95%CI): 17.6 (7.2, 43.2)],less frequent use of footwear[AOR(95%CI): 4.2 (1.8, 9.5)] and open field garbage disposal [AOR (95%CI):3.7(1.4,9.5)]were significantly associated with intestinal parasites.

Conclusions and Recommendations: According to the findings of this study, undernutrition was highly prevalent in the in the study area where intestinal parasites are highly prevalent.

Low child dietary diversity, low household wealth, household food insecurity, intestinal parasites, illness in the last two weeks, open field garbage disposal, low level maternal education and maternal unemployment were independent factors associated with undernutrition. While low child dietary diversity, poor hand washing after defecation, less frequent use of footwear, low household wealth and maternal unemployment were independent factors associated with intestinal parasite infections. Due to the interrelation between many of these health and nutrition problems, effective health and nutrition interventions that require a multi- disciplinary approach such as periodic de-worming, improving sanitation and hygiene, women empowerment, addressing household food insecurity and improving dietary diversity at both the school and community based should be scaled-up to curb undernutrition.

Key words: Undernutrition, intestinal parasitic infections, schoolchildren

ACKNOWLEDGEMENTS

With deep appreciation and heartfelt gratitude, I acknowledge my Advisors Mr. Henok Asefa and Mr. Tsegaye Tewelde for their invaluable comments and scientific guidance.

I am also very grateful and would like to extend my heartfelt thanks and appreciation to Mr. Alemayehu Argaw for his help in inception of the topic, provision of invaluable comments and scientific guidance.

I am extremely grateful to schoolchildren and their parents involved in the study, data collectors, school principals and teachers.

I would like to thank the Arba Minch College of Health Sciences, the Ethiopian Public Health Institute, the Arba Minch Town Health Office, the Arba Minch Hospital, the Arba Minch Health Center, the Arba Minch Town Education Office, the Gamo Goffa Zone Health Department, and the visited schools, for their support during the study.

I would also like to acknowledge Jimma University, which provided funding for this study.

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ACRONYMS

BAZ	BMI -for-age z scores
BMI	Body Mass Index
CBN	Community Based Nutrition
CDDS	Child Dietary Diversity Score
CI	Confidence Interval
CSA	Central Statistical Agency
DHS	Demographic and Health Survey
EOS	Enhanced Out Reach Strategy
epg	eggs per gram of faeces
FTF	Feed the Future
HAZ	Height-for-age z scores
HDDS	Household Dietary Diversity Score
HEP	Health Extension Programme
HFIAS	Household Food Insecurity Access Scale
IPIs	Intestinal Parasitic Infections
MAM	Moderate Acute Malnutrition
NNS	National Nutrition Strategy
NTDs	Neglected Tropical Diseases
OR	Odds Ratio
P4P	Purchase for progress
PI	Principal Investigator
REACH	Renewed Efforts Against Child Hunger
SD	Standard Deviation
SOP	Standard Operating Procedures
SSA	Sub-Saharan African
STH	Soil-transmitted helminthes
SUN	Scaling Up Nutrition Initiative
UNICEF	United Nations International Children`s Emergency Fund
WAZ	Weight-for-age z scores
WHO	World Health Organization

CHAPTER ONE

1 INTRODUCTION

1.1 Background

Malnutrition and intestinal parasitic infections are major public health problems for urban pre-school children as well as schoolchildren in developing countries [1-4]. Childhood malnutrition, encompassing both undernutrition and overweight, are well recognized as an important global public health problem with important consequences for survival, incidence of acute and chronic diseases, healthy development, and the economic productivity of individuals and societies [5, 6].

Malnutrition is a deficiency state of both macro and micronutrients (undernutrition) and their over consumption (over-nutrition) causing measurable adverse effects on human body structure and function, resulting in specific physical and clinical outcomes [7, 8]. Undernutrition may originate from the deficiency or absence of any nutrient. The establishment and severity of undernutrition depends on the cause, intensity and duration of the nutritional deficiency. It can be caused, primarily, by an inadequate diet or, secondarily, by deficiency in gastrointestinal absorption and/or increase in demand, or even, by an excessive excretion of nutrients [9, 10]. Undernutrition encompasses acute (wasting) and chronic (stunting) forms of malnutrition, and underweight together with deficiencies of other essential micronutrients [5, 7, 8].

The best global public health indicator of a child's well-being is growth. Growth performance of children is an excellent reflection of their underlying health and nutritional status. Therefore, assessment of growth performance of children is one very important purpose of anthropometric measurements to assess physical growth, and used to predict performance, health and survival of individuals and reflect the economic and social well being of populations [6, 11, 12].

1.2 Statement of the Problem

Undernutrition and IPIs are widespread in developing countries, particularly in children[1-4]. The level of undernutrition in the world remains ``serious``, with an estimated 870 million, or 1 in 8 people worldwide, were undernourished, with most (852 million) living in developing countries, the worst affected were children, in the period 2010 to 2012 [13]. Similarly, IPIs are still a serious public health problem in the world, particularly in developing countries [14-16]. Worldwide, about 3.5 billion people are affected, and 450 million are ill as a result of IPIs, the majority being children in developing world, particularly in SSA [15]. In addition, it is estimated 100 million people have been reported to have experienced stunting or wasting as a result of IPIs [17]. In Ethiopia, Ascariasis, Hookworm & Trichuriasis is estimated to infect 26 m, 11 m, and 21 million people respectively [16]. The relationship between IPIs and undernutrition is synergistic. IPIs are thought to contribute to undernutrition through subtle reduction in digestion and absorption, chronic inflammation and loss of nutrients. In turn, undernutrition can make a person more susceptible to parasitic infections, which causes a vicious cycle [10, 17, 18].

Undernutrition and IPIs are major public health problems of children in developing countries, particularly in SSA [4,16-22]. Diets in populations there are frequently deficient in macro-and/or micronutrients and the high prevalence of IPIs contributes greatly to undernutrition there [23]. Undernutrition is the underlying cause of 3.1 million child deaths each year—45% of the total [5, 24], 35 % of the disease burden and 11% of total global DALYs [8]. Its results stunt the physical growth and life chances of millions of people, and for Africa and Asia estimates suggest that up to 11% of national economic productivity is lost to undernutrition [5]. Globally, in 2011 an estimated 165 million (26%), 101million (16%), and 52million (8%), of children under-five years of age were stunted, underweight, and wasted respectively [25]. More than 90% affected children live in developing world, particularly in SSA[25], where IPIs are highly prevalent and the parasites are endemic[16]. IPIs as a cause of malnutrition/growth stunting is well documented [18].

Undernutrition and IPIs have a strikingly similar geographical distribution with the same people experiencing both insults together for much of their lives[18]. This is certainly true of Ethiopia, where Ethiopia is estimated to have the second highest burden of childhood stunting in Africa, in 2011[26], for the same period a national DHS indicated that the prevalence of childhood stunting, underweight, and wasting was 44%, 29%, and 10% respectively[27], while Ethiopia has the second, third and fourth highest burden of Ascariasis, Hookworm and Trichuriasis in 2009, in SSA respectively[16], a national prevalence of Ascariasis, Trichuriasis, and Hookworm is estimated at 37%, 30%, and 16% in 2008 respectively [28]. Similar prevalence of undernutrition (50%) and IPIs (56%) were found in urban schoolchildren of North-west Ethiopia, in 2009[29].

A third of Ethiopians are infected with Ascariasis, one quarter is infected with Trichuriasis, one in eight Ethiopians lives with Hookworm [30]. The nutritional status of people infected with parasitic infections is altered through a decline in food intake and/or an increase in nutrient wastage through blood loss, vomiting or diarrhea. These effects can lead to or aggravate undernutrition, IDA and other nutrient deficiencies [17,18]. Apart from morbidity and permanent organ damage, IPIs cause poor physical growth, stunting, poor intellectual development, impaired cognitive function and poor school performance. They do so at a critical time in life: infection reaches maximum intensity in the age range of 5 to 14 years [17, 18, 31].

FAO`s most recent estimates indicate that 45% of Ethiopians were undernourished in 2010-2012. The data show that although undernutrition in Ethiopia is still alarmingly high and remains an acute and widespread challenge [13]. A recent UNICEF study describes undernutrition as “a major threat to the survival and development of Ethiopian girls, boys and women” [32]. According to recent estimates, more than 2 out of every 5 children in Ethiopia are stunted [27]. Undernutrition was associated with 28% of all child mortalities [5, 33]. As many as 81% of all cases of child undernutrition and its related pathologies go untreated [33]. Stunted children in Ethiopia are also more likely to drop out of school. It is estimated that children who were stunted experienced a 3.9% higher repetition rate in primary school [33]. As a result, 16% of all grade repetitions in primary school are associated to the higher incidence of repetition that is experienced by stunted children in 2009. Stunted children achieve 1.1 years less in school education [33]. Undernutrition is estimated to reduce a nation’s economic advancement by at

least 8% (direct productivity losses, losses via poorer cognition, and losses via reduced schooling) [5]. 67% of the adult population in Ethiopia suffered from stunting as children [33]. The annual costs associated with child undernutrition are estimated at ETB 55.5 billion, which is equivalent to 16.5% of GDP [33]. When a child is undernourished due to parasitic infections &/or other causes, the negative consequences follow that child for his/her entire life. These negative consequences also have grave effects on the economies where s/he lives, learns and works [5, 33].

Despite these high burdens of undernutrition, Ethiopia has also made important progress in the reduction of child undernutrition in the last decade [27,34,35]. As reported by Taylor (2012), achieving a 1.34% AARR in underweight and stunting prevalence [36]. Although the downward trend in undernutrition is encouraging, progress is too slow [36]. According to UNICEF, Ethiopia was identified in 2013 as having made 'insufficient progress' and as not being on track to achieving this MDG 1. Being 'on track', denotes AARR in underweight at least 2.6% or prevalence is 5% or less [26, 27].
In terms of IPIs, despite these high burdens of infection, the control of IPIs is in its infancy [30].

Despite the aforementioned challenges, efforts continue, both at national and global levels, to address the issues of undernutrition. At the national level, these efforts include initiatives and strategies such as the National Nutrition Programme(NNP 2008-present), which has many relevant components, and the Productive Safety Net Programme[37,38]. Key nutrition activities of the NNP include: HEP, ENA, CBN, TFP, EOS/EEOS and TSF. At the global level, initiatives include REACH, P4P,SUN,FTF, the ―`1,000 Days` partnership, as well as the Abuja Food Security Summit of 2006[5,24,33].
In terms of IPIS, at the national level, these efforts include initiatives and strategies such as the National Master Plan for NTDs to implementing key internationally accepted strategies in 2013-2015[39]. At the global level these efforts include such as WHO's Global plan to combat NTDs 2008–2015[40], and WHO resolved if prevalence of any STH ≥ 50% among school-age children at a baseline to treat all school-age children (enrolled &non-enrolled) twice a year and if ≥20% and <50% once a year, and also to treat; preschool children, WCBA, including PW in the 2nd and 3rd trimesters and lactating women [41].

Undernutrition in Ethiopia and elsewhere is caused by multiple, complex factors. While inadequate dietary intake and infections are clearly the immediate causes, these factors are shaped by a variety of underlying factors. Understanding the immediate and underlying causes of undernutrition in a given context is critical to delivering appropriate, effective and sustainable solutions and adequately meeting the needs of the most vulnerable people [5, 26]. However, little is known about the nutrition and health of schoolchildren, but there is growing evidence of a considerable burden of morbidity and mortality due to undernutrition and IPIs [20-22].

Epidemiological studies conducted in developing countries have identified several factors associated with undernutrition in schoolchildren, including; child age and sex, Ascariasis, Trichuriasis and Hookworm [15], age, moderate and heavy Trichuris, Ascaris co-infection and decreasing maternal height are strong predictors of stunting [2,3]. High intensity Trichuris, hookworm, maternal education, and decreasing maternal BMI are risk factors of wasting [3]. Moderate-high intensity Trichuris, age, maternal education and decreasing maternal BMI are determinants of underweight [3]. Helminthic[42,43], and protozoal IPIs[43], maternal literacy, age and sex of child[29],age and lack of latrine[44],family monthly income[45], age, Ascariasis and Hookworm [46], Ascariasis and Trichuriasis[47], Giardiasis[48], Amoebiasis[49],urban slum school, low SES, maternal education, maternal occupation and low maternal nutritional knowledge identified as key determinants of undernutrition [50].

Similarly, epidemiological studies conducted in developing countries have identified several factors associated with IPIs in schoolchildren including; low family income, low maternal education, unemployed mothers and OFD [14], living in shacks, and cohabitation with other families[15], paternal occupation(farmer),no shoe wearing[51], age and sex of child, frequent swimming and agricultural activities on bare foot[52].

Only limited research has been conducted on the health and nutritional status of Ethiopian schoolchildren. This may be due to lack of relevant data at national level. Since DHS which provide nutritional status data at national level, do not include schoolchildren [27,34,35], the NNS also not considers schoolchildren as a target [37], and may be due to the limited number of researchers in the area. Most of the previous studies on nutritional status of schoolchildren used inappropriate indicator to define wasting using WHZ for school-aged children and underweight

WAZ for children older than ten years old [29,42,45, 53]. Others focus on only IPIs to show their prevalence without looking the associated factors [54-58]. Some focus on helminths to show the association with undernutrition without estimating the intensity and controlling confounders to show the real effect [29,43,53]. Some reported statistically significant association between IPIs and undernutrition [42,43]. Others reported no statistically significant association [29,45,53]. None of the studies explored the effects of household food insecurity and child dietary diversity. However, there are no studies that explored the prevalence of undernutrition and IPIs and their associated factors among schoolchildren in the study area. Therefore, the objective of this study was to determine the prevalence of undernutrition and IPIs among schoolchildren in the study area and identify role of IPIs and other predictors on nutritional status.

CHAPTER TWO

2 LITERATURE REVIEW

2.1 Overview

Undernutrition and IPIs are widespread in developing countries, particularly in children [1-4]. Undernutrition and intestinal parasitic infections are diseases of poverty. They give rise to much suffering and death; in addition, they contribute to the perpetuation of poverty by impairing the physical and intellectual growth of children, and by diminishing the work capacity and productivity of adults [16, 40, 41].

2.2 Prevalence of Undernutrition

Since 1990 the global prevalence of stunting has decreased 36%, from an estimated 40% (95% CI: 38%-42%) in 1990 to 26% (95%CI:24%-28%) in 2011 with an AARR of 2.1% per year during this period[25,59]. The global prevalence of underweight has declined 37% from 25% (95%CI: 23%-28%) in 1990 to 16% (95%CI: 13%-18%) with an AARR of 2.2% per year [25]. In 2011, an estimated 35.6% (95%CI: 33.3-38.0), 17.7 %(95%CI: 15.7%-19.7%), and 8.5 %(95%CI: 7.4-9.6), children under five years of age in Africa were stunted, underweight and wasted respectively [25].

A meta-analysis of 16 DHS in 10 SSA countries reported that the pooled estimates for mean z-scores were -1.59 for boys and -1.46 for girls with the difference statistically significant ($p< 0.001$). The stunting prevalence was also higher in boys (40%) than in girls (36%) in pooled data analysis; crude OR 1.16 (95%CI:1.12–1.20); child age and individual survey adjusted OR 1.18 (95% CI:1.14–1.22). Male children in households of the poorest 40% were more likely to be stunted compared to females in the same group, but the pattern was not consistent in all studies, and evaluation of the SES/sex interaction term in relation to stunting was not significant for the surveys [60]. As reported by PCD sixteen years ago from one of the largest studies of nutritional status of schoolchildren in low-income countries (Ghana, Tanzania, Indonesia, Vietnam and

India) found the overall prevalence of stunting and underweight to be high in all five countries, ranging from 48 to 56% for stunting and from 34 to 62% for underweight. In all countries there was a trend for HAZ and WAZ to decrease with age, thus as children got older they became progressively shorter relative to the reference population. The boys in most countries tended to be more stunted than girls and in all countries, boys were more underweight than girls [21,22].Undernutrition is widespread among preschool children as well as schoolchildren in SSA; that growth retardation seems to occur throughout the preschool and school-age years; and that boys are significantly more stunted and underweight than girls, perhaps because the adolescent growth spurt is delayed by chronic undernutrition or does not occur at all.

A study conducted in Peru reported the prevalence of stunting and underweight among 1074 schoolchildren to be 34.5% and 10.5%, respectively, co-prevalence was 9.3% [2]. As reported by Jardim-Botelho *et al*. the prevalence of stunting, underweight, and wasting among Brazilian children and adolescents was 28.3%, 10.0%, and 2.4%, respectively [46]. A recent study conducted in Honduras showed that the prevalence of stunting, underweight and thinness among schoolchildren was 5.6%, 1.3% and 2.2% respectively [17].

The National DHS conducted by CSA in Ethiopia in 2011 showed that the level of undernutrition is significant with nearly one in two (44%), children under-five years of age are stunted, 10% wasted, and 29% underweight [27]. A national survey conducted by Hall *et al*. reported stunting and thinness among 7556 schoolchildren to be 22.3% (95%CI: 20.4-24.2) & 23.1% (95%CI: 21.4-24.8), respectively [61]. As reported by Worku *et al*. the prevalence of underweight, stunting, and wasting among schoolchildren was 34.8%, 27%, and 50%, respectively. [29]. In Tigray, the prevalence of stunting and thinness among adolescent girls reported to be 26.5% and 58.3%, respectively. [44]. A study conducted in Angolela showed that 11%, 20.8%, and 19.6% of students were reported to be stunted, underweight and wasted, respectively [43]. A similar study in Adama showed that 12.6%, 1.4% and 7.2% were stunted, wasted and underweight, respectively [45]. The variation in the reported prevalence of undernutrition across studies may be explained by the difference in study setting, sample size, socio-economic, environmental and cultural differences.

2.3 Prevalence and Intensity of Intestinal Parasitic Infections

Global infections reported for some of the most common intestinal parasites are *A.lumbricoides* (20%), Hookworm (18%), *T.trichiura* (10%), and *E.histolytica* (10%) [62]. A study conducted in Mexico reported the prevalence of protozoan infections, helminth infections and polyparasitism among 507 schoolchildren to be 65%, 53%, and 52% respectively [14].

In Ethiopia, reported prevalence studies of STH between 1981 and 2009 showed that the overall prevalence rates range from 0 % to 100 %, with varying prevalence rates for individual parasites across different localities and indicated that the triad of *A. lumbricoides*, Hookworms and *T. trichiura* are most common infections in Ethiopia [39]. A national survey conducted by Hall *et al*. reported Ascariasis, Hookworms, Trichuriasis, Giardiasis and Hymenolopiasis among 7466 school age children to be 20.7%(95%CI:18.0-23.4), 7.7%(95%CI:6.2-9.2), 6%(95%CI:4.6-7.4), 3.2%(95%CI:2.4-4.0), and 2%(95%CI:1.6-2.5) respectively[61].

The national prevalence of Ascariasis is estimated at 37%[28].The prevalence among schoolchildren was reported to be 16.8% in Dagi[52], 14% in Asendabo[54], 2.5% in Adama[45], and 83.4% in Wondo Genet[55]. The intensities of infection was significantly influenced by age (p0.03), with the highest mean epg observed in children 5-9 years old [54]. The national prevalence of Hookworm is estimated at 16%, decreasing with altitude [28]. The prevalence of hookworm among schoolchildren was reported to be 23.6% in Dagi [52], 60.2% in Langano [56], 40.8% in Asendabo [54], 20.4% in Jimma [63], and 28.4% in Bushullo [64]. 92% of the Hookworm infections were due to *N. americanus* and 8% were due to *A. duodenale* [54]. Similarly, the national prevalence of Trichuriasis is estimated at 30% [28]. The prevalence of Trichuriasis among school age children was reported to be 3.6% in Gorgora [51], 3.3% in Jimma [63], and 41.5% in Bushullo [64].

Among 365 communities surveyed for *S. mansoni* between 1961 and 1986, prevalence ranged from 10 to 92% [58]. The prevalence of *S. mansoni* among schoolchildren was reported to be 63% in Adwa [65], 20.6% in Gorgora [51],and 73.7% in Bushullo[64]. Prevalence was higher in males than in females during both surveys (35.3%vs18.1%;& 51%vs32.6% (P< 0.05), a peak

infection rate in the age group 15-19years (41.2%) followed by the age group 10-14 (24%) and the least affected were the 5-9(18.5%) (P<0.002)[66]. *S. mansoni* is widespread; occurring mostly in agricultural communities at 1300-2000 m.Transmission occurs mainly through streams, irrigation schemes, and lakes. The intensity of infection correlates with severity of infection, and varies from locality to locality.

The prevalence of Taenia sp. among school age children was reported to be 7% in Dagi [52], 13.9% in Adama [45], and 1.4% in Bushullo [64]. The prevalence of *H. nana* among school age children was reported to be 28.3% in Gondar [53], 8.9% in Adama [45], and 1.7% in Bushullo [64].

Amoebiasis and Giardiasis are common causes of intestinal protozoal infections throughout the nation. A countrywide survey of Amoebiasis conducted by Erko *et al*. reported the overall prevalence of *E. histolytica* infections in schoolchildren and non-school communities were 15.0% and 3.5%, respectively. Slightly more females (18.4%) than males (14.2%) were infected among schoolchildren ($p<0.05$) but the difference was not significant among non-school communities ($p>0.05$) [67]. The prevalence of Amoebiasis among schoolchildren was reported to be 26.7% in Angolela [43], 21.6% in Dagi [52], and 12.7% in Langano [56].The prevalence of Giardiasis among schoolchildren was reported to be 22.8% in Dagi [52], 12.6% in Adama [45], and 12.7% in Langano [56]. The rate of IPIs was not significantly associated with sex, age or socio-economic factors and nutrition ($P > 0.05$) [45].

2.4 Predictors of Undernutrition

2.4.1 *Intestinal Parasitic Infections as a Predictors of Undernutrition*

A study conducted in Peru reported based on multivariable logistic regression analyses, significant independent risk factors for stunting and underweight were: hookworm infection (OR=1.74; 95% CI: 1.05, 2.86). Significant independent risk factors for stunting only were: moderate and heavy Trichuris and Ascaris co-infection (OR=1.95; 95% CI: 1.35, 2.82) [2].

A study conducted in Brazil among 1113 individuals aged 6 months to 83 years on multivariate analysis showed that, after controlling for age, sex and SES, stunting was significantly associated with *A. lumbricoides* infection among children and adolescents. An increase in the faecal *A. lumbricoides* egg count of 10 000 epg increased the odds of having stunting among children and adolescents by 47% (AOR=1.47, 95% CI: 1.00–2.16), low lean body mass by 93% (AOR=1.93, 95% CI:1.11–3.35) and low fat body mass by 68% (AOR=1.68, 95% CI:1.12–2.51). Whereas low body mass was significantly associated with Hookworm infection among adults and the elderly. An increase of 10 000 epg of hookworm increased the odds of having low fat body mass by 91% (AOR=1.91, 95% CI: 1.08–3.35). Helminth infections are associated with undernutrition in endemic populations, with important differences between the effects of Hookworm and *A. lumbricoides* on age-related nutritional status [46]. Another study in Honduras revealed that polyparasitism was significantly associated with decreased values in WAZ [17].

A study conducted in Turkey showed that Giardia-infected children had a risk for stunted (OR:7.67, 95%CI: 2.25-26.16; p0.001) and poor psychomotor development (OR:2.68, 95%CI: 1.09-6.58; p0.030) [48]. A similar study in Bangladesh showed that children with *E. histolytica*-associated diarrheal illness had lower WAZ changes (−0.103 ± 0.120 vs. 0.176 ± 0.052, *P*0.038). Similarly, the change in HAZ was lower in children with *E.histolytica*-associated diarrheal illness (−0.348 ± 0.186vs0.142 ± 0.08, *P*0.018). Children with *E. histolytica*-associated diarrheal illness were 2.93 times (95%CI: 1.01–8.52, *P* 0.047) more likely to be malnourished & 4.69times (95%CI: 1.55–14.18, *P*0.006) more prone to be stunted [49].

A study conducted in Angolela showed that severe underweightedness was associated with statistically significant increased odds of protozoan IPIs among boys (OR= 3.88, 95%CI:1.12-13.52). Girls who were severely stunted had a 12-fold increased odds (OR = 11.84, 95%CI: 1.72-81.62) of helminthic IPIs. Overall, those with poor nutritional status were more likely to have any IPI [43]. A study in Tikur Wuha, showed that the probability of being underweight was significantly higher in children who were infected with helminthic IPIs, aged 5-10 years and male compared with children who were without helminthic, aged 11-15years and female, respectively.The association of helminthic IPIs with low body mass was strong in the case of Hookworm infection [42].

Treatments against IPIs have shown to be associated with significant improvements on a child's overall well-being. Stephenson *et al*., observed that Kenyan schoolchildren, who were infected with IPIs and then treated with albendazole or pyrantel pamoate, all showed significant improvement in appetite and physical performance just 3 weeks to 4 months after treatment. As a result, these children significantly improved their weight (1.0 kg >the placebo group, P< 0.0002), height (0.6 cm more, P<0.003), arm circumference (0.3 cm more, P<0.0002), and triceps and subscapular skinfolds (1.0 mm more, P<0.0002) compared to the control group [47]. A study in Tikur Wuha showed that the means for weight, WAZ and BAZ of the children significantly increased four weeks after treatment for helminth infection, with a single dose of albendazole and/or praziquantel [42].

Although many studies have reported positive association between IPIs and undernutrition, a study of relationship between malnutrition and IPIs among schoolchildren in Nigeria reported that 74.84% of the infected children are malnourished (P<0.05) and there was no significant difference (P>0.05) of malnutrition between infected and non-infected children [4]. A similar studies among Ethiopian Schoolchildren in Adama [45], Gondar [53], and Bahir Dar [68], reported similar findings i.e., there was no statistically significant difference of nutritional status between infected and non-infected children. The plausible reason for this may be failure of controlling confounders to show the real effect.

2.4.2 *Household Food Insecurity and Child Dietary Diversity as a predictors of Undernutrition*

A recent study conducted to investigate if HFI is associated with undernutrition in children aged 6–59.9 mo in Bangladesh (n = 2356), Ethiopia (n = 3422), and Vietnam (n = 3075) reported that in the adjusted models, the odds of being stunted or underweight were significantly higher for children in severely food-insecure households in Bangladesh (stunting OR:1.36; 95% CI:1.05, 1.76; underweight OR: 1.28; 95% CI: 0.99, 1.65) and Ethiopia (stunting OR:1.48;95%CI: 1.09 ,2.00; underweightOR:1.68;95%CI:1.22,2.30) and in moderately food-insecure households in Vietnam (stunting OR:1.39;95%CI:1.16,1.65; underweight OR:1.69;95% CI:1.28, 2.23)[69].
A study conducted in Bangladesh among 165,111 pre-school children showed that one-half of the children were stunted. In multivariate analyses, compared with low DDS, high DDS was

associated with a 15, 26 and 31% reduced odds of being stunted among children aged 6–11, 12–23 and 24–59 months, respectively, after adjusting for all potential confounders (OR=0.85,95% CI:0.76–0.94; OR=0.74,95% CI:0.69–0.79;OR=0.69,95% CI:0.66–0.73). In all groups, children who were still breastfed were more likely to have limited diversity (OR=1.88, 95% CI: 1.32–2.67;OR =1.71,95% CI: 1.52–1.92; OR=1.15,95% CI:1.11–1.19). Those having diarrhea in the past week and coming from families with low SES were more likely to have decreased diversity (P <0.05) [70].

A recent study conducted in Ghana to assess the magnitude of HFI and its consequences on the nutritional status of children 6–36 months, on a sample of 337 mother/child pairs showed that HDDS and FCS were both significantly associated with chronic malnutrition (stunted growth) but not acute malnutrition (wasting). Compared to children in FI households, children in FS households were 46% protected from chronic malnutrition (OR=0.54,95% CI:0.31–0.94) [71].

A recent study conducted in 600 Nigerian schoolchildren showed that significant differences existed between students in private and public schools in BMI-for-age (p =.025), in DDS (p =.034) and in undernutrition (p =.003). No private schoolchildren exhibited underweight or stunting, but 11.7% were overweight or obese. Stunting (p =.024) and wasting (p =.018) correlated significantly with lower DDS [72]. A recent study conducted in Colombia in 2784 low-income households with preschool children showed that statistically significant associations were found between household food insecurity and diagnoses of children's diarrhea, respiratory infections, and parasitosis (P < 0.0001). The risk for child stunting and underweight increased in a dose–response way as food insecurity became more severe [73]. A recent study conducted in 670 Tanzanian adolescents showed that household energy adequacy per adult equivalent and HDDS were inversely associated with undernutrition after adjusting for gender, age, puberty, and the interaction between age and puberty [74].

2.4.3 *Demographic, Socio-economic and Environmental factors as a Predictors of Undernutrition*

As reported by Jardim-Botelho *et al*. being underweight was more prevalent in adolescent males than in females (9.7% vs 0.7percentage, P0.001) but more prevalent in adult females than in males (8.3% vs 4.6percentage, P 0.046) [45].

A meta-analysis of 16 DHS in 10 SSA countries reported that the pooled estimates for mean z-scores were -1.59 for boys and -1.46 for girls ($p < 0.001$). The stunting prevalence was also higher in boys (40%) than in girls (36%) in pooled data analysis; child age and individual survey adjusted OR1.18 (95% CI:1.14–1.22). Male children in households of the poorest 40% were more likely to be stunted compared to females in the same group [60]. One of the largest studies of nutritional status of schoolchildren in low-income countries (Ghana, Tanzania, Indonesia, Vietnam and India) reported that in all countries there was a trend for HAZ and WAZ to decrease with age. The boys in most countries tended to be more stunted than girls and in all countries, boys were more underweight than girls [21,22].

As reported by Worku *et al*. maternal literacy status, sex and age of the child were significantly associated with malnutrition ($p<0.05$) [29]. In Tigray, lack of latrine facilities was significantly associated with stunting (p0.0033) and thinness ($p<0.0001$). Age was strong predictor of stunting ($r^2 = 0.8838$, $p<0.0001$) and thinness ($r^2 = 0.3324$, $p<0.0001$) [44]. A study in Adama showed that the proportion of malnourished male children was higher than that of female children ($p<0.05$; OR 2.214, 95% CI: 1.285–3.813).Those children whose families had a monthly income of less than 200 ETB were highly affected by malnutrition ($P < 0.05$) [45]. In Jimma, South-west Ethiopia [75] and Pune, India [76] large household size is associated with stunting. A study conducted in Butajira, Ethiopia showed that open field disposal of household rubbish increased the risk of being underweight in a cohort of infants [77].

2.5 Predictors of Intestinal Parasitic Infections

A study conducted in Mexico among 507 schoolchildren showed that children from lower-income families and with unemployed and less educated mothers showed higher risk of intestinal parasitism(OR6.0, 95% CI:1.6–22.6);OR4.5,95%CI:2.5–8.2;OR3.3,95%CI:1.5–7.4 respectively). Defecation in open areas was also a high risk factor for infection (OR 2.4, 95% CI 2.0–3.0) [14].
A study conducted in Rome, Italy among 247 immigrant children (aged 0-15)showed that living in shacks, and cohabitation with other families ($p<0.01$). Children classified in the lower HAZ had a significantly greater prevalence of parasites (30.9%) than the others ($p<0.01$) [15].
A study conducted among 385 preschool children in India revealed that lack of household solid waste collection was significantly associated with IPIs (OR=2.5,95%CI:1.4-4.36,P<0.001)[78].

In conclusion, the above literature review helps us to identify prevalence of undernutrition and IPIs, and important factors associated with undernutrition and IPIs in developing countries, including factors related to individual and household characteristics such as child age & sex, household food insecurity, low DDS, family income, maternal education level and employment status, lack of latrine. The most important IPIs related to undernutrition are Ascariasis, Hookworm, Trichuriasis, Schistosomiasis, Amoebiasis, Giardiasis, and Hymenolopiasis. IPIs act negatively over the genetic growth potential of children and adolescents, keeping them from reaching full somatic growth. IPIs and undernutrition are highly prevalent in Ethiopia, resulting in enoromous disease burdens compared even with other SSA countries. The prevalence and association between undernutrition and IPIs varies by locality in Ethiopia. Some of these findings, however, have remained inconsistent and controversial. A possible explanation for this might be that both undernutrition and IPIs exist to a level of public health significance in the area, probably interacting synergistically and with other socio-economic and dietary factors and failure to control confounders. Another situation to be considered is the intensity of infection for STH and polyparasitism: negative impact increases as infection load &/or co-infection increases.

2.6 Conceptual Framework

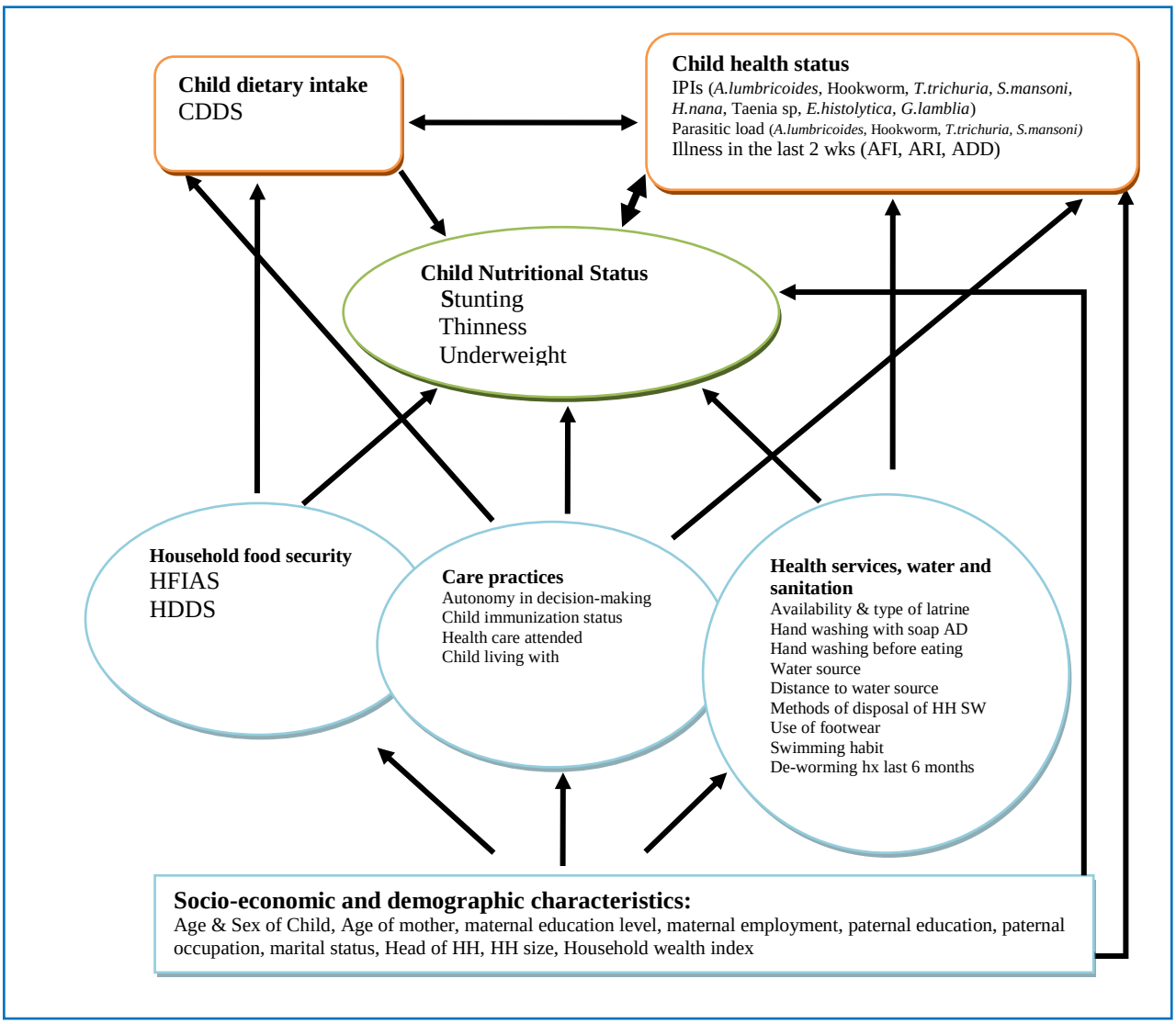


Figure1 Conceptual framework for studying the potential predictors of nutritional status among schoolchildren in Arba Minch town, Southern Ethiopia, March-April, 2014. (Designed after literature review)

The causes of undernutrition are numerous and multifaceted. These causes are intertwine with each other. The immediate determinants are poor diet and infections, which are themselves influenced each other and by a set of underlying factors; household food security, maternal/child caring practices, and access to health services and healthy environment. These underlying factors themselves are influenced by the socio-economic conditions. The black arrows show that the influence of potential predictors on nutritional status.

SIGNIFICANCE OF THE STUDY

Undernutrition and IPIs remains serious public health problems for pre-school children as well as schoolchildren in developing countries, with negative implications for child survival, growth, development, birth outcomes, and long-term health. However, only limited research has been conducted on the health and nutritional status of Ethiopian schoolchildren. This may be due to lack of relevant data at national level. Since DHS, which provide nutritional status data at national level, do not include schoolchildren. A limitation of the studies on nutritional status of schoolchildren identified is the use of not only disparate, but also inappropriate, methods for defining nutritional status. Some studies used WHZ to define wasting in schoolchildren and used WAZ to define underweight for children older than ten years old.

The prevalence and some factors that affect nutritional status in preschool children are relatively well documented however; there are important gaps in knowledge when school-aged children represent the target population. It is known that IPIs, together with other immediate and underlying causes, stand out as important factors that compromise the physical growth of this population. However, in light of the above literature review, most of the previous studies conducted in Ethiopia focused on the prevalence of IPIs themselves; surprisingly, there is paucity of information on the association with undernutrition. Only few studies have been reported about the association between IPIs and nutritional status. Some of these findings, however, have remained inconsistent and controversial. They also overlooked estimating intensity and polyparasitism, which would have been crucial for epidemiological and clinical evaluations. Furthermore, most prior authors have concentrated on nutritional and health impacts of helminths rather than on protozoal infections such as Amebiasis and Giardiasis even though the latter are often more prevalent and associated with undernutrition. None of the studies explored the effects of household food insecurity and child dietary diversity. Moreover, to the best of our knowledge until now no separate prior studies have been conducted to elucidate nutritional status, IPIs, and their predictors in schoolchildren in the study area.

More considerably, the study will have important policy implications/program relevance from a global health perspective as well as a country-specific viewpoint. From a global health

perspective, WHO resolved in endemic areas to treat at least 75% of school-age children, if prevalence of any STH ≥ 50% at a baseline to treat all school-aged children (enrolled &non-enrolled) twice a year. At the National level, government was better informed about where to allocate their scarce resources in their effort to improve the nutrition and health status of their general population, and of schoolchildren in particular. On the other hand, the government of Ethiopia is committed to reduce the burden of IPIs through a NMP for NTDs to implementing key internationally accepted strategies in 2013-2015. This urge need for more research on the prevalence of IPIs and their hidden effects on health and nutritional status of schoolchildren, a neglected age group that harbours a large burden of disease due to undernutrition and neglected IPIs.

With this in view, this study was designed with the objective of assessing the prevalence and predictors of undernutrition and IPIs among schoolchildren in Arba Minch. The findings from this study will provide invaluable information and help to address gaps and to apply interventions as necessary based on the recommendations to be forwarded at the end of this study; and that will contribute to improve health and nutritional status and may help to decrease the vicious intergenerational cycle of growth failure that entraps children and adolescents in the study area in particular and in the country in general.

CHAPTER THREE

3 OBJECTIVES

3.1 General Objective

To determine the prevalence of undernutrition and intestinal parasitic infections among schoolchildren in Arba Minch and identify role of intestinal parasitic infections and other predictors on nutritional status.

3.2 Specific Objectives

1. To estimate the prevalence of stunting, thinness, and underweight among schoolchildren
2. To estimate the prevalence and intensity of intestinal parasitic infections among schoolchildren
3. To identify factors associated with stunting, thinness and underweight among schoolchildren
4. To identify factors associated with intestinal parasitic infections among schoolchildren

CHAPTER FOUR

4 SUBJECTS AND METHODS

4.1 Study Area and Period

The study was conducted in Arba Minch town in March and April, 2014. Arba Minch town is the capital of Gamo Goffa Zone located 505 kms to south of Addis Ababa, the capital city of Ethiopia. The town is found at an altitude of 1200-1300 meters above sea level with an average annual temperature of 29.7^0c and a rainfall of 700 mm. The town of Arba Minch is traversed by Kulfo River serves as sources of water for bathing, washing, swimming, irrigation, recreational and other purposes and in the area Lake Abaya & Chamo serves as sources of water for fishing, recreational and other purposes. Arba Minch town is divided in to four administrative sub-towns (kifle-ketemas) with sixteen districts (kebeles). According to the 2007 population and housing census, the total population in 2013/14 is estimated to be 100,442[79]. According to information obtained from Arba Minch Town Education Office, in 2013/14, the town had a total of 21 primary schools (Grades 1 to 8), 7 of them are public and the rest 14 are private. The 21 primary schools having a total of 17,029 enrolled pupils; 8,273(48.6%) are boys and 8,756(51.4%) girls [80]. The estimated gross primary school enrolment ratio in 2013/14 academic calendar is 107% [80].There are also 1 general hospital, 2 health centres, 23 private clinics, and 14 drug venders [81].

4.2 Study Design

Cross-sectional study was employed to assess nutritional status and intestinal parasitic infections among students in primary schools of Arba Minch Town.

4.3 Population

4.3.1 *Source Population*

The source population was schoolchildren in primary schools of Arba Minch town who were enrolled in the academic year 2013/14 (2006E.C).

4.3.2 *Study Population*

A total of 532 schoolchildren from randomly selected primary schools in Arba Minch town.

4.4 Eligibility Criteria

4.4.1 *Inclusion criteria*

Participants were included to the study if; they are school-aged children (age ≥7 and ≤14 years old) in Arba Minch town and, student attending class (not withdraw) during the period of data collection.

4.4.2 *Exclusion criteria*

Those parent/legal guardians not willing to give informed consent as well as presence of disability/physical deformity that interferes/affects height measurement were excluded from the study.

4.5 Sample Size and Sampling Technique

4.5.1 *Sample Size Determination*

Sample size was determined using sample size formula $[n = \frac{z^2 1-\frac{\alpha}{2} \times p(1-p)}{d^2}]$for estimation of single population proportion with 95% level of confidence and 5% precision. Based on this, a total of 322 subjects were required to estimate 30% prevalence of intestinal parasitic infections from the National survey on schoolchildren in Ethiopia [61]. After using a design effect (DEFF) of 1.5 and adding 10 % non-response rate, the total sample size required for this study was 532.

4.5.2 *Sampling Technique*

A two-stage sampling procedure, where in the first-stage, Probability Proportional to Size (PPS) sampling to select study schools from 21 schools, followed by Simple Random Sampling (SRS) to select equal number of study subjects from each of the selected schools. Using the size of the source population (total number of students) in each of the 21 schools for the first-stage (PPS) and a sampling frame (list of students with age) in the selected schools for the second-stage (SRS).

Stage one: Selecting the study schools:

Steps in choosing schools

The schools were selected with probability proportional to size (PPS).

The size of the source population (total number of students) in each of the 21 schools=17,029

Determining the number of schools: 30% of the schools i.e. 6 schools out of 21 schools.

To ensure a truly random procedure, each school was assigned a random number and ranked in the table according to that number.

The sampling interval was calculated by dividing the source population by the number of schools. In this case, the source population was 17,029 and the number of schools was 6. The SI was therefore 17,029/6 = 2838.

The location of the first school was determined by randomly selecting a number within the SI of 1 to 2833. The randomly chosen number is 1980; the first school was in locality 2 to which the number range 1910 to 3818 has been attributed.

The remaining schools were identified by adding the SI sequentially to the starting number until 6 schools have been selected.

Stage-two: Selection of study subjects within each school: Within each of the selected schools, simple random sampling (SRS) based on a specially prepared sampling frame (list of students with age) in the selected schools identifies subjects.

Finally, 532 study subjects and their parents (532) were included in this study.

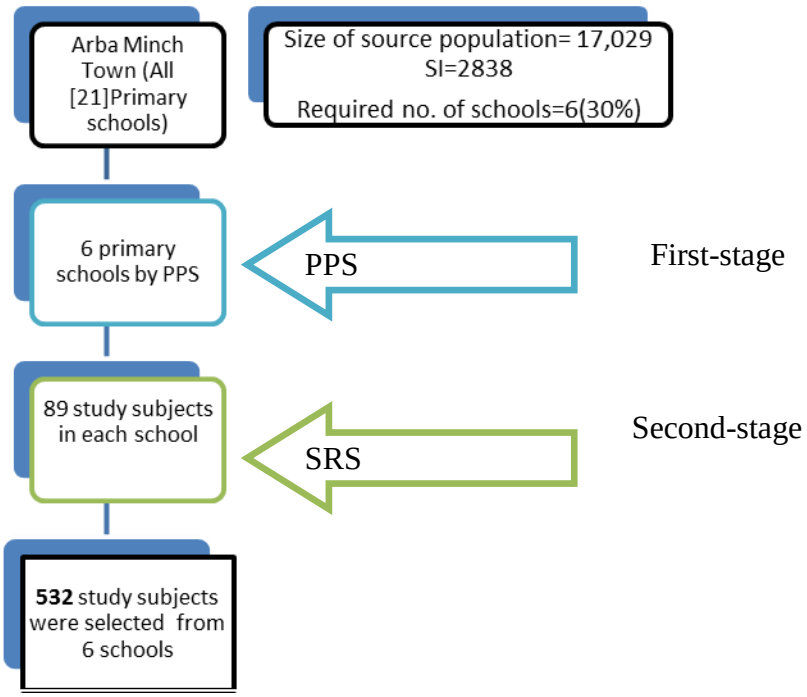


Figure 2 Schematic representation of the sampling procedure.

4.6 Study Variables

4.6.1 Dependent Variables

- ✓ Stunting (Height-for-age z scores (HAZ) <-2SD)
- ✓ Thinness (BMI-for-age z scores (BAZ)< -2SD)
- ✓ Underweight (Weight-for-age z scores (WAZ)<-2SD)
- ✓ Intestinal Parasite infection
- ✓ Parasitic load (low, medium or high-intensity)

4.6.2 Independent Variables

- Age of child
- Sex of child
- Child dietary diversity score (CDDS)
- IPI (*A.lumbricoides*, Hookworm, *T.trichuria*, *S.mansoni*, *H.nana*, Taenia sp, *E.histolytica*, *G.lamblia*)
- Parasitic load (low, medium or high-intensity) (*A.lumbricoides*, Hookworm, *T.trichuria*, *S.mansoni)*
- Illness in the last 2 wks (AFI, ARI, ADD)
- Maternal education level
- Maternal employment status
- Paternal education level
- Paternal occupation
- Household food insecurity access scale (HFIAS)
- Household dietary diversity score (HDDS)
- Age of mother
- Sex of head of household
- Autonomy in decision making
- Marital status
- Household monthly income
- Household size
- Number of children 5 to 14 years
- Availability and type of latrine
- Source of water
- Distance to water source
- Hand washing before eating
- Hand washing with soap and water after defecation
- Method of disposal of household solid waste
- Use of footwear
- Swimming habit
- Child immunization status
- Health care attended
- Hx of de-worming(any ant parasitic drugs) in the last 6 months
- Household wealth index

4.7 Data Collection Instrument, Personnel and Procedure

Data collection was done using standard techniques. Anthropometric measurements and calculation of indices was done according to international consensus and WHO recommendations. Laboratory testing of stool specimens was done according to accepted laboratory techniques.

4.7.1 *Demographic, Socio-economic, Health care related and Environmental characteristics*

A Structured questionnaire was used to collect data. It is composed of five parts. The first part, which is the preamble, containing the objectives and significance of the study. The second part is about identification. The third part consisting of questions adapted from the most recent DHS [27] on the demographic, socio-economic, health care and environmental characteristics. The fourth and fifth parts related to food security and dietary diversity respectively. The questionnaire is adapted in English first then translated to Amharic and back translated to English by translators who understands the technical terms as well as both languages and who are blind to the original questionnaire. The data was collected in the Amharic version of the questionnaire. Trained interviewers who will perform in-person interviews of all participating parents/legal guardians by visiting their household were administered the questionnaire.

There were 14 field staff for data collection. A data collection team consisting of 6 health extension practitioners to administer questionnaire to the parents, 2 trained nurses to take anthropometric measurements, 3 laboratory technologists to a stool sample collection and examination, 1 auxiliary worker to clean recyclable laboratory materials and 2 health officers as a supervisor to control and give support.

4.7.2 *Dietary Adequacy and Food Security Measurements*

Household food insecurity and child dietary diversity were measured as FAO/FANTA guidelines using a tool adapted from scales validated for use in developing countries. A recently validated nine-item scale food security questionnaire based on a four-week recall period adapted from FANTA Household Food Insecurity Access Scale (HFIAS). The dietary diversity questionnaire comprising of 16 food groups based on the FAO/FANTA tools. The Household Dietary Diversity Score (HDDS) and Child Dietary Diversity Score (CDDS) were measured based on a total of 12 and 9 food groups consumed during the past 24 hour respectively [82-86].

4.7.3 *Anthropometric Measurements based on the SOP*

Anthropometric measurements consisting of height and weight were taken based on the SOP outlined in the Anthropometric Indicators Measurement Guide[87]. Body weight was measured to the nearest 0.1 kg on a calibrated electronic digital SECA scale with the student barefoot and wearing school uniform and height was measured in the Frankfurt plane to the nearest 0.1 cm, using a stadiometer with a sliding head bar. Each student was instructed to stand barefoot, with head in the Frankfurt plane (where the margins of the orbital and the upper margin of each ear canal was most nearly parallel to the ground), knees should be straight and the heels, buttocks and the shoulder blades, should touch the vertical surface on the height board.

4.7.4 *Stool Specimen Collection and Parasitological Examination based on the SOP*

Stool samples were collected in clean, dry and leak proof stool cups labeled with the students' unique study ID number. Senior medical laboratory technologist was gave stool cups with an applicator sticks and toilet paper, and directions on how to collect and bring about five gm (thumb size) of fresh stool. Just after collection about 41.7 mg of the samples were processed & examined within 30 minutes of arrival using the Kato-Katz quantitative cellophane faecal thick smear method[88]. Examination of the specimen in the field was carried out in order to capture Hookworms which tend to clear in the stool if not examined within a few hours of collecting the stool. Intensity of infection was estimated indirectly by counting the mean number of epg, and categorized using thresholds recommended by the WHO: for Hookworm, light: 1–1999 epg, moderate:2000–3999 epg, and heavy: ≥4000 epg; for *A.lumbricoides*, light:1–4999 epg, moderate:5000–49999 epg, and heavy:≥50000 epg; for *T.trichuria*,light:1-999 epg,moderate:1000-9999,heavy:≥10000, and for *S. mansoni*, light: 1–99 epg, moderate: 100–399 epg and heavy: ≥ 400 epg [89]. About 20 mg of each stool sample was preserved in a tube containing PVA, transported to AMCHS, for processing, using a formal ether concentration technique to detection of helminth ova and protozoa cysts &/or trophozoites following WHO SOP and was used to determine the prevalence [88].

4.8 Data Analysis Procedure

The data was entered in double using Epi Data and exported to SPSS (V.20), then was checked for missing values and outliers, edited and coded. The anthropometric data was checked for normality and outliers using the software ENA for SMART 2011. Analysed for consistency and validation using the software WHO AnthroPlus and the WHO SPSS macro, and defined according to the 2007 WHO New Child Growth Reference [90-91].

Multivariable analysis was employed for determining the relative contribution of each independent variable to a single outcome.
First, univariate statistics was performed to understand the distribution of independent and outcome variables, and to report the prevalence of undernutrition and IPIs. Second, bivariate analysis of independent variables against outcome variable, to see the association between the dependent variable with each of the independent variables and to identify candidate variables to the multivariable model. Third, to identify predictors, variables with a significance level ($P<0.1$) in bivariate analysis and based on their biological plausibility was included in a multivariable logistic regression model. At this step, the explanatory variables was checked for multicollinearity using the Variance Inflation Factor (VIF) >10 and the Tolerance test <0.2. Goodness-of-ft the models was assessed using the Hosmer–Lemeshow goodness-of-fit test ($P>0.05$) . A probability of $P < 0.05$ was taken to be statistically significant.

4.9 Data Quality Management

As part of data quality management to ensure the quality of data: a standardization of the study tools and procedures was done. The English version of questionnaire was translated to Amharic and back translated to English by translators who are blind to the original questionnaire. An intensive training for all survey team members consists of 3 days of classroom instruction and practice and 1 day of pretesting all survey procedure, including interviews, anthropometric measurement, and stool specimen collection in 5% of the sample size prior to the study was done. During the training anthropometric technique standardization was done using ENA for SMART 2011 for evaluation of measurers. Steps for conducting standardization test prior to the pretest: First, we selected 10 children whose ages fall within the range for the study (7-14 yrs), and given them an ID number. Second, the PI weighs and measures each child without allowing the trainees to see the values. Third, the trainees should carefully conduct the measurements and clearly record the height and weight on their form. Fourth, after a break, without seeing the measurements they previously made, each measurer measures each child a second time.

For evaluating the measurers the precision and the accuracy of their measurements is calculated. For precision the sum of the square of the differences for the double measurements is calculated. This value should be less than two times the precision value of the PI. For the accuracy the sum of the square of the differences between the measurer values (weight1+weight2) and the PI values (weight1+weight2) is calculated. This value should be less than three times the precision value of the PI.

During data collection at each selected school/household, survey team supervisors and the PI were supervised all steps of data collection, including the interview, anthropometric measurement, and stool specimen collection. Upon completion of data collection at each school/household, the PI was reviewed the entire data collection form to ensure completeness and accuracy. Calibration of the weighing scale daily with a 20 kg weight. Verification of 10 % of the anthropometric data by the PI was done. Anthropometric data quality was validated using the plausibility check function of the ENA for SMART 2011 software.

4.10 Ethical Considerations

Ethical clearance was obtained from Jimma University Ethical Committee. Official letter of co-operation from the above organization was written to respective institutions. Permission was requested from the town education office and each of the participating schools and parents committee. Prior to the date of data collection, translated consent forms were forwarded to the parents requesting for the pupils participation in the survey as well as highlighting the need for collecting stool samples from the children. Pupils were requested to return completed consent forms from their parents. If both parents are illiterate, they were consented by their thumbprint after verbal consent by the interviewer during household data survey. Participants found to be positive for any IPIs were treated free of charge as recommended by WHO/FMoH. Additionally confidentiality of all the information was assured.

4.11 Dissemination Plan:

A feedback session for participating schools and key stakeholders (representatives from non-participating schools, community, and the education and health offices) was held at the end of the survey to present and discuss the findings and to jointly draft a plan of action.

A formal report will be submitted to the Participating schools, Jimma University, Arba Minch town Education Office, Health Office, Health Centre, ZHD and to partners. Based on the study findings a workshop will be organized. Community, schools, religious and political leaders and the different government sectors, NGOs, etc. will participate in the workshop. Participants will develop an intervention programme within the reach of the community and will take collective responsibility for the implementation of the programme. It is envisaged also to use the local mass media and different professional journals.

4.12 Operational Definitions

- **School-aged children**: Children between 5 and 14 years of age who may or maynot be enrolled in school [35].
- **Undernutrition**: Poor nutritional status defined as Weight, Height and BMI (kg/m^2)-for-age and sex z-scores <-2SD of the 2007 WHO growth reference [92].
  - Stunting (<−2SD HAZ)
  - Thinness (<−2SD of BAZ)
  - Underweight (<−2SD WAZ*)

* WAZ is only for children age 5-10 years. Since WAZ is regarded as an inadequate indicator of nutritional status beyond pre-school years and older children experiencing the pubertal growth spurt due to its inability to distinguish between relative height and body mass, therefore, BAZ based on the 2007 WHO GR is recommended by the WHO to assess thinness in school-aged children and adolescents (5 to 19 years) [92].

- **Food security** is defined as a state in which "all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" [83].
- **Dietary diversity Score** (DDS) is defined as the number of food groups consumed over a previous day or week. It can be measured at the household or individual level through use of a questionnaire. At the household level, (HDDS) is usually considered as a measure of access to food, while at individual level, (IDDS) it reflects dietary quality, mainly micronutrient adequacy of the diet [82, 84].
- **Polyparasitism**: Concurrent infections with ≥ 2 species of intestinal parasites.
- **Intensity of infection**: The number of helminths infecting an individual [35].
- **prevalence of any STH infection (Path)** can be estimated using the following equation [35]: Path = $\underline{(a + t + h) - (a \times t + a \times h + t \times h) + (a \times t \times h)}$

1.06

Where

a = prevalence of ascariasis (expressed as a proportion)
t = prevalence of trichuriasis (expressed as a proportion)
h = prevalence of hookworm infection (expressed as a proportion)

CHAPTER FIVE

5 RESULTS

5.1 General Characteristics of Study Participants

Of the 532 schoolchildren included in the study, analysis was based on 511 subjects giving a response rate of 96.1%. The mean (SD) age was 10.6 (2.4) years with age groups 7-9 and 10-14 years constitute 186 (36.4%) and 325 (63.6%) of the participants. Majority of the study participants were from households with family size $\geq$ 5 (64.8%) and male headed (87.9%). Most (86.3%) of the study children were living with both of their parents, whereas the rest 54 (10.5%) and 16 (3.1%) were living with either one of their parents or other people including grandparents, other relatives and fosters. Most (56.0%) of children mothers were of age 35-44 years followed by mothers of age $\leq$34 years and $\geq$45 years old constituting 170 (35.4%) and 41 (8.5%) of the mothers, respectively (**Table 1**).

Concerning children's parents education, majority of their mothers (64.4%) and their fathers (79.6%) had secondary or above level of education followed by 88 (19.3%) of the fathers and 85 (17.7%) of the mothers with primary education. Regarding parental occupation, only 259 (54.0%) of the mothers had formal occupation (**Table 1**).

Table 1: Characteristics of Study Participants, Schoolchildren from Arba Minch town (n=511), March-April, 2014

Variables	Frequency (%)
Child age (years)	
7-9	186 (36.4)
10-14	325 (63.6)
Sex	
Male	256 (50.1)
Female	255 (49.9)
Household size	
≤ 4	180 (35.2)
≥ 5	331 (64.8)
Maternal age (n=480)	
≤34 years	170 (35.4)
35-44 years	269 (56.0)
≥45 years	41 (8.5)
Child living with	
Both parents	441 (86.3)
Only with mother	38 (7.4)
Only with father	16 (3.1)
Others[1]	16 (3.1)
Sex of household head	
Male	449 (87.9)
Female	62 (12.1)
Maternal education (n=480)	
No formal education	86 (17.9)
Primary education	85 (17.7)
Secondary & above	309 (64.4)
Paternal education (n=455)	
No formal education	95 (20.9)
Primary education	63 (13.8)
Secondary & above	297 (65.3)
Maternal employment (n=480)	
Unemployed	221 (46.0)
Employed	259 (54.0)
Father's occupation (n=455)	
Employee(Gov`t/NGO/Private/self/daily laborer	389(85.5)
Unemployed	66(14.5)

[1] Others include grandparents, relatives, fosters (orphanage)

5.2 Nutrition and Health related Practices

Concerning dietary intake and food-security status, 281 (55.0%) of the study children consumed less diverse diet (IDDS <5) during the previous day and about two-third (65.8%) of them were from households reported to experience food-insecurity during the last one month. Majority (98.6%) of the study participants were reported to always wash their hands before meals. Only one in five (20.2%) of the study children were reported to constantly use soap for hand washing after toilet, whereas the rest 188 (36.8%) were reported to use some times and 220 (43.1%) do not use soap at all (**Table 2**).

Concerning latrine utilization by type, 325 (63.6%) of children's households use traditional pit latrine and the rest 104 (20.4%) and 78 (15.3%) of the households use VIP (Ventilated Improved Pit latrines) and flush toilets, respectively. More than quarter (25.2%) of participants' households disposes solid wastes by dumping into open field. Regarding swimming habit, 41 (8.0%) of the study children reported to have frequent swimming habit and the rest 36 (7.0%) and 434 (84.9%) reported a less frequent and no practice of swimming, respectively (**Table 2**).

None of the study children took deworming during the last six months and only 374 (73.2%) had constant shoe wearing habit. Hundred and sixty-nine (33.1%) of the study children had illness within two weeks prior to the study, where the causes of illness were reported to be diarrhea, AFI (Acute Febrile Illnesses) and ARI (Acute Respiratory Infections) for 69 (40.8%), 65 (38.5%) and 35 (20.7) of the sick children, respectively, and less than half of them (47.9%) sought medical care (**Table 2**).

Table 2: Nutrition and Health related Practice of Study Participants, Schoolchildren from Arba Minch town (n=511), March-April, 2014

Variables	Frequency (%)
Child Dietary Diversity[1]	
Low	281 (55.0)
High	230 (45.0)
Household food-security	
Food-secure	175 (34.2)
Food-insecure	336 (65.8)
Always wash hands before meals	
Yes	504 (98.6)
No	7 (1.4)
Hand-washing with soap after toilet	
Always	103 (20.2)
Sometimes	188 (36.8)
Never	220 (43.1)
Type of latrine	
Pit latrine	325 (63.6)
VIP	104 (20.4)
Flush latrine	78 (15.3)
Solid waste disposal method	
Proper disposal	382 (74.8)
Open field disposal	129 (25.2)
Shoe wearing	
Always	374 (73.2)
Sometimes/rarely	137 (26.8)
Swimming habit	
Always	41 (8.0)
Sometimes	36 (7.0)
Never	434 (84.9)
Illness in last two weeks	
Yes	169 (33.1)
No	342 (66.9)
Type of illness in last two weeks (n=169)	
Diarrhea	69 (40.8)
AFI	65 (38.5)
ARI	35 (20.7)
Attended medical service (n=169)	
Yes	81 (47.9)
No	88 (52.1)

[1]:low CDDS <5 food groups

5.3 Intestinal Parasite Infection, Nutritional Status and Associated Factors

5.3.1 Intestinal Parasitic Infection

Out the 511 study subjects, 285 were infected with at least one intestinal parasite giving an overall IPI (Intestinal Parasite Infection) prevalence of 55.8% (95%CI: 51.5, 60.1%). Eighty-nine children were found to be infected with more than one parasite giving a polyparasitism prevalence of 31.2 % (95%CI: 25.8, 36.6%). Regarding the type of parasite infection, *A. lumbricoides*, Hookworms, *T. trichiura, H.nana, G.lamblia, Taenia spp., E.histolytica, S.mansoni, E.vermicularis and S.stercoralis* infections were found in 107 (20.9%), 75 (14.7%), 54 (10.6%), 44 (8.6%), 42 (8.2%), 24 (4.7%), 23 (4.5%), 11 (2.2%), 9 (1.8%) and 2 (0.4%) of the children, respectively. The prevalence for any soil-transmitted helminthes (STH), according to the WHO formula, was 63.0% (**Figure 3**).

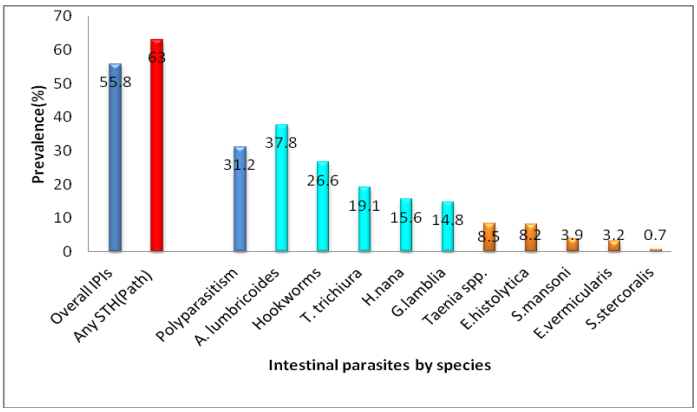


Figure 3 Prevalence of IPI by parasite species, schoolchildren from Arba Minch town (n=511), March-April, 2014

Regarding STH infection intensity, 79 (53.0%) of the cases were of light intensity and 70 (47.0%) were moderate to severe intensity. Light and moderate to severe intensity of infection were observed in 36 (39.1%) & 56 (60.9%) of Ascariasis cases, 22 (41.5%) & 31 (58.5%) of Trichuriasis cases, and 37 (50.0%) & 37 (50.0%) of Hookworm infections, respectively.

Among the socio-demographic variables, IPI was significantly associated with household wealth, child sex, family size, maternal education and employment status. Children living with only their fathers or other relatives had significantly higher IPI risk than their counterparts living with both parents, whereas there was no statistical significant difference between those living with both of their parents and only with their mother [COR (95%CI): 2.0 (0.98, 4.0)]. Children with DDS of $\geq$5 had a significantly lower IPIs compared to those with DDS of <5 [COR (95%CI): 0.05 (0.03, 0.08)], whereas no statistically significant difference was observed by household food-security status [COR (95%CI): 1.4 (1.0, 2.0)].

Concerning the association between IPI and water and sanitation variables, IPI was significantly higher among those children from households disposing solid waste by dumping [COR (95%CI): 23.4 (10.6, 51.5)], located distant from water source and households using TPL compared than using flush toilet Children who always use soaps to wash hands after toilet had significantly lower IPI than those with less frequent use [COR (95%CI): 7.3 (3.7, 14.2)]. Similarly, constant shoe wearing [COR (95%CI): 0.08(0.04, 0.2)] and avoidance of swimming habits [COR (95%CI): 0.02(0.003,0.2)] were associated with less prevalent IPIs.

On multivariable logistic regression modeling, the variables that remained to independently predict IPI were household wealth [AOR (95%CI): 2.4 (1.2, 4.7)], maternal employment [AOR (95%CI): 2.4 (1.2, 4.7)], child DDS [AOR (95%CI): 10.1 (5.5, 18.5)], hand washing with soap [AOR (95%CI): 17.6 (7.2, 43.2)], and solid waste disposal method [AOR (95%CI): 3.7 (1.4, 9.5)] (**Table 3**).

Table 3: Prevalence of IPI by socio-demographic, nutritional and health characteristics of schoolchildren from AM town (n=511), March-April, 2014

Variables	Total	IPI (%)	COR (95% CI)	[1]AOR (95% CI)
Household wealth				
Lowest	192	157 (81.8)	15.7 (9.1, 26.3)**	2.4 (1.2, 4.7)*
Medium	148	90 (60.8)	5.4 (3.3, 8.9)**	1.9 (0.9, 3.9)
Highest	171	38 (22.2)	1	1
Child age (years)				
7-9	186	107 (57.5)	1.1 (0.78, 1.6)	
10-14	325	178 (54.8)	1	
Sex				
Male	256	156 (60.9)	1.5 (1.1, 2.2)*	
Female	255	129 (50.6)	1	
Household size				
≤ 4	180	49 (27.2)	1	
≥ 5	331	236 (71.3)	6.6 (4.4, 10.0)**	
Child living with				
Both parents	441	230 (52.2)	1	
Only with mother	38	26 (68.4)	2.0 (0.98, 4.0)	
Only with father	16	15 (93.8)	13.8 (1.8, 105.1)*	
Others[1]	16	14 (87.5)	6.4 (1.4, 28.6)*	
Maternal education (n=480)				
No formal education	86	74 (86.0)	7.4 (3.9, 14.2)**	
Primary education	85	57 (61.7)	2.5 (1.5, 4.1)**	
Secondary & above	309	154 (45.3)	1	
Maternal employment (n=480)				
Unemployed	221	190 (86.0)	12.6 (8.0, 19.8)**	2.4 (1.2, 4.7)*
Employed	259	64 (24.7)	1	1
Child Dietary Diversity[1]				
Low	281	236 (84.0)	19.4(12.4,30.3)*	10.1 (5.5, 18.5)**
High	230	49 (21.3)	1	1
Household food-security				
Food-secure	175	88 (50.3)	1	
Food-insecure	336	197 (58.6)	1.4 (1.0, 2.0)	
Always wash hands before meals				
Yes	504	279 (55.4)	1	
No	7	6 (85.7)	4.8 (0.58, 40.5)	
Hand-washing with soap after toilet				
Always	103	12 (11.7)	1	1
Sometimes	188	92 (48.9)	7.3 (3.7, 14.2)**	6.0 (2.6, 14.0)**
Never	220	181 (82.3)	35.2 (17.6, 70.5)**	17.6 (7.2, 43.2)**
Type of latrine				
Pit latrine	325	254 (75.4)	16.8 (8.7, 32.7)**	
VIP	104	27 (26.0)	1.9 (0.9, 4.1)	
Flush latrine	82	12 (15.4)	1	
Solid waste disposal method				
Proper disposal	382	163 (42.7)	1	1
Open field disposal	129	122 (94.6)	23.4 (10.6, 51.5)**	3.7 (1.4, 9.5)**
Distance from water source				
<15 minutes	327	137 (41.9)	1	
15-30 minutes	153	126 (82.4)	6.5 (4.0, 10.4)**	
>30 minutes	31	22 (71.0)	3.4 (1.5, 7.6)**	
Shoe wearing				
Always	374	160 (42.8)	1	1
Sometimes/rarely	137	125 (91.2)	13.9 (7.4, 26.1)**	4.2 (1.8, 9.5)**
Swimming habit				
Always	41	40 (97.6)	1	
Sometimes	36	33 (91.7)	0.28 (0.02, 2.77)	
Never	434	212 (48.8)	0.02 (0.00, 0.18)**	

*Significant at P<0.001, **Significant at P<0.05

[1]Adjusted model: Omnibus Tests *P*<0.001, Cox & Snell R Square0.526 , Nagelkerke R Square0.702, Hosmer and Lemeshow Test *P*0.701

5.3.2 Nutritional Status

The prevalence rates for stunting (HAZ<-2SD), underweight (WAZ<-2SD) and thinness (BAZ<-2SD) were 26.0 % (95%CI: 22.2, 29.8%), 19.9% (95%CI: 14.1, 25.7%) and 11.7% (95%CI: 8.9, 14.5%), respectively. Severe stunting (HAZ<-3SD), severe underweight (WAZ<-3SD) and severe thinness (BAZ<-3SD) were 3.7%(95%CI:2,5.5%), 0.5%(95%CI:0.0,1.9%) and 2.9%(95%CI:1.4,4.5%), respectively. Moreover, 4.1% (95%CI: 2.3, 5.9%) of children were overweight (BAZ>+1SD).

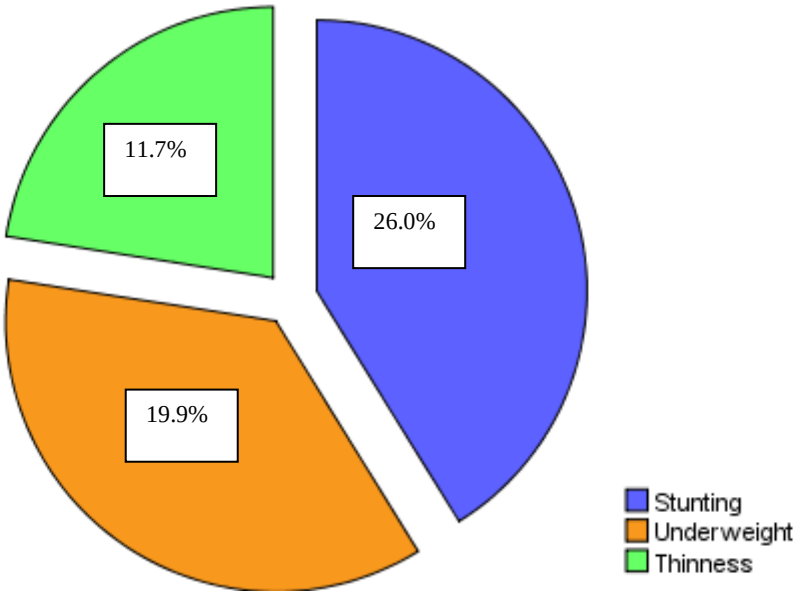


Figure 4 Prevalence of Stunting, Underweight and Thinness of schoolchildren from Arba Minch town (n=511), March-April, 2014

Among the socio-demographic variables, stunting was significantly associated with household wealth, child sex, household size, maternal age, sex of head of household, paternal education, maternal education and employment status. Boys were more likely to be stunted compared to girls [COR (95%CI): 1.53(1.03, 2.3)], whereas no statistically significant difference was observed by age [COR (95%CI): 0.8(0.5, 1.1)].

Concerning the association between stunting and nutrition and health variables, children with DDS of <5 had a significantly higher stunting rates compared to those with DDS of ≥5 [COR (95%CI): 9.5(5.5, 16.7)]. Stunting was significantly higher among those children from food insecure households [COR (95%CI):2.3(1.4, 3.6)]. Stunting was higher in children infected with IPIs [COR (95%CI):4.9(3.04, 7.9)], Ascariasis [COR (95%CI):8.3(4.8, 14.3)], Trichuriasis [COR (95%CI): 7.8(3.9, 15.5)], Hookworm [COR (95%CI): 9.02(4.9, 16.6)] and Schistosomiasis [COR (95%CI): 17.9(2.3, 142.3)]. Similarly, stunting was higher in children who were polyparasitized [COR (95%CI): 45.5(21.13, 97.96)] compared with monoparasitized children.

On multivariable logistic regression modeling, the variables that remained to independently predict stunting were household wealth [AOR (95%CI): 3.2(1.1, 9.5)], maternal education [AOR (95%CI): 4.4(1.7, 11.3)], polyparasitism [AOR (95%CI): 5.1(1.6, 15.7)], and intensity of STH infection [AOR (95%CI): 0.01(0.001, 0.09)] (**Table 4**).

Table 4: Prevalence of stunting by socio-demographic, nutritional and health characteristics of schoolchildren from AM town (n=511), March-April, 2014

Variables	Total	Stunted (%)	COR (95% CI)	[1]AOR(95%CI)
Household wealth				
Lowest	192	99(51.6)	19.2(9.3,39.7)*	3.2(1.1,9.5)**
Medium	148	25(16.9)	3.7(1.7,8.1)**	
Highest	171	9(5.3)	1	1
Child age (years)				
7-9	186	42(22.6)	0.8(0.5,1.1)	
10-14	325	91(28.0)	1	
Sex				
Male	256	77(30.1)	1.53(1.03, 2.3)**	
Female	255	56(22.0)	1	
Household size				
≤ 4	180	12(6.7)	1	
≥ 5	331	121(36.6)	8.1(4.3,15.1)*	
Maternal age (n=480)				
≤34 years	170	23(13.5)	0.1(0.05,0.22)*	
35-44 years	269	73(27.1)	0.24(0.1,0.5)*	
≥45 years	41	25(61.0)	[1]	
Sex of household head				
Male	449	107(23.8)	1	
Female	62	26(41.9)	2.31(1.3,4.0)**	
Maternal education (n=480)				
No formal education	86	52(60.5)	12.0(6.9,20.9)*	4.4(1.7,11.3)**
Primary education	85	34(40.0)	5.2(3.0,9.12)*	
Secondary & above	309	35(11.3)	1	1
Paternal education (n=455)				
No formal education	95	51(53.7)	10.3(5.94,17.9)*	
Primary education	63	51(53.7)	8.6(4.6,16.1)*	
Secondary & above	297	30(10.1)	1	
Maternal employment (n=480)				
Unemployed	207	96(46.4)	8.6(5.24,14.1)*	
Employed	273	25(9.2)	1	
Child Dietary Diversity[1]				
Low	281	117(41.6)	9.5(5.5,16.7)*	
High	230	16(7.0)	1	
Household food-security				
Food-secure	175	29(16.6)	1	
Food-insecure	336	104(31.0)	2.3(1.4,3.6)**	
IPIs				
Yes	285	108(37.9)	4.9(3.04,7.9)*	
No	226	25(11.1)	1	
Polyparasitism				
Polyparasitism	89	79(88.8)	45.5(21.13,97.96)*	5.1(1.6,15.7)**
No-Monoparasitism	196	29(14.8)	1	1
A.lumbricoides				
Yes	107	72(67.3)	8.3(4.8,14.3)*	
No	176	35(19.9)	1	
Hookworm				
Yes	107	72(67.3)	9.02(4.9,16.6)*	
No	176	35(19.9)	1	
T.trichuria				
Yes	54	41(75.9)	7.8(3.9,15.5)*	
No	229	66(28.8)	1	
S.mansoni				
Yes	11	10(90.9)	17.9(2.3,142.3)**	
Intensity of STH				
No-Light	79	29(36.7)	0.002(0.001,0.02)*	0.01(0.001,0.09)*
Moderate-heavy	70	69(98.6)	1	1
A.l Intensity				
No-Light	36	15(41.7)	0.002(0.001,0.02)*	
Moderate-heavy	56	55(98.2)	1	
Hw Intensity				
No-Light	37	21(56.8)	0.015(0.004,0.06)*	
Moderate-heavy	37	35(94.6)	13.3(2.78, 63.87)*	
T.t Intensity				
No-Light	22	11(50.0)	0.01(0.001,0.07)*	
Moderate-heavy	31	30(96.8)	1	

*Significant at $P<0.001$, **Significant at $P<0.05$

[1]Adjusted model: Omnibus Tests $P<0.001$, Cox & Snell R Square 0.447, Nagelkerke R Square 0.668, Hosmer and Lemeshow Test P 0.3

Among the socio-demographic variables, thinness was significantly associated with household wealth, household size, maternal age, sex of head of household, paternal education, maternal education and employment status, whereas neither age nor sex of child was found associated with thinness.

Concerning the association between thinness and nutrition and health variables, children with DDS of <5 [COR (95%CI):3.7(1.9, 7.2)] had a significantly higher thinness rates compared to those with DDS of ≥5, and those who had reported diarrhoeal illness in the two weeks period prior to the study. Thinness was significantly higher among those children from food insecure households [COR (95%CI): 2.03(1.1, 3.9)]. Thinness was higher in children infected with IPIs [COR (95%CI): 18.6(5.7, 60.2)], Amoebiasis [COR (95%CI): 7.8(3.2, 19.2)], Giardiasis [COR (95%CI): 5.0(2.5, 10.1)], and Schistosomiasis [COR (95%CI): 5.2(1.5, 17.6)]. Similarly, thinness was higher in children who were polyparasitized [COR (95%CI): 4.0(2.2, 7.1)] compared with monoparasitized children. Whereas no statistically significant difference was observed by intensity of STH infection [COR (95%CI): 1.3(0.6, 2.7)].

On multivariable logistic regression modeling, the variables that remained to independently predict thinness were polyparasitism[AOR(95%CI):3.6(1.21,10.8)], Amoebiasis[AOR(95%CI): 7.3(1.8,30.8)],Giardiasis[AOR(95%CI):4.3(1.2,15.1)],and reported illness in the last two weeks[AOR(95%CI):2.9(1.04,7.9)] (**Table 5**).

Table 5: Prevalence of thinness by socio-demographic, nutritional and health characteristics of schoolchildren from AM town (n=511), March-April, 2014

Variables	Total	Thin (%)	COR (95% CI)	1AOR(95%CI)
Household wealth				
Lowest	192	43(22.4)	24.4(5.8,102.4)*	
Medium	148	15(10.1)	9.5(2.1,42.4)**	
Highest	171	2(1.2)	1	
Child age (years)				
7-9	186	23(12.4)	1.1(0.6,1.9)	
10-14	325	37(11.4)	1	
Sex				
Male	256	31(12.1)	1.1(0.6,1.8)	
Female	255	29(11.4)	1	
Household size				
≤ 4	180	6(3.3)	1	
≥ 5	331	54(16.3)	5.7(2.4,13.4)*	
Maternal age (n=480)				
≤34 years	170	11(6.5)		
35-44 years	269	29(10.8)	1.8(0.9,3.6)	
≥45 years	41	10(24.4)	4.7(1.8,11.9)**	
Sex of household head				
Male	449	45(10.0)	1	
Female	62	15(24.2)	2.9(1.5,5.5)*	
Maternal education (n=480)				
No formal education	86	17(19.8)	3.2(1.6,6.4)**	
Primary education	85	11(12.9)	1.9(0.9,4.2)	
Secondary & above	309	22(7.1)	1	
Paternal education (n=455)				
No formal education	95	17(17.9)	3.0(1.5,6.0)**	
Primary education	63	7(11.1)	1.7(0.7,4.3)	
Secondary & above	297	20(6.7)	1	
Maternal employment (n=480)				
Unemployed	207	43(20.8)	10.0(4.4,22.7)*	
Employed	273	7(2.6)		
Child Dietary Diversity[1]				
Low	281	48(17.1)	3.7(1.9,7.2)*	
High	230	12(5.2)	1	
Household food-security				
Food-secure	175	13(7.4)	1	
Food-insecure	336	47(14.0)	2.03(1.1,3.9)*	
IPIs				
Yes	285	57(20.0)	18.6(5.7,60.2)*	
No	226	3(1.3)	1	
Polyparasitism				
Polyparasitism	89	24(27.0)	4.0(2.2,7.1)*	3.6(1.21,10.8)**
No-Monoparasitism	422	36(8.5)	1	1
S.mansoni				
Yes		6(54.5)	5.2(1.5,17.6)**	
No		51(18.8)	1	
E.histolytica				
Yes	23	14(60.9)	7.8(3.2,19.2)*	7.3(1.8,30.8)**
No	259	43(16.6)	1	1
G.lamblia				
Yes	42	20(47.6)	5.0(2.5,10.1)*	4.3(1.2,15.1)**
No	241	37(15.4)	1	1
Intensity of STH infection				
No-light	441	50(11.3)	1	
Moderate-heavy	70	10(14.3)	1.3(0.6,2.7)	
Solid waste disposal method				
Proper disposal	382	20(5.2)	1	
Open field disposal	129	40(31.0)	8.1(4.5,14.6)*	
Illness in last two weeks				
No	342	12(3.5)	0.09(0.05,0.2)*	
Diarrhea	69	35(50.7)	5.7(2.5,12.9)*	2.9(1.04,7.9)**
AFI	65	10(15.4)	1	1
ARI	35	3(8.6)	0.5(0.1,2.0)	
Attended medical service (n=169)				
Yes	81	15(18.5)	1	
No	88	33(37.5)	2.6(1.3,5.4))**	

*Significant at $P<0.001$, **Significant at $P<0.05$

[1]Adjusted model: Omnibus Tests $P<0.001$, Cox & Snell R Square 0.283, Nagelkerke R Square 0.408, Hosmer and Lemeshow Test P 0.637

Among the socio-demographic variables, underweight was significantly associated with household wealth, household size, maternal age, sex of head of household, paternal education, maternal education and employment status. Whereas no statistically significant difference was observed by sex [COR (95%CI): 1.2(0.6, 2.5].

Concerning the association between underweight and nutrition and health variables, children with DDS of <5 [COR (95%CI): 2.7(1.2, 5.8)] had a significantly higher underweight rates compared to those with DDS of ≥5. Underweight was significantly higher among those children from food insecure households [COR (95%CI): 3.2(1.5, 7.1)]. Underweight was higher in children infected with IPIs [COR (95%CI): 11.8 (3.47, 40.1)], Ascariasis [COR (95%CI): 5(2.02, 12.4)], Trichuriasis [COR (95%CI): 4.4(1.78, 10.8)]. Similarly, underweight was higher in children who were polyparasitized [COR (95%CI): 21.8(8.9, 53.2)] compared with monoparasitized children. Moderate-heavy intensity STH [COR (95%CI): 9.7(4.1, 23.3)], moderate-heavy Ascariasis [COR (95%CI): 9.7(4.1, 23.3)], and moderate-heavy Trichuriasis [COR (95%CI): 7.5(2.8, 19.6)] were associated with high prevalent underweight.

On multivariable logistic regression modeling, the variables that remained to independently predict underweight were polyparasitism [AOR (95%CI):8.8(2.6, 29.6)], reported illness in the last two weeks [AOR (95%CI):7.6(2.2, 26.1)], household food insecurity [AOR (95%CI):3.5(1.03,11.6)] and maternal unemployment [AOR (95%CI):5.6(1.4,22.1)] (**Table 6**).

Table 6: Prevalence of underweight by socio-demographic, nutritional and health characteristics of schoolchildren from AM town (n=511), March-April, 2014

Variables	Total	Underweight (%)	COR (95% CI)	[1]AOR(95%CI)
Household wealth				
Lowest	78	33(42.3)	38.1(5.0,290.1)*	
Medium	55	3(5.5)	3.0(0.3,29.8)	
Highest	53	1(1.9)	1	
Sex				
Male	89	19(21.3)	1.2(0.6,2.5)	
Female	97	18(18.6)		
Household size				
≤ 4	66	2(3.0)	1	
≥ 5	120	35(29.2)	13.2(3.1,56.8)**	
Maternal age (n=480)				
≤34 years	67	7(10.4)	1	
35-44 years	90	18(20.0)	2.1(0.8,5.4)	
≥45 years	17	8(47.1)	7.6(2.2,26.1)**	
Sex of household head				
Male	158	18(18.6)	1	
Female	28	11(39.3)	3.3(1.4,7.8)**	
Maternal education (n=174)				
No formal education	28	8(28.6)	3.6(1.3,10.0)**	
Primary education	37	14(37.8)	5.4(2.2,13.5)*	
Secondary & above	109	11(10.1)	1	
Paternal education (n=164)				
No formal education	36	14(38.9)	7.1(2.6,18.9)*	
Primary education	31	10(32.3)	5.3(1.9,15.1)**	
Secondary & above	97	8(8.2)	1	
Maternal employment (n=174)				
Unemployed	80	28(35.0)	9.6(3.5,26.4)*	5.6(1.4,22.1)**
Employed	94	5(5.3)	1	1
Child Dietary Diversity				
Low	96	26(27.1)	2.7(1.2,5.8)**	
High	90	11(12.2)	1	
Household food-security				
Food-secure		10(11.0)	1	1
Food-insecure	91	27(28.4)	3.2(1.5,7.1)**	3.5(1.03,11.6)**
IPIs	95			
Yes	107	34(31.8)	11.8 (3.47, 40.1)*	
No	79	3(3.8)	1	
Polyparasitism				
Polyparasitism	38	25(65.8)	21.8(8.9,53.2)*	8.8(2.6,29.6)*
No-Monoparasitism	148	12(8.1)	1	
A.lumbricoides				
Yes	50	25(50.0)	5(2.02, 12.4)*	
No	54	9(16.7)	1	
Hookworm				
Yes	12	7(58.3)	3.3(1.0, 11.4)	
No	91	27(29.7)	1	
T.trichuria				
Yes	30	17(56.7)	4.4(1.78, 10.8)**	
No	74	17(23.0)	1	
Intensity of STH				
No-Light	157	20(12.7)	1	
Moderate-heavy	29	17(58.6)	9.7(4.1,23.3)*	
A.l Intensity				
No-Light	157	20(12.7)	1	
Moderate-heavy	29	17(58.6)	9.7(4.1,23.3)*	
T.t Intensity				
No-Light	165	25(15.2)	1	
Moderate-heavy	21	12(57.1)	7.5(2.8,19.6)*	
Illness in last two weeks				
Yes	61	30(49.2)	16.3(6.6,40.6)*	7.6(2.2,26.1)**
No	125	7(5.6)	1	1

*Significant at $P<0.001$, **Significant at $P<0.05$

[1]Adjusted model: Omnibus Tests $P<0.001$, Cox & Snell R Square 0.371, Nagelkerke R Square 0.596, Hosmer and Lemeshow Test P 0.785

CHAPTER SIX

6 DISCUSSION

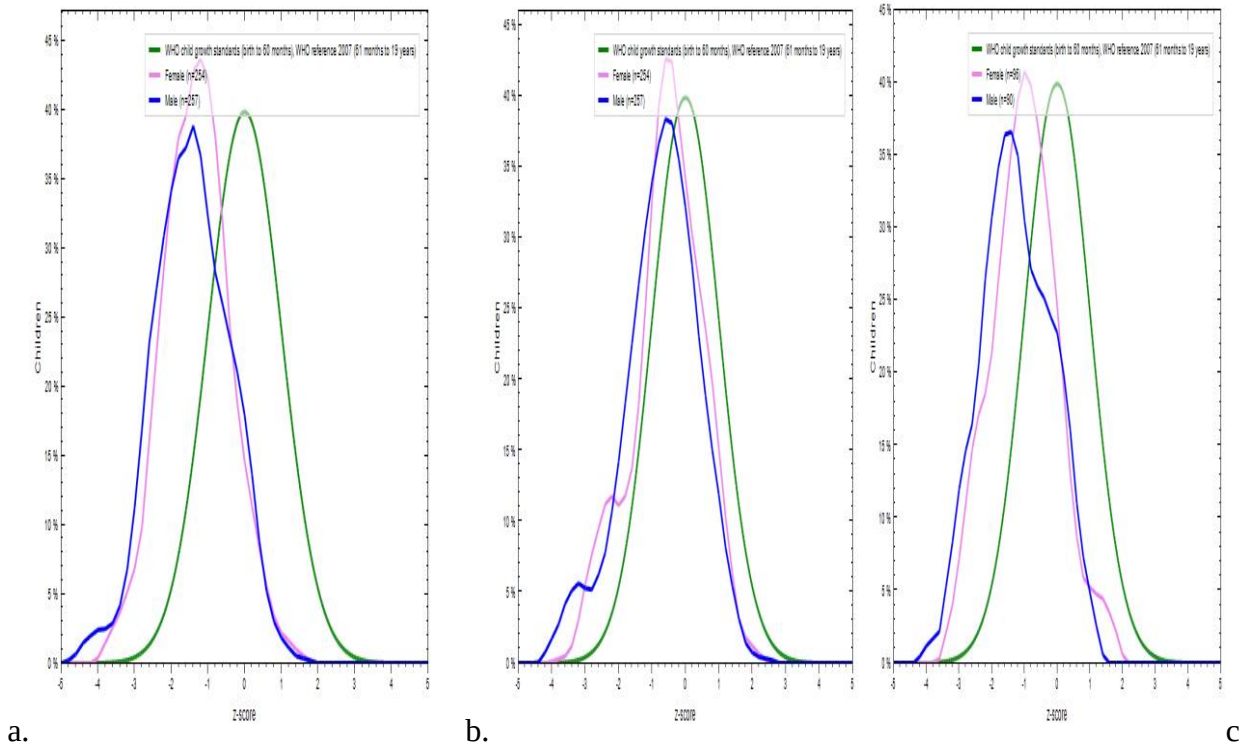
This study showed a high prevalence of intestinal parasite infection among urban schoolchildren of Southern Ethiopia.

The findings of this study demonstrated that the overall prevalence of intestinal parasitic infection was 55.8% (95%CI: 51.7-59.7%). This is consistent with other studies conducted among schoolchildren in North-west Ethiopia (55.6%) [29] and Nigeria (57.99%) [4]. On the other hand, the overall prevalence of IPIs observed in this study was inconsistent with studies conducted in different geographic areas of Ethiopia, 35.5% in Adama, Central Ethiopia [57], 77.9% in Bahir Dar, North west Ethiopia[52] and 83.8% in Langano, South East Ethiopia [56]. The variation in the reported prevalence of IPIs across studies may be explained by the difference in study setting, demographic, socio-economic, environmental and cultural differences.

In this study, the prevalence of any soil-transmitted helminth/STH (*Path*) was 62.96% and nearly half of infected children (47%) harbouring moderate-heavy intensity STH. This finding is comparable with a study conducted in Bushullo, Southern Ethiopia that reported a prevalence of any STH among schoolchildren to be 67.3% [64]. However, this finding is inconsistent with a study conducted among schoolchildren in Jimma Zone, which reported that prevalence of 47% and all STH infections are of light intensity [63]. This variation might be due to increased involvement of Jimma University researchers in the area resulting in improved awareness of the community and hence contributing to the low prevalence of IPIs.

According to the WHO, a prevalence of any STH ≥50% carries a high risk of disease and classified as schoolchildren in high risk areas [41]. The new vision for a world free of childhood morbidity due to these helminths, according to the WHO, is reducing the prevalence of STH infection of moderate and heavy intensity to ≤1% [41]. Therefore, these data underscore the need for Ethiopia to implement and monitor integrated control efforts.

Our results also showed a high prevalence of undernutrition among urban schoolchildren of Southern Ethiopia. Compared to the 2007 WHO child growth reference, which have a mean of zero and standard deviation of one, children in this survey were shorter and lighter as reflected in their mean HAZ -1.373± (SD) 0.9424 (Boys -1.45± 0.9897, Girls -1.293± 0.8871); BAZ -0.63 ± 1.063 (Boys-0.709±1.0854, Girls-0.551±1.0355); WAZ -1.114±0.9961(Boys -1.229±1.0174, Girls -1.0086±0.9694). Boys had a statistically significantly lower mean z -score of height-for-age than girls (-1.45 vs. -1.29, P =0.037).



a. b. c

Figure 5 (a, b, c) shows the mean z -scores of height-for-age, BMI-for-age and Weight-for-age for each sex of Arba Minch schoolchildren in March-April, 2014, respectively vs. WHO 2007 reference.

The findings of this study demonstrated that the prevalence of stunting, thinness and underweight was 26.0% (95%CI: 22.2-29.8%), 11.7% (8.9-14.5%) and 19.9% (14.1-25.7%), respectively. This finding is consistent with the results of a study conducted among urban schoolchildren in Gondar, North west Ethiopia [53], which reported that 25.2%, 8.9% and 15.1% of schoolchildren were stunted, thin and underweight, respectively.

Stunting or poor linear growth describes chronic undernutrition. The prevalence of stunting found in this study is consistent with a study among schoolchildren in Gondar and adolescent girls in Tigray, Northern Ethiopia, which reported that the prevalence of stunting to be 27% [29] and 26.5% [44], respectively. Consistent with the national schoolchildren survey and other previous studies in SSA [61], and low-income countries [22], our study showed stunting to be higher in boys (29.6%) than in girls (22%) with the difference statistically significant (COR=1.53(95%CI:1.026-2.278;P=0.037).

Thinness or wasting, usually describes acute undernutrition. This study found that 11.4% of the children were thin, which is low compared with the data from the recent national survey of schoolchildren, which reported that 23.1% [61] of Ethiopian schoolchildren were thin. Similarly, the prevalence of thinness was very low in comparison with a study conducted among schoolchildren in Gondar, which reported that half of schoolchildren were wasted (50%)[29].

Underweight is used as a composite indicator to reflect both acute and chronic undernutrition, although it cannot distinguish between them. The prevalence of underweight observed in this study is in agreement with what is reported in a study conducted in Angolela, Central Ethiopia which reported that 20.8% of schoolchildren were underweight [43]. The prevalence of underweight found in this study is low compared with [27, 29] studies among Ethiopian children, but higher when compared with other developing countries [3, 46].

The variation in the reported prevalence of undernutrition across studies may be explained by the difference in study setting, sample size, demographic, socio-economic, environmental and cultural differences.

The present study showed that the probability of having intestinal parasite infection was six times as likely in children who practice hand washing with soap and water after toilet occasionally and almost eighteen times higher in children who never practice hand washing with soap and water after toilet compared with children who practice always. This finding is consistent with data on Bahir Dar, North west Ethiopia schoolchildren, which showed higher rates of IPIs was significantly associated with less frequent hand washing with soap and water[AOR(95% CI):10.56(4.827, 23.12)] [53]. Hand washing is one of the most important interventions that has proven to effectively intervene with fecal–oral transmission of diseases. The use of water and soap or similar agents is critical for effective removal of parasitic ova/(oo)cysts from contaminated hands[62].

Our results also showed that the probability of having IPI was four times more likely in children who never use footwear compared with children who use regularly. This is consistent with study conducted in Bahir Dar, North west Ethiopia reported that lack of footwear significantly associated with IPIs[AOR(95% CI): 2.7 (1.479, 4.971) [53].

We found that mother`s employment is an important predictor of IPI in schoolchildren. The probability of having IPI was twice as likely in children with unemployed mothers compared with children with employee mothers. This study corroborates earlier findings that children with unemployed mothers have higher rates of IPIs [OR (95%CI):4.5(2.5–8.2)] [14].

In this study, the probability of having IPIs was almost four times more likely in children who were members of households that dispose garbage in an open field compared with households that managed properly. This is in agreement with a study conducted in India which showed that IPIs was significantly associated with lack of household solid waste collection [OR (95%CI): 2.5(1.4-4.36) [78].

Our study also showed that the probability of stunting was five times more likely in polyparasitized children compared with non-infected and monoparasitized children. This finding agrees with data on Peru schoolchildren, which showed a higher risk of stunting in children infected with co-infection [OR (95% CI):1.95(1.35, 2.82)] [2].

We found that mother`s education is an important predictor of child stunting. The probability of having stunting was four times higher in children with mothers who had no formal education compared with mothers who had post secondary education. This is consistent with studies conducted among schoolchildren in Gondar, North west Ethiopia[29] and elsewhere [76]. Our study has indicated that mother's education is an important predictor for child stunting. This suggests that improving mother's years of schooling may have significant influence on child nutritional status and ultimately alter the poverty cycle as stunting is a key predictor of human capital.

In this study, the probability of having thinness was almost four times more likely in polyparasitized children compared with children no or monoparasitized. This finding is inconsistent with a study conducted among schoolchildren in Honduras, which reported that no evidence for association between polyparasitism and BAZ scores (p=0.446) no statistically significant association between polyparasitism and thinness [17]. The inconsistency might be due to the differences in socio-demographic environmental and cultural characteristics.

Our results also showed that children who had reported diarrhoeal illness in the last two weeks were almost three times more likely to be compared with children who had no reported illness in the last two weeks. This is inconsistent with data on Peru schoolchildren, which showed a statically significant association between diarrhoea in the last week and stunting and underweight [OR=1.96; 95% CI: (1.17, 3.29)][2].

In this study independent of other predictors, the probability of having underweight was almost nine times as likely in polyparasitized children compared with children who were no-monoparasitized. This finding is consistent with the result of the study conducted among schoolchildren of Honduras that reported significant association of polyparasitism with being underweight [AOR (95%CI):2.6,29.6)] [17].

This study showed that children who were members of food insecure households were three times more likely to be underweight compared with children who were members of food secure households. This study corroborates earlier findings that children from children from food insecure households have higher rates of underweight compared with children from food secure households [74].

Strengths:

We recognize that our study has some strength. Considering a design effect in the sample size estimation to take into account clustering by school and this study sample is likely representative of the schoolchildren as in Arba Minch 107% children attend primary school [80]. In addition, by utilizing anthropometric measurements and laboratory protocols recommended by the WHO, our results permit comparisons with other studies both nationally and internationally.

Limitations:

A few limitations to this study must be considered. This findings are based on a cross-sectional study so that causal inferences cannot be made from the associations reported here. Some of the risk factors were obtained from maternal report, as there was no other means of obtaining that information, and as such could have been subject to recall bias. The dietary diversity was constructed based on a simple count of the number of food groups consumed. No information on portion sizes and amount of intake was collected.

CHAPTER SEVEN

7 CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

According to the findings of this study, undernutrition was highly prevalent in the in the study area where intestinal parasites are highly prevalent. Low child dietary diversity, low household wealth, household food insecurity, intestinal parasites, illness in the last two weeks, open field garbage disposal, low level of maternal education and maternal unemployment were independent factors associated with undernutrition. While low child dietary diversity, never hand washing after defecation, less frequent use of footwear, low household wealth and maternal unemployment were important factors associated with intestinal parasite infections. Due to the interrelation between many of these health and nutrition problems, effective health and nutrition interventions that require a multi- disciplinary approach at both the school and community based should be scaled-up to curb undernutrition.

7.2 Recommendations

Appropriate authorities to target vulnerable children, households and communities can use our results.

To FMoH, RHB, GGZHD, AMTHO, AMTARDO, AMTEO

Behaviour change interventions:

-Improving household sanitation, specifically proper household solid waste management, practicing hand washing after defecation

Feeding:

-Improving dietary diversity among the most vulnerable could improve their nutritional status

-Optimizing the overall quality of foods through inclusion of a variety of food groups may be more essential to improve the nutritional status of schoolchildren

-Addressing household food insecurity of their targeted population to maximize their potential nutritional impacts

-Skills-based nutrition education for the family

-School administrators and teachers have a role to play in ensuring dietary diversity by educating the children on the importance of eating a variety of healthful foods, incorporating nutrition into the school curriculum, and establishing nutrition clubs for the school children.

Periodic deworming intervention:

-Prevalence of any STH (*Path*) was more than 50%; therefore, there was a need for mass deworming of schoolchildren in the study area.

-Furthermore, efforts should be made to strengthen and expand school and community-based programs that promote inexpensive, yet effective, practices aimed at preventing the spread of parasitic diseases by promoting the use and distribution of prophylaxis and other de-worming medications while making substantial improvements in school and community-based sanitation facilities

Girls education and women empowerment:

Family planning:

-Use of family planning should be encouraged at community level

- ✓ Future research

-To explore the determinants of nutritional status by using rigorous designs.

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APPENDICES

Appendix A: Written Informed Consent for the Parents/guardians

Study participant parents/guardians information and consent sheet

Survey Title: Nutritional Status, Intestinal Parasitic Infections and their Predictors among Schoolchildren in Arba Minch Town, Southern Ethiopia.

Investigating Team: Research team from Jimma University undertake this study:

Principal Investigator: The following person is directly responsible for the design and the implementation of the study: Mr. Tagel Getachew (BSc.PH, MPH Student).

Aim of the study: To determine the prevalence of undernutrition and intestinal parasitic infections among schoolchildren in Arba Minch and identify the role of IPIs and other predictors on nutritional status.

Study procedure: For this study, we recruit the schoolchildren aged 7 to 14 years randomly.

If you allow your child to participate in the study, we will take his/her body weight and height measurement to assess nutritional status. In addition, a stool sample was taken from your child for analysis to determine whether your child is sick with intestinal parasites.

Confidentiality: The data collected may be published but no names will appear in any publications. No personal data and diagnoses was made available in a way that allows the identification of real persons to other people, authorities or companies than those directly involved in the study.

Potential risks: No risks and harm to your child will result from the study.

Potential benefits: If you allow your child to take part in this study, he/she will help researchers to improve on the well-being of schoolchildren in your community.

Costs/compensation: Participation in this study will not result in any costs to you. The treatment of diagnosed intestinal parasitic infections is free of charge.

Rights of the child as a Research volunteer: You have the right to allow or stop, or withdraw your child from participating in the survey at any time.

Contact person for further questions and complaints: Any questions or complaints can be directed at the fieldworkers who will try to answer them or transfer them to the principal investigator. You may also wish to contact directly Mr. Tagel Getachew anytime, Cell phone: 0913491223, Residence: 0468812207.

I (please print) **_____have read and understood this text and all my questions have been answered. I am aware of my rights and duties and I freely accept to participate in this study with my child.**

Date and signature participant parent/legal guardian: _____

Date and signature fieldworker: _____

Appendix B: Survey Questionnaire

Part-I: Introduction and consent:

Hello. My name is _____. I am working with the research team of Jimma University. We are conducting a survey about nutritional and health status of schoolchildren in Arba Minch. We would very much appreciate your and your child participation in this survey. The information we collect will help the government to improve the health and nutritional status of schoolchildren in your community. Your child is selected for the survey. As part of the survey, we would first like to ask some questions about your household characteristics, health and nutrition behaviours and practices. The questions usually take about 15 to 20 minutes. All of the answers you give was confidential and will not be shared with anyone other than members of our survey team. You don't have to be in the survey, but we hope you will agree to answer the questions since your views are important. If I ask you any question you don't want to answer, just let me know and I will go on to the next question or you can stop the interview at any time.

In case you need more information about the survey, you may contact the person listed on this informed consent form.

Give information and consent sheet with contact information

Do you have any questions?

May I begin the interview now?

Name and signature of Interviewer: _____ Date: _____

RESPONDENT AGREES TO BE INTERVIEWED…1 RESPONDENT DOES NOT AGREE TO BE INTERVIEWED…2→END

Part-II: Identification

STUDY ID.NO. | | | | Q.No | |

Town: Arba Minch Kifle-ketema: _____ Kebele: _____House No: _____

School name:_____ School No._____

Date of Interview: Day | | |

Month | | |

Year | 2 | 0 | 0 | 6 |

Interviewers visit: 1st visit...1
2nd visit...2
3rd visit...3 | |

Part-III: Background characteristics

L.No	Questions & filters	Coding categories/response options	Code
1	Age of the child _____years DOB:----/-----/-----		
2	Sex of the child	1=Male 2=Female	
3	Since 2 weeks ago, has this child had any attack of illness?	0=No ⟶ (skip to Q.no.5) 1=Yes	
3.a.	If yes, what were the diseases this child had in the last two weeks? (more than one answer is possible) (Had Diarrhoea in last two weeks?) (Had Cough/cold in the last two weeks?) (Had Fever in the last two weeks?) (Had Vomiting in the last two weeks)	1=Malaria/Fever 2=Cough/Cold 3=Diarrhoea/Dysentery/Vomiting 4=Others (specify)----------	
4	Was this child taken to a clinic/HC/hospital for this problem?	1=Yes 2=No 3=Others (specify)----------	
5	During the last 6 months, did this child take deworming pills (any anti-parasitic drug)?	0=No 1= Yes	
6	Before eating does this child wash his hands?	1=Yes Always 2=Yes Sometimes 3=No Never	
7	After going to the toilet, does this child wash his hands	1=Yes Always 2=Yes Sometimes 3=No Never	
8	Vaccination status(by BCG scar and by mother's history and/or vaccination card) [BCG, OPV, DPT, Measles]	1=Fully vaccinated 2=Partially vaccinated 3=Not vaccinated	
9	Does this child have a regular shoe wearing habit?	1=Yes Always 2=Yes Sometimes 3=No Never	
10	Does this child have a swimming habit?	1=Yes Always 2=Yes Sometimes 3=No Never	
11	What is the sex of the household head?(Head of the household)	1=Male 2=Female	
12	Relationship of the respondent to the child	1= Mother 2= Father 3=Others (specify)……	
13	Age of respondent----------		
14	With whom does this child live?	1= Mother and Father 2= Mother 3= Father 4=Others (specify)……	
15	Age of mother (If mother is absent, caregivers/guardians age) _____		
16	Mother`s highest educational level (If mother is absent, caregivers/guardians educational level)	1=Illiterate 2=Primary (1-6) 3=Junior (7-8) 4=Secondary (9-12) 5=Other higher education	

17	Mother's occupation? (If mother is absent, caregivers/guardians occupation)	1=Unemployed 2=Student 3=Government employee 4=Private employee 5=Others (specify)…….	
18	Father`s highest educational level	1=Illiterate 2=Primary (1-6) 3=Junior (7-8) 4=Secondary (9-12) 5=Other higher education	
19	Father`s occupation	1=Government employee 2=Trader 3=Driver 4=Farmer 5=6=Daily laborer Others (specify)……	
20	Current marital status of mother`s/caregivers/guardians	1=Married 2=Single 3=Divorced 4=Widowed	
21	How many people live in your household?(HH size) _____		
22	How many children are below five years in your household?_____		
23	How many children are b/n five and fourteen years in your household?_____		
24	How many birr your family earn monthly?(Household income) _____		
25	Autonomy in decision making		
25.a	Who decides on household income?	1= Mother 2=Mainly father 3=Only father 4=Both jointly 5=Others (specify)…….	
25.b	Who decides on the household health expenditure?	1= Mother 2=Mainly father 3=Only father 4=Both jointly 5=Others (specify)…….	
25.c	Who usually makes decisions about health care for mother and children?	1= Mother 2=Mainly father 3=Only father 4=Both jointly 5=Others (specify)…….	
25.d	Who usually makes decisions about making major household purchases?	1= Mother 2=Mainly father 3=Only father 4=Both jointly 5=Others (specify)……	

26	What is the main source of drinking water for members of your household?	1=Piped(tap) inside the house 2=Tap in compound 3=Public tap 4=River 5=Protected spring or well 6=Others (specify)…….	
27	How long does it take you to go there, get water, and come back?_____minutes		
28	Average household water use per day for drinking, cooking and personal hygiene is	1=<20 litres 2=20 -60 litres 3=61-120 litres 4=More than 120 litres	
29	What type of toilet facility does your household use?	1=Flush toilet, private 2=Flush toilet, shared 3=Traditional Pit, private 4=Traditional Pit, shared 5=VIP,private 6=VIP,shared 7=No facility/bush/field 8=Other (specify)----------	
30	The house you are living in	1=Rented from kebele 2= Rented from individual 3=Owned 4=Others (specify)…..	
31	Housing condition(by observation)		
31.1	Main material of the floor: (For the main house)	1=Cement 2=Earth/mud 3=Cow dung 4=Vinyl/plastic sheets 5=Others (specify)……..	
31.2	What is the Main material of the roof:(For the main house)	1=Corrugated iron sheet 2=Thatch 3=Cement/concrete 4=Others (specify)_____	
31.3	What is the wall material (for the main house)?	1=Wood and mud 2=Stone & cement 3=Reed and bamboo 4=Others(specify)---------	
32	How many rooms in your house are used for sleeping? _____		
33	What type of lighting facility does your household use?	1=Electricity(Meter, private) 2=Electricity (meter, shared) 3=Lantern 4=Kerosine lamp 5=Other (specify)…….	

34	Method of household solid waste disposal	1=Collected by municipality 2=Collected by private estab/ ass`ns 3=Dumped in street or open space 4=Dumped in river 5=Burned 6=Disposed in the compound 7=Others (specify)…….	
35	Do you have separate room which is used as kitchen?	1=Yes, in a separate building 2=No, in the living house 3=No, outdoors 4=others(specify)----------	
36	Does the household have any of the following properties?	0=No 1=Yes	
36.1	Digital camera/Tape recorder/CD player		
36.2	Functioning flat screen Television		
36.3	Generator used during electric power interruption		
36.4	Functioning dish		
36.5	Functioning refrigerator		
36.6	Computer		
36.7	Motor Cycle		
36.8	Bajaj		
36.9	Car		
36.10	Bathe Rome		
36.11	Laundry machine		
36.12	Touch screen mobile(mother and father)		
36.13	Sofa		
36.14	Spring mattress		
36.15	Sponge/Foam mattress		
36.16	Cotton mattress		

Part-IV:[1-9]Household Food Insecurity Access Scale (HFIAS) Questionnaire

1	In the past four weeks, did you worry that your household would not have enough food?	0 = No (skip to Q2) 1=Yes	
1.a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)	
2	In the past four weeks, were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?	0 = No (skip to Q3) 1=Yes	
2.a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)	
3	In the past four weeks, did you or any household member have to eat a limited variety of foods due to a lack of resources?	0 = No (skip to Q4) 1 = Yes	

3.a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)	
4	In the past four weeks, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?	0 = No (skip to Q5) 1 = Yes	
4.a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)	
5	In the past four weeks, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?	0 = No (skip to Q6) 1 = Yes	
5.a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)	
6	In the past four weeks, did you or any other household member have to eat fewer meals in a day because there was not enough food?	0 = No (skip to Q7) 1 = Yes	
6.a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)	
7	In the past four weeks, was there ever no food to eat of any kind in your household because of lack of resources to get food?	0 = No (skip to Q8) 1 = Yes	
7.a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)	
8	In the past four weeks, did you or any household member go to sleep at night hungry because there was not enough food?	0 = No (skip to Q9) 1 = Yes	
8.a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)	
9	In the past four weeks, did you or any household member go a whole day and night without eating anything because there was not enough food?	0 = No (HFIAS questionnaire is finished) 1 = Yes	
9.a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)	

Part-V: Dietary Diversity(DDS) Questionnaire

Please describe the foods (meals and snacks) that you ate or drank yesterday during the day and night, whether at home or outside the home. Start with the first food or drink of the morning.

Write down all foods and drinks mentioned. When composite dishes are mentioned, ask for the list of ingredients.

When the respondent has finished, probe for meals and snacks not mentioned

The interviewers should establish whether the previous day and night was usual or normal for the households. If unusual- feasts, funerals or most members absent, then another day should be selected

	Breakfast	Snack	Lunch	Snack	Dinner	Snack
Respondent(M/CT)						
Child						

[HHs: include foods eaten by any member of the household , and exclude foods purchased and eaten outside the home]

When the respondent recall is complete, fill in the food groups based on the information recorded above. For any food groups not mentioned, ask the respondent if a food item from this group was consumed.

Q.No	Food group	Examples	0=NO 1=Yes
1	Grains/ Cereals	Grains [Teff ,Wheat, Sorghum, Barley, Maize, Rice, Millet] Cereal staples and cereal-based products or any other grains or foods made from these (e.g. injera, bread, kita, Kur-kufa, Fosese, porridge, rice, sphaghetti,	
2	White roots and tubers	Roots & tubers: Any white potatoes, white yams, bulla, kocho, cassava, sweet potato, taro, or any other foods made from roots &/or tubers?	
3	Vitamin a rich vegetables And tubers	Carrot, red sweet pepper Any pumpkin, squash, or sweet potatoes that are yellow or orange inside?	
4	Dark green leafy vegetables	DGLV like kale, lettuce ,spinach or amaranth leaves?	
5	Other vegetables	e.g. tomato, onion,cauliflower,garlic, mushrooms,	
6	Vitamin a rich fruits	Fruits eg. Mangoes, etc or any of their products)? ripe papaya and 100% fruit juice made from these? Any ripe mangoes, ripe papayas	
7	Other fruits	100% fruit juice made from these, Bananas, Avocado, Pineapple, Orange, Lemon, Grapevine, Any other fruits or vegetables?.....	
8	Organ meat	Any liver, kidney, heart or other organ meats?.....	
9	Flesh meats	Any beef, lamb, goat, chicken?	
10	Eggs	Any eggs	
11	Fish and seafood	Any fresh or dried fish?.....	
12	Legumes, nuts and seeds	Dried beans, dried peas, nuts, seeds or foods made from these (eg. peanut butter) Any foods made from beans, peas, lentils or pulses?..... Any nuts or seeds such as peanuts, sunflower seeds?.....	
13	Milk and milk products	Dairy:Milk and milk products (e.g. fresh, skimmed, cream milk etc)? Milk, Cheese Any cheese, yogurt, milk or other milk products?.	
14	Oils and fats	Fats/Oil (any foods made with vegetable oil, butter, margarine etc)? oil or butter added to food or used for cooking	

15	Sweets	Sugar, honey, sweetened soda or sweetened juice drinks, sugary foods such as chocolates, candies, cookies and cakes	
16	Spices, condiments, beverages	Spices (black pepper, salt), condiments(salt,) beverages (coffee, tea)	
HH level only	Did you or anyone in your household eat anything (meal or snack) OUTSIDE the home yesterday?		
Individual level	Did you eat anything (meal or snack) OUTSIDE the home yesterday?		
	Total number of food groups consumed_____		
	If the child was given separate diet apart from the family diet, then ask the following? 0=No(End) 1=Yes		
	What did the child eat for Breakfast?		
	What did the child eat for Lunch?		
	What did the child eat for dinner?		
	Is this the usual diet for the child?		

Appendix C. Anthropometric Survey Data Collection Form

Anthropometric Measurements

This is very important measurement, maximum care for accuracy !

School: ______________________Date: ______School number: ___Team number: ______

Child Study ID.No.	HH No.	Sex (M/F)	Age in years	Birthday	Age in months	Weight (kg) ±100g	Height (cm) ±0.1cm	Oedema (y/n)	Section & id no.	Remark

Appendix D. Parasitological Survey Data Collection Form

Kato-Katz

Instructions: Count all eggs on the slide and note the number and epg in the appropriate field

Technologist/Technician: ______________________ Date: ________

Study ID No.	*A.lumbricoides*		Hookworm		*T.trichiura*		*S.mansoni*		Other		Other	
	eggs/ slide	epg	eggs/ slide	Epg	eggs/ slide	Epg	eggs/ slide	epg	Name	eggs/ slide	Name	eggs/ slide

Fomol-ether cconcentration

Instructions: Identify all **eggs/cysts/trophozoites** on the slide and note the result in the appropriate field

Technologist/Technician ____________________ Date: ________

Study ID No.	*A.lumbricoides*	Hookworm	*T.trichiura*	*S.mansoni*	Taenia spp.	*E.histolytica*	*G.lamblia*	*H.nana*	Other parasites identified
									Name

Appendix E. Amharic version of written informed consent for parents

ጅማ ዩኒቨርስቲ

የሕብረተሰብ ጤናና የሕክምና ሳይንስ ኮሌጅ

የኢፒዲሞሎጂ ትምህርት ክፍል

ለጥናቱ ተሳታፊ ወላጅ የሚሰጥ መረጃና ማስፈቀጃ ቅጽ

የጥናቱ ርዕስ፡ በአርባ ምንጭ ከተማ የተማሪዎች የጤናና ስነ-ምግብ ሁኔታና እነዚህንም የሚወስኑ ነገሮች

ዋና ተመራማሪ፡ አቶ ታገል ጌታቸው

አማካሪዎች፡ አቶ ሔኖክ አሰፋ እና አቶ ፀጋዬ ተወልደ

የጥናቱ ዓላማ፡ በተማሪዎች ላይ ከተመጣጠነ የምግብ ንጥረ-ነገሮች እጥረትና ከአንጀት ጥገኛ ትሎች የተነሳ የሚመጡ የጤና ቸግሮችን መመርመርና እነዚህንም የሚወስኑ ነገሮችን ማጥናት ስሆን ከዚህ ምርምር የምገኘው መረጃም እነዚህ ችግሮችን ለመቅረፍና ለመከላከል ፕሮገራሞችን ለማቀድና ለማከናወን ይረዳናል፡፡

የጥናቱ ሂደት፡ በአርባ ምንጭ ከተማ ከሚገኙ የአንደኛ ደረጃ ት/ቤቶች እድሜያቸው ከ 7-14 ዓመት የሆናቸው ተማሪዎች በዕጣ የጥናቱ ተሳታፊ እንዲሆኑ ይመረጣሉ፡ በዚህ መሰረት የእርስዎ ልጅም ተመርጧል/ለች፡፡ መልካም ፈቃድዎ ከሆነ ስለ ቤቱሰብዎ ማህበራዊና ኢኮኖሚያዊ፤ እና ለሎች አብረው የሚሄዱ ጥያቄዎችን እንጠይቅዎታለን፡፡ ከዚህ በተጨማሪ ይህንን የመረጃና ማስፈቀጃ ወረቀት ያመጣልዎትን/ያመጣችልዎትን ልጅዎትን የሰውነት ክብደትና ቁመት እንለካለን፤ የዓይነ-ምድር ናሙና ወስደን በላቦራቶሪ እንመረምራለን፡፡

ሚስጥራዊነቱ፡ ከእርስዎና ከልጅዎ የምናገኘውን መረጃ በሚስጥር እንጠብቃለን፡፡ የሚሰጡን መረጃ ከስምዎ ጋር ወይም ከልጅዎ ስም ጋር አይያያዝም፡፡

ጉዳቱ፡ በጥናቱ ተሳታፊ መሆን ምንም ዓይነት ጉዳት የለውም፡፡

ጥቅሙ፡ ከእርስዎና ከልጅዎ የምናገኘው መረጃ በአከባቢዎ የልጆችን የጤና ሁኔታ ለማሻሻል አስተዋጽኦ ያደርጋል፡፡

ዋጋ፡ በጥናቱ ተሳታፊ መሆን ምንም ዓይነት ዋጋ አይኖረውም፡፡ በልጅዎ የዓይነ-ምድር ምርመራ ወቅት በአንጀት ጥገኛ ትሎች ታሞ ከተገኘ በነፃ የፀረ-ትላትል መድሃኒት ይታከማል፡፡ የሰውነቱ የስነ-ምግብ ሁኔታ ከእድሜው አንፃር ችግር ያለበት ሆኖ ከተገኘ እናሳውቅዎታለን፤ አስፈላጊውን ምክር ከሰጠኖት በኋላ ለተጨማሪ ወደ አቅራቢያዎ ወደሚገኝ የጤና አጠባበቅ ጣቢያ እንዲሄዱ ማስታወሻ እንጽፍልዎታለን፡፡

የተሳታፊው መብት፡ በራስ ተነሳሽነት ከሚሰጡት ፈቃድ ውጪ በዚህ ጥናት የመሳተፍ ግደታ የለብዎትም፡፡

የጥናቱ ተጠሪ ግለሰብ፡ ማንገኛውም ዓይነት ጥያቄ ካለዎት መረጃ ለመሰብሰብ ወደ ቤትዎ የሚመጣውን መረጃ ሰብሳቢ ወይም በቀጥታ የጥናቱ ተመራማሪ የሆነውን አቶ ታገል ጌታቸውን በማንኛውም ሰዓት በአካልም ሆነ በስልክ ቁጥር፡ሞባይል 251913491223 የመኖሪያ 0468812207 ማግኘት ይችላሉ፡፡

ልጅዎን ምርመራ ከማድረጋችንና ወደ እርስዎ ቤት መጥተን ቤተሰብዎንና ልጅዎን የሚመለከቱ ጥያቄዎችን ከመጠየቃችን በፊት የእርስዎን ፈቃደኛነት ለመጠየቅ እንወዳለን፤ በዚህ መሰረት ፈቃደኛ ከሆኑ ቀጥሎ ባለው ክፍት ቦታ ላይ ስምዎንና ፊሪማዎን በማኖር ፈቃድዎን ገልፀው በልጅዎ በኩል ይላኩልን፡፡ **እናመሰግናለን**

✂ ----------

እኔ _____የተሰጠኝን መረጃ አንብቤ/ተነቦልኝ ተረድቸዋሁ፤ የራሴንና የልጄን መብትም በሚገባ ተገንዝቤያለሁ፤ በዚህ ጥናት ውስጥ በራሴ ተነሳሽነት ከልጄ ጋር ለመሳተፍ ፈቃደኛ መሆኔን እገልፃለሁ፡፡

የወላጅ/ያሳዳጊ/የዘውትር ተንከባካቢ

ፊሪማ፡_____ቀን፡_____

ፈቃዱን ያረጋገጠው መረጃ ሰብሳቢ ስም፡_____ ፊሪማ፡_____

ቀን፡_____

Appendix F. Amharic version of survey questionnaire

ጅማ ዩኒቨርስቲ

የሕብረተሰብ ጤናና የሕክምና ሳይንስ ኮሌጅ

የኢፒዲሞሎጂ ትምህርት ክፍል

በአርባ ምንጭ ከተማ የተማሪዎችን የጤናና ስነ-ምግብ ሁኔታና እነዚህንም የሚወስኑ ነገሮችን ለማጥናት የተዘጋጀ መጠይቅ

ይህን መጠይቅ የሚጠየቁት የተማሪው/ዋ እናት ወይም እድሜው ከአስራ አምስት ዓመት በላይ የሆነ የሁልጊዜ ተንከባካቢ ወይም አሳዳጊ መሆን አለበት፡፡

ጤና ይስጥልኝ፡ ስሜ _____ይባላል፡፡ ይህ " በአርባ ምንጭ ከተማ የተማሪዎች የጤናና ስነ-ምግብ ሁኔታ" በሚል ርዕስ የሚካሄድ ጥናት ስሆን እኔም የጥናቱ መረጃ ሰብሳቢ ነኝ፡፡ የእርስዎንና የልጅዎን በዚህ ጥናት ተሳታፊ መሆን በጣም ነው የምናደንቀው፡፡ ከዚህ በመቀጠል ያሉትን ጥያቄዎች በመመለስ ትብብር እንዲያደርጉልኝ በትህትና እጠይቅዎታለሁ፡፡ የሚሰጡት ምላሽ በአከባቢዎና በአገሪቱ የተማሪዎችንና በተመሳሳይ የዕድሜ ክልል ውስጥ ያሉ ልጆችን የጤናና ስነ-ምግብ ሁኔታ ለማሻሻል በሚደረገው ጥረት ውስጥ ገንቢ አስተዋጽኦ ያደርጋል፡፡ ማንኛውም እርስዎ የሚሰጡት መልስ ለሌላ ሰው አይነገርም፡፡ መልስ መስጠት የማይፈልጉበት ጥያቄ ካለ መልስ እንዲሰጡበት አይገደዱም፡፡ ስለ ጥናቱ ተጨማሪ መረጃ ካስፈለግዎና ጥያቄ ካለዎት የመረጃና ፈቃድ ወረቀቱ ላይ የተመለከተውን ግለሰብ ማግኘት ይችላሉ፡፡

ጥያቄ ካለዎት ?

መጠየቅ መጀመር እችላለሁ?

መላሹ ከተስማሙ ወደ ቀጣዮቹ ጥያቄዎች ይሀዱ መላሹ ካልተስማሙ በማመስገን ያብቁ →

የጠያቂው ስም፡---------- ቀን፡---------- ጉብኝት፡1ኛ-----2ኛ-----3ኛ-----

መጠይቅ የተጀመረበት ሰዓት-------ደቂቃ------ያለቀበት ሰዓት-------ደቂቃ------

የጠያቂው ቃል፡ ይህን መጠይቅ በላዩ ላይ በተፃፈው መመሪያና ጥያቄ እንዲሁም በተሰጠኝ ስልጠና መሠረት ሞልቻለሁ፡፡

በላዩም የሰፈረው መረጃ ትክክለኛ መሆኑን አረጋግጣለሁ፡፡ ፊሪማ፡----------ቀን፡----------

የጥናቱ ተሳታፊ ልጅ መለያ ቁጥር [ ] ቤተሰቡ መለያ ቁጥር [ ] ይቁ ቁጥር [ ]

ከተማ----------ክፍለ ከተማ----------ቀበሌ----------የቤት ቁጥር----------

የት/ቤቱ ስም----------የት/ቤቱ መለያ ቁጥር----------

ጥ.ቁ	ጥያቄዎች	አማራጭ መልሶች/መለያዎች	ኮድ
1	የልጅዎ እድሜው ስንት ነው?---------- የተወለደበት ቀን------ወር--------ዓ.ም----------		
2	የልጅዎ ፆታ	1=ወንድ 2=ሴት	
3	ባለፉት 2 ሣምንታት ልጅዎ ታሞ ነበር?	0=አይ አልታመመም → (ወደ ጥ.ቁ 5 ይሀዱ) 1= አዎ ታሞ ነበር	
3.a.	ምንድን ነበር የታመመው? (ከ አንድ በላይ መልስ ይቻላል)	1= ወባ/ትኩሳት 2= ሳል/ጉንፋን 3= ተቅማጥ/ትውከት 4 =ሌላ(ግለጥ/ጭ)----------	
4	ልጅዎን ለዚህ ህመሙ ምን አደረጉለት?	1= ወደ ሐኪም ቤት ወስጀዋለሁ 2= ወደ ሐኪም ቤት አልወሰዱኩም 3= ሌላ(ግለጥ/ጭ)----------	
5	ባለፉት 6 ወራት ልጆ የፀረ-ትላትል መድሀኒት ወስዷል/ለች?	1= ወስዷል/ዳለች 2= አልወሰደም/ችም	

6	ልጅዎ ምግብ ከመመገቡ በፊት እጁን ይታጠባል?	1= አዎ ሁልጊዜ ይታጠባል 2= አዎ አንዳንድ ጊዜ ይታጠባል 3= የለም አይታጠብም	
7	ልጅዎ ከመፀዳጃ ቤት ስመለስ እጁን በሳሙና ይታጠባል?	1= አዎ ሁልጊዜ ይታጠባል 2= አዎ አንዳንድ ጊዜ ይታጠባል 3= የለም አይታጠብም	
8	ልጅዎ በህፃንነቱ/ቷ ክትባት በሙሉ ተከትባል/ለች?	1= አዎ ተከትቦ ጨርሷል/ሳለች 2= ተከትባል ግን አልጨረሰም 3= በጭራሽ አልተከተበም	
9	ልጅዎ አዘውትሮ/ራ ጫማ ያደርጋል/ታደርጋለች?	1= አዎ ሁልጊዜ ያደርጋል/ታደርጋለች 2= አዎ አንዳንድ ጊዜ ያደርጋል/ታደርጋለች 3= የለም አያደርግም/አታደርግም	
10	ልጅዎ ወንዝ/ምንጭ ይዋኛል/ትዋኛለች?	1= አዎ ሁልጊዜ ይዋኛል/ትዋኛለች 2= አዎ አንዳንድ ጊዜ ይዋኛል/ትዋኛለች 3= የለም ዋኝቶ/ታ አያውቅም/አታውቅም	
11	የቤተሰቡ ኃላፊ ፆታ	1=ወንድ 2=ሴት	
12	መላሹ ከ ልጁ/ጂቱ ጋር ያለው ግንኙነት	1= እናት 2= አባት 3= ሌላ(ግለጥ/ጭ)----------	
13	የመላሹ እድሜ----------ዓመት		
14	ልጁ ከማን ጋር ነው የሚኖረው?	1= ከእናትና አባት 2= ከእናት 3= ከአባት 3= ሌላ(ግለጥ/ጭ)----------	
15	የእናት/ያሳዳጊ/ተንከባካቢ እድሜ ----------ዓመት		
16	የእናት/ያሳዳጊ/ተንከባካቢ ያጠናቀቁት ከፍተኛው የትምህርት ደረጃ	1= አልተማሩም 2= ከ1ኛ-6ኛ ክፍል ተምረዋል 3= ከ7ኛ-8ኛ ክፍል ተምረዋል 4= ከ9ኛ-12ኛ ክፍል ተምረዋል 5=የከፍተኛት/ት(ዩኒቨርስቲ/ኮሌጅ)ተምረዋል	
17	የእናት/ያሳዳጊ/ተንከባካቢ ቋሚ ስራ	1= ምንም ተቀጥራ አትሰራም 2= ተማሪ 3=የመንግስት ሠራተኛ 4= የግል ስራ 5 =ሌላ(ግለጥ/ጭ)----------	
18	የአባት ያለው ከፍተኛ የትምህርት ደረጃ	1= አልተማሩም 2= ከ1ኛ-6ኛ ክፍል ተምረዋል 3= ከ7ኛ-8ኛ ክፍል ተምረዋል 4= ከ9ኛ-12ኛ ክፍል ተምረዋል 5=የከፍተኛት/ት(ዩኒቨርስቲ/ኮሌጅ)ተምረዋል	
19	የአባት ስራ	1= የመንግስት ሠራተኛ 2= ነጋዴ	

		3= ሾፈር 4= ገበሬ 5= የቀን ሠራተኛ 6= ሌላ(ግለጥ/ጭ)----------	
20	በአሁኑ ሰዓት ያለው የእናት/ያሳዳጊ/ተንከባካቢ የጋብቻ ሁኔታ	1= ያገባ/ች 2= ያላገባ/ች 3= የፈታ/ች 4= የትዳር ጋደኛ የሞተበት/ባት	
21	እርስዎን ጨምሮ የቤተሰብ ብዛት ስንት ነው?----------		
22	በቤተሰቡ ውስጥ ዕድሜያቸው ከ5 ዓመት በታች ያሉ ህፃናት ብዛት ስንት ነው?----------		
23	በቤተሰቡ ውስጥ ዕድሜያቸው ከ5-14 ዓመት ያሉ ልጆች ብዛት ስንት ነው?----------		
24	አማካኝ የቤተሰቡ የወር ገቢ በብር ስንት ነው?----------		
25	በቤተሰቡ ውስጥ ውሳኔ ሰጪነትን ይመለከታል		
25.a	በቤተሰቡ ውስጥ ገንዘብ ላይ ውሳኔ ሰጪው ማንነው?	1= እናት 2= በአባዛኛው አባት 3= አባት ብቻ 4= እናትና አባት በጋራ 5= ሌላ(ግለጥ/ጭ)----------	
25.b	በቤተሰቡ ውስጥ የቤተሰቡን የጤና ወጪ ውሳኔ ሰጪው ማንነው?	1= እናት 2= በአባዛኛው አባት 3= አባት ብቻ 4= እናትና አባት በጋራ 5= ሌላ(ግለጥ/ጭ)----------	
25.c	በቤተሰቡ ውስጥ የእናትና ልጆችን የጤና ወጪ ውሳኔ ሰጪው ማንነው?	1= እናት 2= በአባዛኛው አባት 3= አባት ብቻ 4= እናትና አባት በጋራ 5= ሌላ(ግለጥ/ጭ)----------	
25.d	በቤተሰቡ ውስጥ ዋና ዋና የሚገዙ ነገሮች ላይ ውሳኔ ሰጪው ማንነው?	1= እናት 2= በአባዛኛው አባት 3= አባት ብቻ 4= እናትና አባት በጋራ 5= ሌላ(ግለጥ/ጭ)----------	
26	ቤተሰቡ የመጠጥ ዉሀ የሚቀዳው ከየት ነው?	1= ከቧንቧ, መኖሪያ ቤት ውስጥ የተገጠመ 2= ከቧንቧ, ግቢ ቤት ውስጥ የተገጠመ 3= ከህዝብ ቦኖ 4= ከወንዝ 5= ከተጠበቀ(የታጠረ)የውሀ ጉድጓድ/ምንጭ 6= ሌላ(ግለጥ/ጭ)----------	
27	ውሀ በሚቀዳበትና በቤት መካከል ያለው የደርሶ መልስ		

	ርቀት(ውሀ ቀድቶ ለመመለስየሚፈጀው) በደቂቃ……		
28	የቤተሰቡ አማካይ ጠቅላላ የውሀ ፍጆታው በቀን በሌትር ምን ያህል ነው?	1= ከ20 ሌትር በታች 2= ከ20-40 ሌትር 3= ከ61-120 ሌትር 4= ከ120 ሌትር በላይ	
29	ቤተሰቡ የሚጠቀመው የመፀዳጃ ቤት ዓይነትና ሁኔታ	1= በውሀ የሚሠራ, የግል 2= በውሀ የሚሠራ, የጋራ 3= ልማዳዊ ጉደጓድ, የግል 4= ልማዳዊ ጉደጓድ, የጋራ 5= የተሻሻለ, የግል 6= የተሻሻለ, የጋራ 7= የመፀዳጃ ቤት የለንም/ጫካ/ሜዳ ላይ 8= ሌላ(ግለጥ/ጭ)----------	
30	የምትኖሩበት ቤት	1= የኪራይ,ከቀበሌ 2= የኪራይ,ከግለሰብ 3= የግል 3= ሌላ(ግለጥ/ጭ)----------	
31	የመኖሪያ ቤቱ ሁኔታ(ቤቱን በመቃኘት የሚመለስ)		
31.a.	ወለሉ	1= ሲሚንቶ 2= አፈር 3= በእበት የተለቀለቀ 4=ፕላስቲክ 5= ሌላ(ግለጥ/ጭ)	
31.b.	ጣሪያው	1=ቆርቆሮ 2=ሣር 3=ኮንክሪት 4= ሌላ---------	
31.c.	ግድግዳው	1=አፈርና እንጨት 2=ሲሚንቶ 3= ቀርቀላ 4= ሌላ-------	
32	የመኖሪያ ቤቱ ስንት የመኝታ ክፍሎች አሉት?----------		
33	ለመኖሪያ ቤቱ የምትጠቀሙት የመብራት ዓይነት	1= ኤሌክትሪክ,ቆጣሪው የግል 2= ኤሌክትሪክ,ቆጣሪው የጋራ 3= ፋኖስ 4= ኩራዝ 5= ሌላ(ግለጥ/ጭ)----------	
34	ደረቅ ቆሻሻን እንደት ያስወግዳሉ?	1= ማዘጋጃ ቤት ይሰበስባል 2= በግል ድርጅቶች/ማህበራት ይሰበስባል 3= መንገድ ላይ/ክፍት ቦታ ላይ በመጣል 4= በአቅራቢ በሚገኝ ወንዝ ውስጥ በመጣል 5= በማቃጠል 6= ግቢው ውስጥ በመጣል 7= ሌላ(ግለጥ/ጭ)----------	

35	ከመኖሪያ ቤቱ የተለየ ማዕድ ቤት ኣላችሁ?	1= አለን 2=የለንም ከመኖሪያ ቤት ውስጥ ነው የምናበስለው 3=የለንም ከውጭ(ሜዳላይ)ነው የምናበስለው 4= ሌላ(ግለጥ/ጭ)----------	
36	ከሚከተሉት ቋሚ የቤት ሀብት የትኞችሁ በእርስዎ ቤት ይገኛሉ?	0= የለም 1= አለ	
36.1	ዲጅታል ካመራ/ቴፕ/ሲዲ ማጫወቻ		
36.2	የሚሠራ ፍላት ስክርን ቴሌቪዥን		
36.3	ጀነረተር የኤሌክትሪክ ሐይል ስቋረጥ የምትጠቀሙት		
36.4	የሚሠራ ዲሽ		
36.5	የሚሠራ ፍሪጅ		
36.6	ኮሚፒዩተር		
36.7	ሞተርሣይክል		
36.8	ባጃጅ		
36.9	መኪና		
36.10	ሻወር ቤት		
36.11	የልብስ ማጠቢያ ማሽን		
36.12	ታች ስክሪን ሞባይል(የእናትና አባት)		
36.13	ሶፋ		
36.14	ስፕሪንግ ፍራሽ		
36.15	ስፖንጅ ፍራሽ		
36.16	ጥጥ ፍራሽ		

የቤተሰብ የምግብ ዋስትህናና አመጋገብን የተመለከተ መጠይቅ

ለመላሹ ያንብቡለት፡"ከዚህ ቀጥሎ ለሚጠየቁት ለእያንዳንዱ ጥያቄ በመጀመሪያ ባለፉት አራት ሣምንታት(1 ወር ወይም 30 ቀናት) ጊዜ ውስጥ ሁኔታው መከሰት አለመከሰቱን በሚገባ ያስታውሳሉ፤ ተከስቶ ከሆነ ስንት ጊዜ እንደተከሰተ ይነግሩኛል።

ጥ.ቁ	ጥያቄ	አማራጭ ምላሽ	ኮድ
1	ባለፉት 4 ሣምንታት,ለቤትዎ በቂ ምግብ የለም ብለው ተጨንቀው ያውቃሉ?	0=አይ,ተጨንቄ አላውቅም→ (ወደጥ.ቁ2) 1=አዎ,ተጨንቄ አውቃለሁ	
1.a	ለምን ያህል ጊዜ ነው እንዲህ የተከሰተው?	1=በጣም ጥቂት ጊዜ(አንዴ ወይም ሁለቴ ላለፉት አራት ሣምንታት) 2=አንዳንድ ጊዜ(ከ 3 እስከ 10 ጊዜ ላለፉት አራት ሣምንታት) 3=ብዙ ጊዜ(ከ 10 ጊዜ በላይ ላለፉት አራት ሣምንታት)	
2	ባለፉት 4 ሣምንታት,እርስዎ ወይም ሌላ የቤትዎ አባል በገንዘብ እጦት ምክንያት መብላት የፈለጉትን ምግብ ያልበሉበት ጊዜ ነበር?	0=አይ,አልነበረም→ (ወደጥ.ቁ3) 1=አዎ,ነበር	
2.a	ለምን ያህል ጊዜ ነው እንዲህ የተከሰተው?	1=በጣም ጥቂት ጊዜ(አንዴ ወይም ሁለቴ ላለፉት አራት ሣምንታት) 2=አንዳንድ ጊዜ(ከ 3 እስከ 10 ጊዜ ላለፉት አራት ሣምንታት) 3=ብዙ ጊዜ(ከ 10 ጊዜ በላይ ላለፉት አራት ሣምንታት)	
3	ባለፉት 4 ሣምንታት,እርስዎ ወይም ሌላ የቤትዎ አባል በገንዘብ እጦት ምክንያት በዓይነቱ ውስን የሆነ ምግብ በልታቹሃል?	0=አይ,አልበላንም→ (ወደጥ.ቁ4) 1=አዎ, በልተን ነበር	
3.a	ለምን ያህል ጊዜ ነው እንዲህ የተከሰተው?	1=በጣም ጥቂት ጊዜ(አንዴ ወይም ሁለቴ ላለፉት አራት ሣምንታት) 2=አንዳንድ ጊዜ(ከ 3 እስከ 10 ጊዜ ላለፉት አራት ሣምንታት) 3=ብዙ ጊዜ(ከ 10 ጊዜ በላይ ላለፉት አራት ሣምንታት)	
4	ባለፉት 4 ሣምንታት,እርስዎ ወይም ሌላ የቤትዎ አባል በገንዘብ እጦት ምክንያት መብላት የማትፈልጉትን ምግብ የበላችሁበት ጊዜ ነበር?	0=አይ,አልነበረም→ (ወደጥ.ቁ5) 1=አዎ, የበላንበት ጊዜ ነበር	
4.a	ለምን ያህል ጊዜ ነው እንዲህ የተከሰተው?	1=በጣም ጥቂት ጊዜ(አንዴ ወይም ሁለቴ ላለፉት አራት ሣምንታት) 2=አንዳንድ ጊዜ(ከ 3 እስከ 10 ጊዜ ላለፉት አራት ሣምንታት)	

		3=ብዙ ጊዜ(ከ 10 ጊዜ በላይ ላለፉት አራት ሣምንታት)	
5	ባለፉት 4 ሣምንታት,እርስዎ ወይም ሌላ የቤትዎ አባል በቂ ምግብ ባለመኖሩ ምክንያት መብላት ከሚፈልጉት ያነሰ ምግብ የበላችሁበት ጊዜ ነበር?	0=አይ,አልነበረም→ (ወደጥ.ቁ6) 1=አዎ, ትንሽ የበላንበት ጊዜ ነበር	
5.a	ለምን ያህል ጊዜ ነው እንዲህ የተከሰተው?	1=በጣም ጥቂት ጊዜ(አንዴ ወይም ሁለቴ ላለፉት አራት ሣምንታት) 2=አንዳንድ ጊዜ(ከ 3 እስከ 10 ጊዜ ላለፉት አራት ሣምንታት) 3=ብዙ ጊዜ(ከ 10 ጊዜ በላይ ላለፉት አራት ሣምንታት)	
6	ባለፉት 4 ሣምንታት,እርስዎ ወይም ሌላ የቤትዎ አባል በቂ ምግብ ባለመኖሩ ምክንያት ጥቂት ምግብ በቀን ውስጥ የበላችሁበት ጊዜ ነበር?	0=አይ,አልነበረም→ (ወደጥ.ቁ7) 1=አዎ, በቀን ጥቂት የበላንበት ጊዜ ነበር	
6.a	ለምን ያህል ጊዜ ነው እንዲህ የተከሰተው?	1=በጣም ጥቂት ጊዜ(አንዴ ወይም ሁለቴ ላለፉት አራት ሣምንታት) 2=አንዳንድ ጊዜ(ከ 3 እስከ 10 ጊዜ ላለፉት አራት ሣምንታት) 3=ብዙ ጊዜ(ከ 10 ጊዜ በላይ ላለፉት አራት ሣምንታት)	
7	ባለፉት4 ሣምንታት, በቤትዎ ምንም የሚበላ/የሚቀመስ ምግብ ያልነበረበት ጊዜ ነበር ወይ ገንዘብ ባለመኖሩ ምክንያት?	0=አይ,አልነበረም→ (ወደጥ.ቁ8) 1=አዎ, ምንም የሚበላ/የሚቀመስ ምግብ ያልነበረበትጊዜ ነበር	
7.a	ለምን ያህል ጊዜ ነው እንዲህ የተከሰተው?	1=በጣም ጥቂት ጊዜ(አንዴ ወይም ሁለቴ ላለፉት አራት ሣምንታት) 2=አንዳንድ ጊዜ(ከ 3 እስከ 10 ጊዜ ላለፉት አራት ሣምንታት) 3=ብዙ ጊዜ(ከ 10 ጊዜ በላይ ላለፉት አራት ሣምንታት)	
8	ባለፉት 4 ሣምንታት,እርስዎ ወይም ሌላ የቤትዎ አባል በቤታችሁ በቂ ምግብ ባለመኖሩ ምክንያት ምግብ ሳትበሉ ዖማቹን ያደራቹበት ቀን ነበር?	0=አይ,አልነበረም→ (ወደጥ.ቁ9) 1=አዎ, ዖማችን ያደርንበት ቀን ነበር	
8.a	ለምን ያህል ጊዜ ነው እንዲህ የተከሰተው?	1=በጣም ጥቂት ጊዜ(አንዴ ወይም ሁለቴ ላለፉት አራት ሣምንታት) 2=አንዳንድ ጊዜ(ከ 3 እስከ 10 ጊዜ ላለፉት አራት ሣምንታት) 3=ብዙ ጊዜ(ከ 10 ጊዜ በላይ ላለፉት አራት ሣምንታት)	
9	ባለፉት 4 ሣምንታት,እርስዎ ወይም ሌላ የቤትዎ አባል በቤታችሁ በቂ ምግብ ባለመኖሩ ምክንያት ሙሉ ቀንና ማታ ያለምግብ የሆናቹበት ጊዜ ነበር?	0=አይ,አልነበረም → (የምግብ ዋስትና መጠይቁ አልቋል) 1=አዎ, ዖማችን ያደርንበት ቀን ነበር	

ላለፉት 24 ሰዓታት ከትናንትና ጀምሮ ቀንና ማታ እቤት ወይም ከቤት ውጪ እርስዎ ወይም ሌላ የቤትዎ አባል የተመገቡዋቸውን ምግቦችና መጠጦች ቢነግሩኝ፡ ጥዋት ቁርስ ላይ ከተበሉትና ከተጠጡት ይጀምሩ፡፡

መረጃ ሰብሳቢ፡*ከአንድ በላይ የምግብ ዓይነቶች ከያዘ ዝርዝሩን ይጠይቁ

*በመጀመሪያ ትናንትና ቀንና ማታ ለቤተሰቡ ከወትሮው የተለየ አለመሆኑን ያጣሩ፤ ለምሳሌ,ዖም፤ድግስ፤ተዝካር…

*መልስ ሰጪው ከጨረሱ፤ተጨማሪ ምግቦች መከሰስን ጨምሮ ካለ እንዲያስታውሱ ያድርጉ

መላሽ	ቁርስ	መክሰስ	ምሳ	መክሰስ	እራት	መክሰስ
እናት/ ተንከባካቢ						
ልጁ						

*መላሹ ላልጠቀሳቸው የምግብ እህል ዓይነቶች ከዚህ በታች ካሉት የምግብና እህል ዓይነቶች ይጠይቋቸው

ጥ.ቁ	የምግብ ዓይነቶች ግሩፕ	ለምሳሌ የተዘረዘሩ የምግብ ዓይነቶች	1(የምግቡስም)=የተመገቡት ካለ 0= ምንም የተመገቡት ከለለ
1	ጥራጥሬ እህሎች (ጤፍ,ስንዴ,ገብስ፣በቆሎ,ማሽላ,ሩዝ)	ከእነዚህ የተሠራ ምግብ ለምሳሌ፤ እንጀራ, ዳቦ, ቂጣ, ገንፎ, ኩርኩፋ, ፎሰሴ, ሙቅ, ፓስታ,ማካሮኒ፣	
2	ነጭ ሥራ ስር (ድቡልቡል ድንች, ስኳር ድንች, ቦዬ, እንሰት, ጎደሬ, ቆጮ, ቡላ)	ከእነዚህ የተሠራ ምግብ ለምሳሌ፤ድንች ወጥ፣የቡላ ገንፎ, ፍርፍር ፤የቆጮ ቂጣ,	
3	በቫይታሚን ኤ የበለፀገ አትክልትና ሥራ ስር(ካሮት,	ከእነዚህ የተሠራ ምግብ ለምሳሌ፤ካሮት ያለበት ወጥ(በየዓይነት)	

4	አረንጋዴ አትክልት(የአበሻ ጐመን, ሽፈራው, ቆስጣ, ሰላጣ,	ከእነዚህ የተሠራ ምግብ ለምሳሌ፤ በየዓይነት፣ ጐመን በስጋ,	
5	ሌላ አትክልቶች (ጥቅል ጐመን, የአበባ ጐመን, ቲማቲም,ቃሪያ,ሽንኩርት,ነጭሽንኩርት,ፎሶሊያ, እንጉዳይ)	ከእነዚህየተሠራ ምግብ ለምሳሌ፤በየዓይነት,	
6	በቫይታሚን ኤ የበለፀጉ ፍራፍሬዎች (ማንጎ,ፓፓያ)	ከእነዚህ የተሠራ ለምሳሌ፤ማንጎ ጁስ, ፓፓያ ጁስ,	
7	ሌላ ፍራፍሬዎች (ሙዝ,አቮካዶ, ብርቱካን, አፕል,አናናስ,እንጆሪ,ሎሚ,ወይን)	ከእነዚህየተሠራለምሳሌ፤ጁስ,አቮካዶ ፍርፍር,	
8	የሆድ ዕቃ ስጋ (ጉበት,ኩላሊቲ)	ከእነዚህ የተሠራ ምግብ ለምሳሌ፤ዱለት,	
9	ስጋ (የበሬ,የበግ,የፍየል,የዶሮ)	ከእነዚህየተሠራምግብለምሳሌ፤ጥብስ,ቅቅል, ዶሮወጥ(ብልቱ/ስጋው),ቀይወጥ,ሚስቶ, ምንቸት,ዶሮፋንታ,ቀይ/አልጫ ፍሬሽ,	
10	እንቁላል (የዶሮ እንቁላል)	ከእነዚህ የተሠራ ምግብ ለምሳሌ፤እንቁላል ፍርፍር/ቅቅል/ሣንዲዊች	
11	ዓሣ (ትከስ ዓሣ,የዓሣ ቋንጣ)	ከእነዚህ የተሠራ ምግብ ለምሳሌ፤ ለብለብ, ሾርባ,ቅቅል,ጎድን,ግሪል ፊሽ,ኮትሌት,ወጥ	
12	የቅባትና ዘይት ጥራጥሬ እህል (አተር,ባቀላ,ሽምብራ,ሱፍ,ሰሊጥ,ተልባ,ለውዝ)	ከእነዚህ የተሠራ ምግብ ለምሳሌ፤ሽሮ ወጥ,ክክወጥ,ሱፍፍትፍት, እንጀራ በተልባ/ በሰሊጢ, ዳቦ በለውዝ ቅቤ,	
13	ወተትና የወተት ተዋጽኦ	ወተት/ትኩስ,የታሸገ/,አይብ,እርጎ,አሬራ,	
14	ዘይትና ቅባት(ቅቤ,የምግብ ዘይት)	ቅቤ ወይም ዘይት ተጨምሮበት የተሠራ ወጥ፤	
15	ጣፋጭ ነገሮች	ስኳር,ማር,ኬክ,ኮኪስ,ብስኩት,የለስላሳ መጠጥ	
16	ቅመማ ቅመሞችና ማጣፈጫዎች, መጠጦች	ሚጥሚጣ,ስልጆ,ቡና,ሻይ,	
በቤተሰብ ደረጃ(እናት/ተንከባካቢ)፡እርስዎ ወይም ሌላ የቤትዎ አባል በመደበኛ የምግብ ሰዓት (ቁርስ/ምሳ/እራት) ወይም መክሰስ ነገር ውጪ ትናንትና ተመግበዋለል?			
በግለሰብ ደረጃ(ልጁ)፡ከቤት ውጪ በመደበኛ የምግብ ሰዓት(ቁርስ/ምሳ/እራት) ወይም መክሰስ ነገር በልተሃል ትናንትና?			
ልጅዎ ለቤተሰብ ከሚሰጠው የተለየ ምግብ ይሰጠዋል? 0=አይሰጠውም((መጠይቁ አልቋል) 1=ይሰጠዋል			
የሚሰጠው ከሆነ ትናንትና ምን ተሰጠው?			

DECLARATION

I, the undersigned, declare that this thesis is my original work, has not been presented for a degree in this or any other university and that all sources of materials used for the thesis have been fully acknowledged.

Name: Tagel Getachew Dires
Signature: _____
Name of the institution: _____
Date of submission: _____

This thesis has been submitted for examination with my approval as University advisor

Name and Signature of the first advisor _____
_____
Name and Signature of the second advisor _____
_____