

Addis Ababa
University

(Since 1950)



COLLEGE OF DEVELOPMENT STUDIES

CENTER FOR FOOD SECURITY STUDIES

UNDERNUTRITION AND INTESTINAL HELMINTH AND
PROTOZOAN PARASITES AMONG PRIMARY SCHOOL IN
LIDETA SUB CITY, ADDIS ABABA, ETHIOPIA

BY

EYUEL BEKELE GURMU (BSc IN PUBLIC HEALTH)

NOVEMBER, 2021

ADDIS ABABA, ETHIOPIA.

ADDIS ABABA UNIVERSITY
COLLEGE OF DEVELOPMENT STUDIES
CENTER FOR FOOD SECURITY STUDIES

UNDERNUTRITION AND INTESTINAL HELMINTH AND
PROTOZOAN PARASITES AMONG PRIMARY SCHOOL IN
LIDETA SUB CITY, ADDIS ABABA

BY

EYUEL BEKELE (BSc IN PUBLIC HEALTH)

ADVISOR

ABEBE HAILE (PhD)

MSc THESIS SUBMITTED TO COLLEGE OF DEVELOPMENT
STUDIES, CENTER FOR FOOD SECURITY STUDIES

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR
THE DEGREE OF MASTER IN FOOD SECURITY AND
DEVELOPMENT STUDIES

NOVEMBER, 2021

ADDIS ABABA, ETHIOPIA.

Addis Ababa University

Declaration

I hereby, I am the sole of author of this thesis and that neither any part of this thesis nor the whole of the thesis has been submitted for a degree to any other university or institution. I declare that this is a true copy of my thesis and materials used for the thesis have been duly acknowledged.

Declared by: Eyuel Bekele Gurmu

Signature: _____

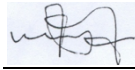
Date: _____

Place: Addis Ababa University, Addis Ababa.

Addis Ababa University
College Of Development Studies,
Center for Food Security Studies

As advisor of the thesis, hereby declare that I have read and evaluated this thesis prepared by under my supervision, by **Eyuel Bekele Gurmu** entitled '*Undernutrition and Intestinal Helminthes and Protozoan Parasites Among Primary School in Lideta Sub City, Addis Ababa, Ethiopia*' and recommended for open defense as fulfilling the requirement for the degree of Master of Science in Food Security and Development.

Abebe Haile (PhD)



28/11/2021

Advisor

Signature

Date

As members of the Examining Board of this thesis open defense, we certify that we have read and evaluated the thesis prepared by **Eyuel Bekele Gurmu** entitled '*Undernutrition And Intestinal Helminthes And Protozoan Parasites Among Primary School In Lideta Sub City, Addis Ababa Ethiopia*' and recommend that it is acceptable as a thesis required for the degree of Masters of Science in Food Security and development.

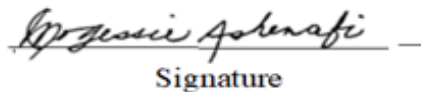
Signed by the examining committee

Name, Chairman

Signature

Date

Mogessie Ashenafi.....
Name, Internal examiner



Nov. 29, 2021

Date

Aregash Samuel (PhD)



30/11/2021

Name, External examiner

Signature

Date

Final approval and acceptance of this thesis is contingent upon the candidate's submission of the final copy of the thesis, incorporating all the comments by Examining Board, to the Council of Graduate Studies (CGS) through the Center Academic Committee (CAC) of the center.

Chair person of the center of graduate program coordinator

Dedication

I dedicate this project to God my creator, my strong pillar, my source of inspiration, knowledge and understanding. I also dedicate to this research to my family Bekele Gurm and Etagegn Mergia who whose words of encouragement and wisdom. Thank you.

I dedicate to my best friend Anteneh, Birehanu, Desta and Elias who have support me through the processes and constant source of inspiration.

Eyuel Bekele

Acknowledgement

My deepest gratefulness goes to God who has provided all that was needed, Throughout this entire study, He took care of everything that would have stopped me in my tracks and strengthened me even through my most difficult times.

I am very thankful to Addis Ababa University, College of Development Studies Center for Food Security Studies for giving me this chance and I am also thanks the members of college research review board.

My special thanks to my advisor Abebe Haile (PhD) for their kind advice, and constructive comments encouragement that will greatly helping me in development of this thesis.

My heartfelt pleasure also extends to the Lideta Sub City Health Office and Lideta Sub City education Office for openhanded and openness in different of data and documents of the sub city, especially for department of diseases prevention and control and department of children nutrition and health.

My sincere appreciations also extend to the Kara Mara primary school, Omedla primary school, Addis fire primary school, Africa primary school, Alem-maya Primary School, Eedget besira Primary School, and Enat Ethiopia Primary School staff members are also greatly acknowledged for helping and facilitating the collection of stool samples during my field work.

Mr. Firew (laboratory technologist), W/ro Beletishachew health center and St. Peter hospital laboratory department are also acknowledged for her technical support during field and laboratory work.

Finally thanks for those who are involved directly or indirectly in this work who I have not mentioned their name here.

Eyuel Bekele

Contents

Declaration.....	I
Dedication.....	III
Acknowledgement.....	IV
List of Tables.....	VII
List of Figures.....	VIII
Acronyms and Abbreviations.....	IX
Abstract.....	X
1. CHAPTER ONE: INTRODUCTION.....	1
1.1. Background of the Study.....	1
1.2. Statement of the Problem.....	4
1.3. Objectives.....	7
1.3.1. General Objective.....	7
1.3.2. Specific Objectives.....	7
1.4. Research Questions and Hypothesis.....	7
1.5. Significance of the Study.....	7
1.6. Scope and Limitation of the Study.....	8
1.7. Organization of the Paper.....	8
2. CHAPTER TWO: LITERATURE REVIEW.....	10
2.1. Undernutrition.....	10
2.2. Empirical Related Review.....	12
2.2.1. Intestinal Parasitic Infection and It's Association with Undernutrition.....	12
2.3. Operational Terms.....	15
2.4. Conceptual Framework of the Study.....	16
3. CHAPTER THREE: DESCRIPTION OF THE STUDY AREA AND THE RESEARCH METHODS	17
3.1. Description of the Study Area.....	17
3.2. Research Methods.....	18
3.2.1. Study Design.....	18
3.2.2. Source and Study Population.....	18
3.3. Study Period.....	18
3.4. Inclusion and Exclusion Criteria.....	18
3.4.1. Inclusion.....	18

3.4.2.	Exclusion.....	18
3.5.	Sample Size Determination and Sampling Techniques	18
3.5.1.	Sample Size Determination.....	18
3.5.2.	Sampling Techniques.....	21
3.6.	Tools of Data Collection.....	23
3.6.1.	Anthropometric Measurement	24
3.6.2.	Microscopic Examination of Intestinal Parasite	24
3.7.	Data Management and Data Analysis.....	25
3.8.	Validity and Reliability of Data and Techniques.....	26
3.9.	Variables	26
3.9.1.	Dependent Variable.....	26
3.9.2.	Independent Variables.....	26
3.10.	Ethical Considerations	27
4.	CHAPTER FOUR: RESULT AND DISCUSSION	28
4.1.	Result	28
4.1.1.	Socio-Demographic Characteristics of the Study Participants	28
4.1.2.	Environmental and Sanitation Characteristics	29
4.1.3.	Anthropometric Characteristics	29
4.1.4.	Laboratory Findings.....	32
4.1.5.	Prevalence of Undernutrition and Its Associated Factors	33
4.1.6.	Prevalence of Stunting and Its Associated Factors	35
4.1.7.	Prevalence of Underweight and Its Associated Factors.....	37
4.1.8.	Prevalence of Intestinal Parasitic Infection and Its Associated Risk Factors.....	38
4.2.	Discussion.....	41
5.	CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS	45
5.1.	Conclusions.....	45
5.2.	Recommendations.....	46
	REFERENCE.....	47
	APPENDICES	56

List of Tables

Table 1: Sample Size Determine from three outcomes the prevalence school children meal frequency, children hand washing habit sometimes and open defecation habit in school children.	20
Table 2: Socio-demographic characteristics of the school children lideta sub city, Addis Ababa Ethiopia, 2021.....	28
Table 3: Environmental and sanitation characteristics of the school children lideta sub city, Addis Ababa Ethiopia, 2021.....	30
Table 4: Anthropometric characteristics of the school children lideta sub city, Addis Ababa Ethiopia, 2021.....	30
Table 5: Laboratory findings of the school children lideta sub city, Addis Ababa Ethiopia, 2021.	32
Table 6: Bivariate and multivariate logistic regression analysis of variables associated with undernutrition among school children in lideta sub city, Addis Ababa Ethiopia, 2021.	34
Table 7: Bivariate and multivariate logistic regression analysis of variables associated with stunting among school children in lideta sub city, Addis Ababa Ethiopia, 2021.	35
Table 8: Bivariate and multivariate logistic regression analysis of variables associated with underweight among school children in lideta sub city, Addis Ababa Ethiopia, 2021.....	37
Table 9: Bivariate and multivariate logistic regression analysis of variables associated with parasitic infection among school children in lideta sub city, Addis Ababa Ethiopia 2021.	39

List of Figures

Figure 1: Conceptual Frame Work: The Negative Cycle Between Under Nutrition and Intestinal Parasite among Primary School Students (WHO, 2005: UNICEF, 1990), 2021.	16
Figure 2: Map of Ethiopia, Addis Ababa and Lideta Sub City in Woredas and location of school, Addis Ababa Ethiopia (source: Addis Ababa administration), 2021.....	17
Figure 3: Schematic Presentation of the Sampling Procedure at Selected Governmental Primary Schools in Lideta Sub City Addis Ababa Ethiopia 2021.....	22
Figure 4: Height-for-age distribution as compared to standard population reference by sex combined with z-score below the-2SD.	31
Figure 5: BMI for-age distribution as compared to standard population reference by sex combined with z-score below the-2SD.	31
Figure 6: Frequency of intestinal parasites identified among school children in Lideta sub city, Addis Ababa Ethiopia, 2012.....	32
Figure 7: Prevalence of Undernutrition on school children in lideta sub city, Addis Ababa Ethiopia, 2021.....	33
Figure 8: Prevalence of intestinal parasite in school children lideta sub city, Addis Ababa Ethiopia, 2021.....	38

Acronyms and Abbreviations

AOR	Adjusted Odds Ratio
BAZ	Body Mass Index For-Age
BMI	Body Mass Index
CDC	Centers for Disease Control and Prevention
CSA	Central Statistical Agency
DHS	Demographic and Health Survey
FDRE	Federal Democratic Republic of Ethiopia
EMDHS	Ethiopian Mini Demographic and Health Survey
EPG	Egg Per Gram
FAO	Food and Agriculture Organization
FSS	Food Security Strategy
ENA	Emergency Nutrition Assessment
HAZ	Height- For- Age Z Score
IPIs	Intestinal Parasitic Infections
MOH	Ministry Of Health
MAM	Moderate Acute Malnutrition
NCHS	National Center for Health Statistics
NNP	National Nutrition Program
NNS	National Nutrition Strategy
PRSPs	Poverty Reduction Strategy Papers
PSNP	Productive Safety Net Program
SSA	Sub Sharan Africa
STH	Soil Transmitted Helminthes
SHNS	School Health and Nutrition Strategy
SAM	Sever Acute Malnutrition
UNICEF	United Nations Children’s Fund
WFP	World Food Program
WHO	World Health Organization

Abstract

Undernutrition and Intestinal helminthes and protozoan parasitic infection have been reported to affect the physical growth, cognitive development, and the general health status of schoolchildren. Nevertheless, data are scarce regarding their effect on the overall Intestinal parasitic status and nutrition of schoolchildren Ethiopia. To assess these effects, a school based cross-sectional study was conducted on 350 schoolchildren; seven primary school in lideta sub city. The data were conducted between March one to April 25 202, data were gathered on the socio-demographic, environmental and sanitation, Anthropometry and laboratory findings this conditions of the selected primary school of the study participants through standardized structured questionnaire by interview. Fresh stool samples were collected and processed by formalin 10ml in 10%, Normal saline and used Olympus biological microscopic to examine Intestinal parasitic infection. Anthropometric measurements: weight, height and body mass index were analyzed using WHO (2007) anthro plus software. SPSS statistical software version 24 was used for data analysis and P-value <0.05 was reported as statistically significant. The overall prevalence of undernutrition was 36.9% (95% CI: 31.7 - 41.7), (16% (95% CI: 12.3-19.7) stunted, 24.3% (95% CI: 19.7-28.9)) were Underweight. The risk of undernutrition was significantly increased among students with school feeding program (AOR=4.33, 95% CI: 1.97-9.51), Schoolchildren borne from family monthly income less than 3000(AOR=1.9, 95% CI: 1.11–3.51) and with parasitic infection (AOR=1.71, 95% 2.43-3.15). The risk of stunting was increased among students with grade (1-4) of student (AOR=4.6, 95% CI: 2.10-10.5), Income of household (AOR=2.26, 95% CI: 1.12-4.5) and education of mother (AOR=0.15 95% CI: 0.04-0.51). The risk of underweight was increased among students with Parasite Infection (AOR=4.7, 95% CI: 1.8-11.9), school feeding program (AOR=4.9, 95% CI: 2.1-11.3) and family were >5 members (AOR=2.25, 95% CI: 1.12-4.5) The overall prevalence of intestinal parasitosis was 19.7% (95% CI: 15.7-24.3), The risk of parasitic infection was significantly increased among students with age group 6-11 (AOR=0.27; 95% CI: 0.09-0.81), student parents with income less than 3000(AOR=10.5; 95% CI: 3.96-12.23), water drinking from splash(filtered) (AOR=0.13 95% CI: 0.04-0.39), washing their hands regularly after vesting latrine(AOR=5 95% CI: 2.37-13.06), untrimmed fingernails (AOR=4.37; 95% CI: 1.89-10.11), eating regularly uncooked and unwashed fruit and vegetables (AOR=3.92; 95% CI:1.48-10.33) and (AOR=3.7; 95% CI:1.47-9.44. While, the prevalence of undernutrition and intestinal parasitic infection was higher among school-age children and revealed that undernutrition and intestinal parasitic infection were significantly associated in lideta sub city. The results need integrated and strengthening strategies to preventive and curative undernutrition and intestinal parasites.

Keywords: *Undernutrition, Intestinal parasites, schoolchildren, lideta sub city.*

1. CHAPTER ONE: INTRODUCTION

1.1. Background of the Study

Nutritional status is critical for a child's health, physical development, mental development, academic performance, and life progress (NACS, 2016: Alemneh K., *et al.*, 2017). Malnutrition is a pathological condition that occurs as a result of a relative or absolute lack of one or more important nutrients (UNICEF, 2013). Malnutrition is caused by a variety of reasons, including incorrect eating practices, poor child and mother care practices, as well as social and traditional influences (Osei and colleagues, 2010). Malnutrition in children raises the risk of illness and mortality both in childhood and later in life. It's a nutritional state in which the weight for age, height for age, and weight for height indices are all below the NCHS 1974 reference's -2 Z-score (NCHS, 1974: WHO, 2012).

Undernutrition is defined by three main indicators: underweight, stunting, and wasting. These three indicators represent different histories of nutritional insult to the child. Stunting is commonly linked to repeated exposure to poor economic situations, poor sanitation, and the interaction of insufficient energy and nutritional intakes with illness. Low weight-for-height is an indicator of wasting (i.e., thinness) and is generally associated with recent illness and failure to gain weight or a loss of weight, whereas low weight-for-age indicates a history of poor health or nutritional insult to the child, including recurrent illness and/or starvation (FDRE, 2017).

Low dietary intake, inaccessibility to food, inequitable distribution of food within the household, inappropriate food storage and preparation, dietary taboos, and infectious diseases make children the most vulnerable to undernutrition. Undernutrition impairs the immune system, putting children at greater risk of experiencing more severe, frequent, and long-term illnesses. Undernutrition is also a consequence of repeated infections, which may further worsen the child's nutritional status at a time of greater nutritional needs. (FAO, 2013: UNICEF, 2015: Verhagen *et al.*, 2013).

In 2010, 104 million and 171 million children were stunted and underweight globally. Stunting is extremely common in children in Latin America and the Caribbean (9.3-24.0%), Africa (20.2-48.1%), and all underdeveloped countries (Adenuga¹, 2017). According to a

study conducted in Nepal's Western Region, 26 % of people are undernourished, 13 % are stunted, 12 % are wasted, and just 1% are both stunted and wasted. The study found that maternal factors such as literacy, occupation, diet knowledge, and monthly per-capita income have a highly significant ($p < 0.005$) relationship with child nutrition. Similarly, in a country study conducted in Nepal's Kailali District, more than two-thirds (69%) of households were classified as food insecure (lack of access to adequate food), and stunting rates were high and according to this study associations between household food insecurity and stunting, underweight, or anemia were no significant. The incidence of wasted children in India's urban slums was 18.5 %, 33.3 % were stunted, and 46.8% were in normal nutritional status. Nutritional status was found to be positively linked with age in this study (Akoto Osei, 2010: Joshi 2011: Srivastava *et al.*, 2012).

Undernutrition is common in Africa, and it grows through time and place due to a variety of causes such as a lack of clean water and improved sanitation, poor hygiene, a lack of health education, and, most crucially, unsuitable agricultural methods and inadequately healthy and diverse meals. Stunting affects 18% of children in South Africa, whereas it affects 42.0 % of children in mid-Africa and 50.0 % of children in Eastern Africa. According to a study conducted in Burkina Faso, the prevalence of undernutrition was 35.1%, stunting was 29.4%, and thinness was 11.2%. In Eritrea, the prevalence of malnutrition was 36.9%, with 18.5 % stunting and 21.2 percent thinness (Erismann *et al.*, 2017: Adenuga *et al.*, 2017: Yafet K. *et al.*, 2020).

In Ethiopia, malnutrition is a major public health issue. Every year, about five million people face food shortages. The number of children under the age of five who are Undernutrition is a measure of a population's nutritional status (FDRE, 2017). Between 2000 and 2016, Ethiopia's National Nutrition Program (NNP) aimed to reduce chronic malnutrition (stunting) from 58 percent to 38.4 %. During the same time span, the proportion of underweight children reduced from 41% to 23.6 percent, and wasting decreased from 12% to 9.9%. The NNP has also been linked to the Productive Safety Net program (PSNP), which provides cash-based assistance to needy families. Underweight (21%) wasting (12%) and stunting (37%) were detected among Ethiopian children under the age of five years in a study conducted by the Central Statistical Agency (CSA) in 2005 (EMDHS, 2019).

Intestinal helminthes parasitic refers to worms that dwell in the human body as parasites. When infective eggs, or larvae, enter the body, mature, lay eggs, and feed off the person, this

is known as intestinal helminthes parasitic. When people are neglected, they become infected with worms because they live in a dirty environment with low sanitation and unsanitary habits. Roundworm (*Ascaris lumbricoides*), hookworm (*Ancylostoma duodenale* and *Americanus*), whipworm (*Trichuris trichiura*), *Hymenoleps nana*, and protozoan parasites Sarcodina (*Entamoeba histolytica/dispar*) and Mastigophora (*Giardia lamblia*) are the most common intestinal helminthes and protozoan parasite (CDC, 2020).

According to the World Health Organization, More than 24 percent of the world's population are infected with soil-transmitted helminthes infections greatest numbers occurring in sub-Saharan Africa, the Americas, China and East Asia, over 270 million pre-school children and over 600 million of school children are living in areas where the parasites are intensively transmitted and are in need of treatment and preventive interventions. Study done in Thailand, Nepal, Yemen, Karaikal and Serbia the prevalence of intestinal parasite was (16 %) (21.3 %) (62.7 %) (28 %) and (19.1 %) (Guyatt 2010: WHO, 2017: Freeman *et al.*, 2010: Punsawad *et al.*, 2018: Chandrashekhar *et al.*, 2020: Qasem *et al.*, 2020: Teja *et al.*, 2020: Korzeniewski *et al.*, 2020).

Although the majority of children in developing nations now live to be five years old, they still suffer significant health and nutritional issues. Infection with *Ascaris lumbricoides*, *Trichuris trichiura*, *Ancylostoma duodenale* and *Americanus*, *Entamoeba histolytica/dispar*, and *Giardia lamblia* is one of the most serious health concerns that hundreds of millions of school-aged children suffer. Poverty, poor environmental cleanliness, and inadequate health care all contribute to the high occurrence of these illnesses. Intestinal helminthes parasite infections are ubiquitous in all regions of Africa, but they are most prevalent in Sub-Saharan Africa, where conditions that predispose man to infection, such as poverty, poor sanitation, ignorance, and malnutrition, are prevalent. Worm infections are more common in pre-school and school-aged children, as well as women of childbearing age, especially adolescent females. Although intestinal worms can infect any member of a population, these individuals are more susceptible to heavy infections and the severe effects of persistent infections than others. In a study conducted in Nigeria, 86.2 percent of schoolchildren had intestinal parasites, with *Ascaris lumbricoides* (62 %), *Entamoeba histolytica/dispar* (25 %), *Giardia duodenalis* (12.3%), *Endolimax nana* (11.8 %), *Entamoeba coli* (9.9%), *Trichuris trichiura* (8.4%), and *Blastocystis hominis* (3.4 %) being (Keutchazoue 2020; Nguyen *et al.*, 2012; Gyang *et al.*, 2019; Forson. *et al.*, 2017).

Ethiopia, as in many other developing countries, intestinal helminthes parasite infections are frequent and cause major public health concerns including as malnutrition, anemia, and growth retardation, as well as increased susceptibility to other infections (Yirgalem G. *et al.*, 2014). In Ethiopia, soil transmitted helminthes diseases (STH) are common and widespread, especially among youngsters and pregnant women. The risk factors for STH infections may differ depending on where you live (Tilahun A. *et al.*, 2015). Lack of personal or environmental hygiene, a lack of drinking water, low socioeconomic position, overcrowding living conditions, and poor health or nutritional status may all contribute to an increased risk of STH infections (Abebe A., *et al.*, 2011). STH infection is a severe public health problem in Ethiopia, as it is in other developing countries (Abraham and Birehanu, 2013; Abraham D. *et al.*, 2014). Except for areas of the Somali and Afar regions, where the annual mean temperature is too high for transmission, most of Ethiopia is suitable for STH transmission. In a study conducted in Northwest Ethiopia, the prevalence of intestinal parasitic infections was found to be 42.9 %; similarly, infection with any protozoan parasite (30.2 %) was found to be greater than helminthes infection in Angolela city (7.1 %). (Destaw, D. *et al.*, 2021; Nguyena, 2012; Pullan and Brooker, 2012).

All of the above mentioned health issues and their consequences can be avoided or considerably reduced by implementing cost-effective solutions. Many countries, including Ethiopia, rely heavily on schools to get these treatments to the people who need and will benefit from them. Drug therapy, sanitary improvement, and health education are three primary strategies that help to minimize intestinal helminthes parasite infections. Over the last two decades, advances in drug discovery have made mass therapy acceptable and inexpensive. To achieve long-term outcomes, however, pharmacological treatment should be combined with sanitary measures and health education (Nguyen, *et al.*, 2012; WHO, 2018).

1.2. Statement of the Problem

Information on the nature of the interaction between intestinal helminthes parasites, protozoan parasites, anthropometric markers, and other related disorders is essential for developing the best intervention methods for school-aged children. There is a scarcity of data on the extent of malnutrition and its link to the intestinal helminthes parasite. The case was high, especially in historic towns like Addis Ababa, but the amount of reports on the relationship with intestinal parasite scholars was frightening. However, knowing about these issues is essential for putting in place effective control measures. The findings of this study

would be extremely useful in youngsters who are likely to be infected with intestinal parasites (Tamirat H., 2017).

According to the EMDHS 2019, 37% of children under the age of five are underweight or stunted (below-2 SD), with 12% severely stunted (below -3 SD). Stunting is more common as children get older, with 22 percent of children aged 6 to 8 months having stunting and 44 percent of children aged 48 to 59 months having stunting. The majorities of authors demonstrate the prevalence of Undernutrition in school children but do not demonstrate the prevalence of intestinal infection in school children as a link to Undernutrition and food security, particularly in Ethiopia, where the focus is solely on Undernutrition and its consequences, rather than the depth of intestinal infection as a cause of Undernutrition in school children. Most researchers in our country focused on rural areas when it came to malnutrition; however, malnutrition is not only a problem in rural areas; it is also an issue in urban areas, and most articles do not focus on school children (EMDHS, 2019: UNICEF, *et al.*, 2019).

Ethiopia has one of the world's highest rates of child malnutrition. Malnutrition, particularly undernutrition, is common in Ethiopia, accounting for more than half of all child fatalities (53 %). In Sub-Saharan Africa; Ethiopia has the highest rate of malnutrition. According to a research conducted by Ethiopia's Central Statistical Agency (CSA) in 2005, underweight, wasting, and stunting in children under the age of five years were determined to be 21 %, 12 %, and 37 %, respectively. According to the most recent data from the Demographic and Health Survey (DHS), 21% of Ethiopian children are underweight, with 9% being seriously underweight. The prevalence of undernutrition in Addis Ababa's lideta sub-city is 31%, with stunted people accounting for 19.6% and underweight people accounting for 15.9% (Dawit D. *et al.*, 2015: EMDHS, 2019).

The implementation of the Poverty Reduction Strategy Papers (PRSPs), in particular, has had a vital impact in addressing child malnutrition. However, the policies that have been adopted, particularly in SSA, have differed substantially. Furthermore, countries who enacted comparable policies saw varying results in terms of child nutrition; whereas some countries saw a reduction in malnutrition, others did not (Hunegnaw M. 2013: WHO, 2019: Yafet K. *et al.*, 2020).

More than 90% of the world's stunted children, or 820 million people live in Africa and Asia, with numbers rising since 2015 (Abbaszadeh, et al.2020: Amanuel Y. and Hunachew B.,

(2020). The most common and important intestinal parasites in many underdeveloped nations, including Ethiopia, are soil transmitted nematodes. In Ethiopia, for example, the intestinal helminthes parasite was discovered to be the second most common cause of outpatient morbidity after malaria (Daniel G. *et al.*, 2020: MOH., 2016/17).

According to a Ministry of Health report, intestinal parasites are the seventh leading cause of outpatient visits in health institutions, accounting for 2.8 % of all visits. EFY 2009 reports have shown that access to basic sanitation facilities in Ethiopia, particularly in rural areas, is very limited. Only 45.8% of the overall population has access to a toilet at the household level, and 30% of the population relies on open defecation, with even fewer people having access to clean water. As a result, there is a paucity of literature on undernutrition and intestinal parasite in primary schools in Ethiopia, particularly in Addis Ababa. Although the prevalence of undernutrition and intestinal parasite was high in that primary school, there is a paucity of literature on the relationship or association between undernutrition and intestinal parasite in primary schools in the lideta sub city. The prevalence of intestinal parasites and severe acute malnutrition was significant in the prevalence lideta sub city, according to the Addis Ababa health bureau's annual report for 2019. According to the Ministry of Health, Deworming is only given to children aged two to five once every six months, but children aged six and up are not included in the program. This program does not include children aged six or up who attend primary school, as these students are more vulnerable to intestinal parasites due to a variety of factors. As a result, the prevalence of intestinal parasites is higher at Lideta Sub City Health Office (Lideta sub city health office 2019: MOH, 2016/17: UNICEF, 2012).

1.3. Objectives

1.3.1. General Objective

The general objective of this study is to assess under nutrition and intestinal helminthes and protozoan parasite among governmental primary school students in lideta sub city, Addis Ababa, Ethiopia, 2021.

1.3.2. Specific Objectives

This study was conducted to achieve the following specific objectives to:

- Determine the nutritional status of student among the governmental primary school in Lideta sub city.
- Determine intestinal helminthes and protozoan parasite of student among the governmental primary school in Lideta sub city.
- To identify nature of association between under nutrition and intestinal parasite of student among the governmental primary school in Lideta sub city.

1.4. Research Questions and Hypothesis

The research is planned to answer the following questions.

1. How many school children are affected by undernutrition in governmental primary school in Lideta sub city?
2. How many school children are affected by intestinal parasite in governmental primary school in Lideta sub city?
3. Are intestinal parasitic infections causes for undernutrition in governmental primary school in Lideta sub city?
4. What are associated factors for both undernutrition and intestinal parasitic infections in governmental primary school in Lideta sub city?

1.5. Significance of the Study

Knowledge gained from this study support filling knowledge gaps, increase awareness of Undernutrition and intestinal parasite among governmental primary school students in lideta Addis Ababa.

The significance of the study is beneficial to the primary school students of lideta and community of Addis Ababa, there was limited information on the under nutrition and intestinal

parasite among primary school students in Addis Ababa city because of there were no similar studies conducted in the study area.

- The study result also support enhancing, the benefit of under nutrition and intestinal parasite among primary school students in Addis Ababa and improvement of food security.
- The results of this study is to inform future program planning for the municipalities, government or Non-governmental organizations (NGO) as it continues to help communities increase access to improve the awareness of under nutrition and intestinal parasite among primary school students.

The result of this study was maximizing undernutrition and intestinal parasite among primary school students so that the policy makers and concerned bodies could take appropriate measures considering gaps.

1.6. Scope and Limitation of the Study

This study was cover the basic undernutrition measurements including Anthropometric measurement to illustrate the level of undernutrition by measuring height and weight from every selected student using a portable digital balance and wooden board fixed with a plastic tape but the other measurement of undernutrition was physical examination, dietary diversity score or food frequency and socioeconomic of the student does not examine in this study because this study basically focused on the relationship between undernutrition and intestinal and protozoan parasite. Also the study was assess the level of intestinal parasite on those primary school student by collecting required stool sample but the this study does not investigate the level of anemia by determining the level of hemoglobin and serum ferritin concentration and also doesn't assess the level of Cognitive development of students. Does not assess wasting status of school children due to WHO anthro plus software it is limited up to 10 years and the reference standard NCHS used for assessing nutritional status of the schoolchildren is from developed countries.

1.7. Organization of the Paper

This thesis is divided into five chapters. Background of the study, statement of the problem, the objective, research question and hypothesis, significance of the study, scope and limitations of the study, ethical considerations, and study's organization are all covered in the first chapter. The second chapter covers a review of the literature, which includes undernutrition, empirical,

operational terms, and the study's conceptual framework. The third chapter discusses the study area, research methods, study period, inclusion and exclusion criteria, sample size determination and sampling methodologies, sampling obtained, data management and analysis, and variables. The results and discussion that make up the main body of the thesis are offered in Chapters four and the conclusions and recommendations are presented in Chapter five. Finally, the annexes and reference materials are supplied.

2. CHAPTER TWO: LITERATURE REVIEW

2.1. Undernutrition

A decrease in food intake and/or an increase in nutrient wastage due to blood loss, vomiting, or diarrhea affects the nutritional status of patients afflicted with intestinal parasites and protozoa. Protein energy malnutrition, anemia, and other nutrient deficits can be caused or exacerbated by these impacts (Tilahun A. 2015: WHO, 2020). Children in Latin America, Asia, Africa, and all developing countries suffer from chronic malnutrition at a high rate. Stunting was found to be a predictor of grade failure in recent longitudinal studies of children from Brazil, Guatemala, India, the Philippines, and South Africa (Lawal and Olukemi, 2010: Srivastava, 2012).

According to UNICEF, 24 countries account for 80% of the 195 million stunted children worldwide, with 38.2 percent in Oceania, 35 percent in east Africa, 32 percent in middle Africa, and 29 percent in western and southern Africa. Ten of these 24 countries are in Sub-Saharan Africa. Worse yet, by 2020, the three East African countries of Kenya, Tanzania, and Uganda had a combined population of eight million undernourished children, accounting for 21% of the SSA total. Despite being one of the 24 countries in the world with the greatest proportion of stunted children, Rwanda has the highest stunting rate in East Africa, at 35% between 2000 and 2018. Stunting, underweight, and moderate acute malnutrition (MAM) were shown to be prevalent in 22.5 percent, 5.3 percent, and 18.5 percent of Ugandan primary school students, respectively, in an across-sectional investigation. Males were three times more likely to be underweight (OR 3.2, 95 percent CI 1.17–9.4, $p = 0.011$). Children who attended urban slum schools were 1.7 times more likely to be stunted (OR 1.7, 95 percent CI 1.03–2.75, $p = 0.027$) (UNICEF, 2012: Adenuga, *et al.*, 2017: WHO, 2010: Harold, *et al.* 2010).

In Ethiopia, child malnutrition is still a major issue. According to a recent UNICEF study, malnutrition poses a "severe threat to the life and development of Ethiopian girls, boys, and women." According to the latest Demographic and Health Survey (DHS), 23.6 percent of Ethiopian children are underweight, with 9% being severely underweight. 38.4 percent are stunted, and 10% are wasted, according to the same statistics. These figures are among the world's highest, and they are severe even by African standards (EMDHS, 2019: UNICEF, 2012: WHO, 2010). Some children are more sensitive to malnutrition than others due to socioeconomic and demographic factors. Wasting is more common among children whose moms have no education and less common among those whose mothers have a secondary education, according

to Alemneh and Zeleke (11 % versus 3 %). Furthermore, rural children are more likely than their urban counterparts to be wasted (10% vs. 6%) and stunted (46 percent versus 32 percent). Child malnutrition is gendered, with boys being more vulnerable than girls. They are more likely to be both underweight (31% vs. 27%) and wasted (11% vs. 8%). (Alemneh K., *et al.*, 2017: EMDHS, 2019: Zeleke M. 2020).

In Ethiopia, malnutrition is a major public health issue. A study done in Southern Nations Nationalities and Peoples Regional state in hawassa town attest that 41 %of the children were stunted, 22 % underweight and 13.2 % wasted, similarly in Jimma town the prevalence of underweight, wasting and stunting were 18 %, 6.9 %and 21 % correspondingly. The Somali and Afar areas have the highest prevalence of underweight children (both at 32 %), whereas Addis Ababa has the lowest percentage (5 %). The largest percentages of wasted children are found in Somalia (21%), Afar (14%), and Gambela (13%), while the lowest percentages of wasted children are found in Addis Ababa (2%) and Harari (4%) (Zeleke M. *et al.*, 2020; Alemneh K. *et al.*, 2017).

In the last 15 years, the nutritional status of Ethiopian children has improved, according to the 2019 mini Ethiopian Demographic and Health Survey (mini EDHS). From 51% in 2005 to 37% in 2019, the percentage of people that are stunted has decreased. Similarly, the percentage of children who are underweight has decreased from 33% to 21%, and the prevalence of children who are wasting has decreased from 12% to 7%. 37 percent of children under the age of five are underweight for their age or stunted (below -2 SD), with 12% severely stunted (below -3 SD). The highest proportion of stunted children (45%) was recorded between the ages of 24-35 months, and it was also slightly greater among males than females (40 % versus 33 %). Overall, 7% of Ethiopian children are wasted, with 1% severely wasted (below -3 SD). In Addis Ababa, the prevalence of wasted children is 2 percent. The 2019 EMDHS results show that 21 % of all children are underweight (below-2 SD), and 6 % are severely underweight (below -3 SD) in Addis Ababa lideta sub city the prevalence of undernourished show that 31 %, from those the prevalence of stunted 19.6 % and 15.9 % underweight (Dawit D. *et al.*, 2015: EMDHS, 2019).

2.2. Empirical Related Review

2.2.1. Intestinal Parasitic Infection and It's Association with Undernutrition

Intestinal parasite diseases have affected 24 percent (1.5 billion) of the world's population. Hookworms, *Ascaris lumbricoides*, and *Trichuris trichiura* infections, as well as protozoan parasite (*Giardia lamblia*) infections, are common in children aged 5 to 15 (Freeman MC. et al., 2019). These three species of worms are thought to infect almost 400 million school-aged youngsters. Around 12% of the worldwide burden of disease caused by IPIs is attributable to major causes of morbidity and mortality among school-aged children in developing countries, particularly in Sub-Saharan African nations (varying from 27.7% to 95%). Children aged 5 to 15 years old have the highest incidence of roundworm, hookworm, whipworm, and protozoan infections (*Giardia lamblia*). All age groups have infections, according to an analysis of infection prevalence by age group. Hookworm infection, on the other hand, is more common as people get older. As a result of their playing behaviors and frequent contact with soil, school-aged children are a high risk population segment for intestinal parasite infection. Where sanitary facilities are inadequate and hygiene practices are poor, the burden of infection is higher in developing countries. Intestinal parasite infection is common in Sub-Saharan African countries, the Americas, and Asia. The most common protozoa parasite was *Endolimax nana* (77.35 %), *Blastocystis sp.* (71.1 %), *Giardia lamblia* (39.1 %), *Entamoeba coli* (25.7 %), and the *Entamoeba histolytica* (9.2 %). Consumption of untreated water increased the risk of harmful intestinal parasites in this study (Hernández, 2019: Tamirat H., 2017: Papier 2014: Lwanga, et al., 2012).

In Africa, it is believed that 90 million school-aged children are infected with a soil-transmitted intestinal parasite. When compared to other age groups, school-aged children are more inclined to and vulnerable to intestinal parasites. In a study of Ugandan schoolchildren, the overall frequency of intestinal parasites was 20.9 %, with protozoa, helminthes, *Giardia lamblia*, and hookworm infections accounting for 13.9 %, 15.4 %, and 9%, respectively. In a similar study in Uganda, the prevalence of hookworm infection was 10.9 %, *Trichuris trichiura* was 3.1 %, *Schistosoma mansoni* was 1.9 %, and *Ascaris lumbricoides* was 0.2 % (Buzigi, 2015: Francis, et al, 2012).

Hookworm, *Trichuris trichiura*, *Schistosoma mansoni*, and *Ascaris lumbricoides* were found to be the most common helminthes infections among Ugandan primary school students, with

prevalence rates of 10.9 %, 3.1 %, 1.9 %, and 0.2 %, respectively. The risk of helminthes infection was double in rural schools (OR 1.95, 95 % CI 1.12–3.32, $p = 0.012$). The study found that helminthes infections were responsible for 26.6 %, 46 %, and 10.3 % of cases of stunting, underweight, and MAM, respectively (Harold, *et al.*, 2010).

According to a study conducted in Nigeria, 106 (8.1 %) of the 1,296 school students evaluated were infected with soil-transmitted illnesses, including 64 (4.9 %) with *Ascaris lumbricoides*, 33 (2.5 %) with hookworm, and 9 (0.7 %) with *Trichuris trichiura*. The elimination of intestinal parasites can help children's nutritional status. The administration of anti-intestinal parasite therapy on a regular basis in Uganda and Zanzibar has been linked to a 10% rise in weight gain over expectations. In countries where the prevalence of intestinal parasites is more than 50%, the WHO agreed to have a Deworming coverage of 75% to 100% among school-aged children (A. Harold, *et al.*, 2010; Knopp S., *et al.* 2013; (Francis, *et al.*, 2012; WHO, 2013).

The frequency and location of intestinal parasites varies greatly across Ethiopia. From April to May 2014, a school-based cross-sectional study on intestinal parasites was conducted in a selected public elementary school in Jimma town, with a total of 420 students. The prevalence of parasites was 68.6%, and intestinal parasites were identified in this study, with *Trichuris trichiura* being the most common parasite identified, followed by *Ascaris lumbricoides* (Zelege M., *et al.*, 2020).

According to a study conducted in the Southern Nations Nationalities and Peoples Regional State in Hawassa town in four kebeles on 597 preschool children, 42.2 % had *Ascaris lumbricoides*, 4.4% *Giardia lamblia*, 2.8 % Hookworm, 1.8% *Entamoeba histolytica*, and 1.8 % *Trichuris trichiura*. In a study conducted in Gurage, the prevalence of intestinal parasites was 42.1%, with seven different parasite species identified. The most common parasite species were *Giardia lamblia*, *Ascaris lumbricoides*, and *Entamoeba histolytica*, with hookworm, *Tenia* species, *Hymenolepis nana*, and *Trichurias trichuris* rounding out the top five (Alemneh K., *et al.* 2017; Haile A., *et al.* 2017). Furthermore, according to a study conducted in the northwest of Ethiopia, the prevalence of underweight (15.1%), stunting (25.2%), and thinness/wasting (8.9%) of the overall population was determined to be 22.7 percent positive for intestinal parasites. *Ascaris lumbricoides* was the most common parasite (31/405, 7.6%). This study found no statistically significant link between malnutrition and parasite diseases (Bemnet A., 2013; Legese C, 2020).

Infection by many intestinal parasite species is a common occurrence in endemic areas. Study among school children in East Arsi Adle town the prevalence of intestinal parasite shows that 27.1%, for at least one intestinal parasite, a total of six parasites were detected. The most prevalent were *Ascarislumbricoides* (12.00%), *Entamoebahistolytica/dispar* (10.3), *Trichuristrichiura* (8.4%), *Giardia lamblia* (7.4%), *Hymenolepsis nana* (3.1%), and *Teaniasaginata* (2.9%). In addition to these, single (15.45%) and multiple (20.18%) infections were identified. (Tadesse M., et al. 2014). Similarly, Study done in Addis Ababa on street dwellers prevalence of intestinal parasitic infections show that 71.8% , a total of seven species of intestinal parasite and two species of protozoan parasites were identified the most prevalent were *Ascarislumbricoides* (34.9%) followed by *Trichuristrichiura* (22.8%) and *Teania species* (17.5%). According to a report by lideta sub city health office 2019 bulletin intestinal parasite is one of the top ten leading causes of morbidity in the sub city. The intestinal parasite prevalence show that 5.74 in 2017 but in 2018 the prevalence of intestinal parasite show that 5.26% reduced by 0.48, (Lideta sub city health office. 2019: Banchiamlak M., et al., 2014: Mulumebet T., et al., 2019).

2.3. Operational Terms

Anthropometric measurement has been determined using the International Reference Population defined by the U.S. National Center for Health Statistics (NCHS), as recommended by WHO and the U.S. Centers for Disease Control and Prevention (CDC) (WHO, 2008).

Undernutrition: is defined as the outcome of insufficient food intake and repeated infectious diseases. Children were defined as undernourished when they are stunted or underweight/thinness.

Stunting: A child was defined as stunted if the height for age index was found to be below -2 SD of the median of the standard curve.

Underweight or thinness: is used to describe a child or adolescent whose weight is too low for his/her height. It is defined using the sex-specific BMI-for-age index. Refers to a deficit and is defined as underweight below the -2 SD of BAZ for age from the NCHS/WHO reference of the median of the standard curve. BMI-for-age is the preferred indicator of body thinness to classify malnutrition in children and adolescents (WHO, 2008).

Intestinal parasite (helminthes parasite and protozoan parasite) infection is positive: Direct microscopic evidence of one or more parasites of ova or parasite.

Primary School children age: according to Ethiopian national education system Primary School age children from age 5 to 17 it included both rural and urban area.

2.4. Conceptual Framework of the Study

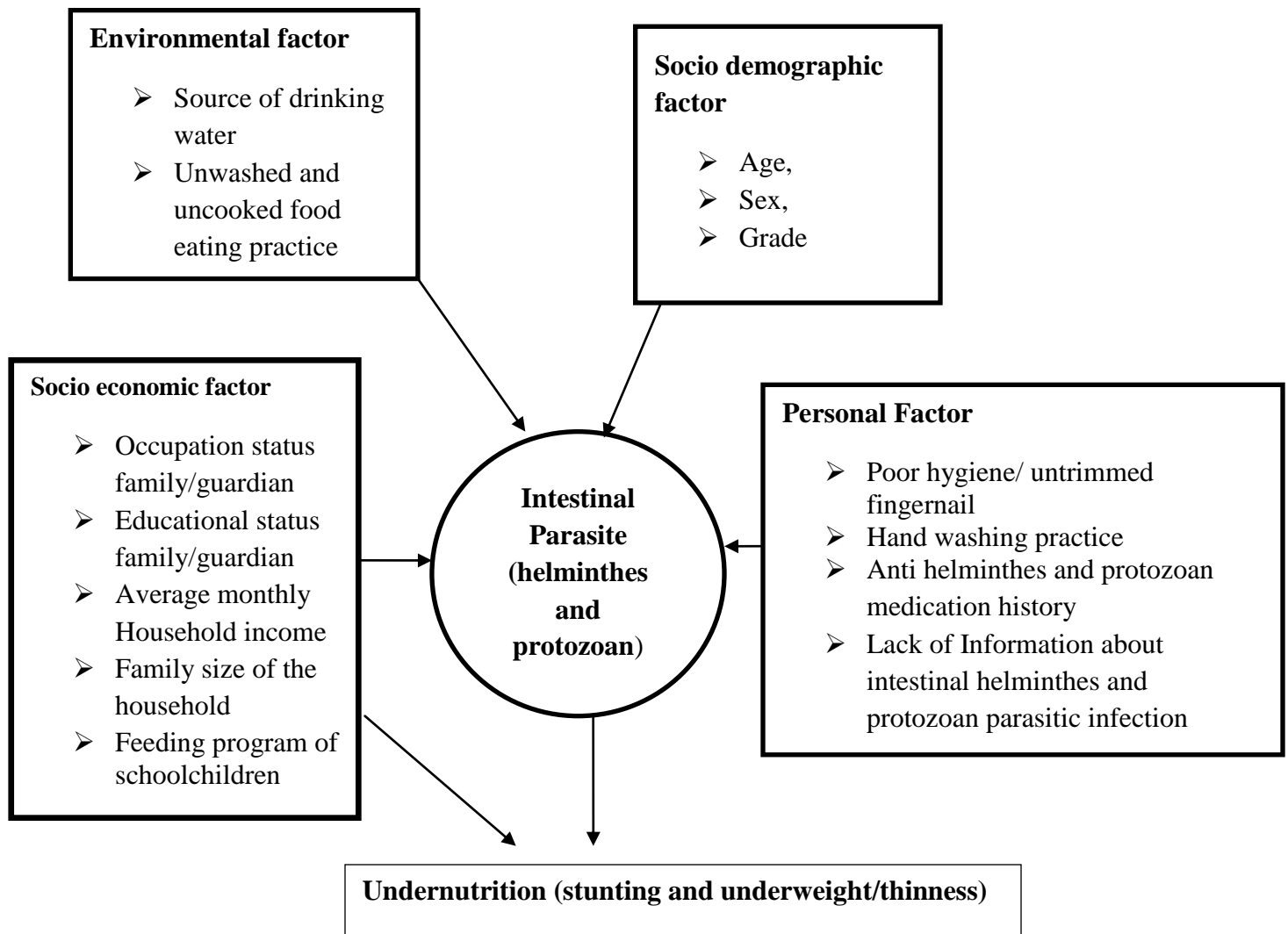


Figure 1: Conceptual Frame Work: The Negative Cycle Between Under Nutrition and Intestinal Parasite among Primary School Students (WHO, 2005: UNICEF, 1990), 2021.

3. CHAPTER THREE: DESCRIPTION OF THE STUDY AREA AND THE RESEARCH METHODS

3.1. Description of the Study Area

The study was conducted in Lideta sub city on Primary school, found in Lideta Sub-City, Addis Ababa, Ethiopia. Addis Ababa is the capital city of Ethiopia, total population in 2013 censuses 3.6 million based on this projection in 2020 the number of population became 10,444,000 million, annual population growth rate 2.9 and build land area 647 Km². Lideta sub city are also one of eleven sub city that located in Addis Ababa City Administration the capital of Ethiopia. The total area of the sub city was 918.4 km² and the sub city is located in central western area of the city near by the center with cordination 9°0'41.76'' N 38°44'3.84'' E and also it border with the district of addis ketema to the north west, arada to the north, kirkos to the east, nifas sika lafto to the south and kolfe keranio to the west. According to the 2009 EC census projection, the Sub City has a total population of 265,187 (127,290 male and 137,897 female) in ten woredas. In lideta sub city the main transporting system was using mini bus, taxi, city bus and train system service giving for people and the road network link between different sub cities. In lideta sub city totally 134 schools was studying in those school there are 22,025 students from those students 1335 of them are females and 9385 of them are males. In this sub city totally 33 primary governmental schools from those schools total number of students was 10636 from those number of students of females was 5558 and 5234 was male. Lideta sub city reached over all primary health care coverage 86 % with a total of 3 governmental hospitals, 4 private hospitals, greater than 21 private clinics and 6 health centers as of 2011 EFY and Parasitic diseases in this sub city is top ten reportable diseases (Lideta sub city health office, 2019).

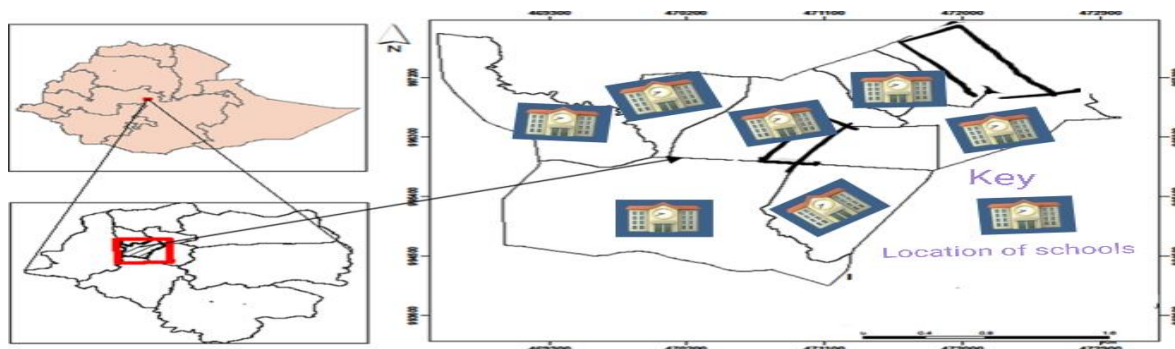


Figure 2: Map of Ethiopia, Addis Ababa and Lideta Sub City in Woredas and location of school, Addis Ababa Ethiopia (source: Addis Ababa administration), 2021.

3.2. Research Methods

3.2.1. Study Design

A cross-sectional study was taken to establish the status of Undernutrition and intestinal parasite and protozoan parasite among selected primary school children in Lideta sub city, Addis Ababa, Ethiopia.

3.2.2. Source and Study Population

The source population was all the students in the selected primary school and the study population was the students in Lideta sub city in the selected primary school that was present during the study period.

3.3. Study Period

The data were collected from March one to April 25, 2021.

3.4. Inclusion and Exclusion Criteria

3.4.1. Inclusion

Inclusion criteria of this study was Schools who set up in lideta sub city which are governmental schools and Selected Primary schools plus the study was included student attend at the study period. Parents or guardians were given written informed consent and children also were understood to agree and offer informed consent.

3.4.2. Exclusion

Segregation criteria of this study was schools that were not found in lideta sub city, school which are found in lideta sub city those are Non-Governmental schools and Unselected Primary schools are not involved in study. Student who are new transferred in from other schools within two weeks of the study period and student who in are Extension program additionally, student treated with anti-helminthes drugs within three weeks of the study period are excluded in study.

3.5. Sample Size Determination and Sampling Techniques

3.5.1. Sample Size Determination

To determine the number of Undernutrition and intestinal parasitic among primary school to be included in the study, single population proportion formula was used in the following assumptions to calculate the first objective based on previous study on Undernutrition and intestinal parasitic associated risk factors among government elementary school children in

Hawassa, Ethiopia 53.3% (Alemneh Kabeta, August 2017). 95% of confidence interval to be 1.96, degree of precision to be 5% and 10 % for non-response yielding the total sample size of 415.

Thus:

$$n = \frac{(Z_{1-\alpha/2})^2 p(1-p)}{d^2}$$
$$n = \frac{(1.96)^2 \times 0.533(1 - 0.533)}{(0.05)^2}$$
$$n = 378$$

Where: Z= 1.96 with 95% of confidence internal

P= proportion of Undernutrition and intestinal parasitic infection selected primary school children..... 53.3%.

D= degree of precision 0.05

n= the required sample size

The second objective, the sample size calculation is computed using the formula for estimating the difference between two population proportions by using open Epi info with the following assumption: 95% CI=1.96, power=80% and Ratio of expose to unexposed, the respective Undernutrition and intestinal parasitic infection primary school children. Thus factors considered are Meal Frequency (≤ 3 and ≤ 3 times a day), Hand Washing Habit (sometimes and Always), and Habit of open defecation (two times more likely to be infected) which are usually characterized in literature having significant association with undernutrition and intestinal parasitic infection (Table 1).

Table 1: Sample Size Determine from three outcomes the prevalence schoolchildren meal frequency, children hand washing habit sometimes and open defecation habit in school children.

Factor Considers	Reference	Outcome Prevalence Among Exposed	Outcome Prevalence Among Unexposed	10% Non-Response	Final Sample Size
Meal Frequency (No of meal frequency school children)	Tamirat H. Infectious Diseases p394: 2018	27.7 % # of school children meal frequency ≤ 3 times a day	13.4 % # of school children meal frequency ≥ 3 times a day	28.2	282
Hand Washing Habit (No school children Hand washing habit)	Tamirat H. Infectious Diseases P.394: 2018	39% # of school children hand washing habit sometimes	8.1% # of school children hand washing habit always	8.1	81
Habit of open defecation	Zelege M. P.10: 2020	69.09 % # of open defecation habit in school children	30.91 % # of open defecation in school children	6.9	69

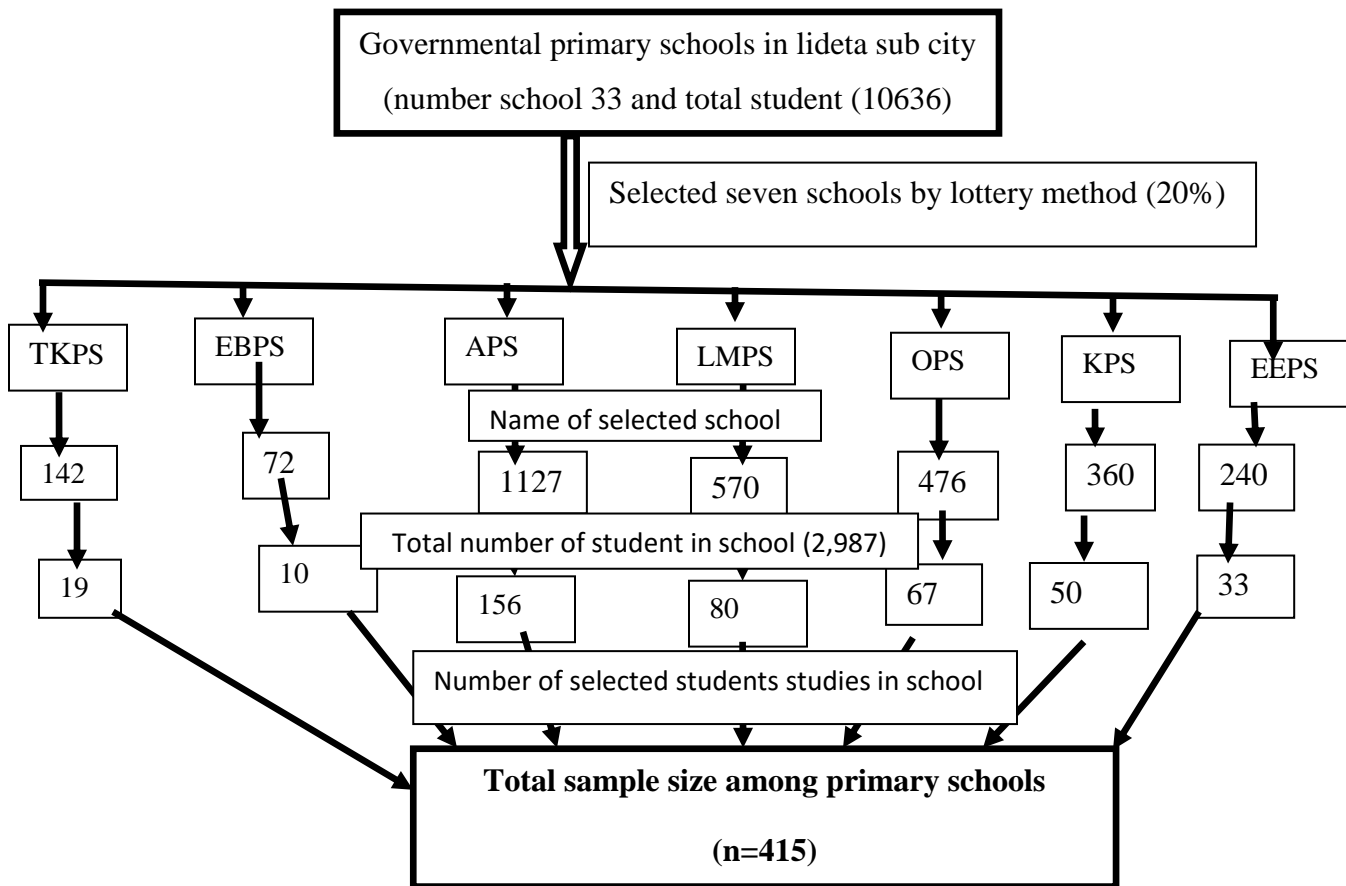
Since the sample size 378 calculated for the first objectives could accommodate the second objective 415 was selected due to representativeness.

Finally, the required sample size among Undernutrition and intestinal helminthes and protozoan parasitic infection primary school children n=415 were included in this study.

3.5.2. Sampling Techniques

All government selected primary schools in a lideta sub city was registered first and from the list seven schools was selected as a study schools by lottery methods (20%). To select the sample children, the students were first stratified according to their educational level (grade 1 to grade 8). Then a quota was allocated for each grade and each class room. Finally, the sample children were selected using systematic random sampling techniques by using class rosters as the sample frame (figure3).

Schematic Presentation of the Sampling Techniques



Calculation of the selected students studies in school

Total number of selected 7 schools students=2,987

Total sample size among primary schools=415

Total number of student in each school=

$$= \frac{\text{Sample size} * \text{Total number of student in each school}}{\text{Total number of selected 7 schools students}}$$

Key

- APS: - Alem-maya Primary School
- EBPS: - Eedgetbesira Primary School
- EEPS: - Enat Ethiopia Primary School
- KPS: - Karamara Primary School
- LMPS: - Lideta limat Primary School
- OPS: - Omedla Primary School
- TKPS: - Tesfa Kokeb Primary School

Figure 3: Schematic Presentation of the Sampling Procedure at Selected Governmental Primary Schools in Lideta Sub City Addis Ababa Ethiopia 2021.

3.6. Tools of Data Collection

Consent was obtained from the study area relevant authorities. Information regarding the number of students in each school, grade, grade-section, and available spaces for the survey were obtained in a visit to the schools. The time schedule for data collection on each student was arranged with the school principals three days before data collection.

A standardized structured questionnaire was developed for the purpose of data collection after reviewing relevant literatures then five health extension workers recruited for the purpose of data collection and also one supervisor will be recruited before data collection and then training for data collectors and supervisors will be given for two days by preparing and using training manual. The questionnaire will be prepared in English language and translated into Amharic language (National language) and then back to English by the principal investigator and other personnel fluent on both languages to prevent for possible misunderstanding and misinterpretation. Pretesting on 5% of the total sample size was conducted in that sub city but in unselected primary schools. The students were interviewed about their socio-demographic characteristics, environmental and sanitation and anthropometric interview was conducted by the nurse (health extension workers) using the standardized questionnaires in Amharic language. Based on the pre test, some questions were modified based on the findings. After the preliminary field survey, the final questionnaires, recording formats, and data collectors' instruction materials were prepared in Amharic. The necessary materials were procured. Data collection was started after three days of the pre-test and conducted from March one to April 25, 2021. The school nurse, teachers and administrators were requested for collaboration, and adequate rooms were given by the schools for use of anthropometric measurements and fresh stool collection. The data collector attend at school earlier before school was started to get informed consent from their parents or guardians after that the data collector ask the parents or guardians for socio-demographic and environmental characteristics of the students then the selected students give a code and register their class rooms and back to their classes, then the selected students were sent by their attending teachers to the data collectors to measure their weight and height and finally, lab technician collect fresh stool sample.

3.6.1. Anthropometric Measurement

Anthropometric indices were taken by health extension workers (clinical nurses) by measuring height and weight two times from every study participant (students) and take the average height and weight. Weight was determined using a portable digital balance. The children were measured wearing light uniforms, without shoes, belts, caps or any other material that could meddle with their actual heights and weights. Weight was measured to the nearest 0.1kg. Height was assessed with a wooden board fixed with a plastic tape and it will be recorded to the nearest 0.1cm. Height of the child or adult in standing position usually children are above 2 years. The head should be in the Frankfurt position (a position where the line passing from the external ear hole to the lower eye lid is parallel to the floor) during measurement and the shoulders, buttocks and the heels should touch the vertical stand. Measurements are recorded to nearest millimeter according to the WHO guidelines (WHO, 2008).

The first step was measure Height of child was both the assistant and measurer should be on their knees then the right hand of the assistant should be on the shins of the child against the base of the board and the left hand of the assistant should be on the knees of the child to keep of them close to the board after that the heel, the calf, buttocks, shoulder and occipital prominence should be flat against the board and the child should be looking straight ahead and the hand of the child should be by their side then the measurer's left hand should be on the Childs chin and the Childs shoulders should be leveled subsequently the head piece should be placed firmly on the Childs head and the measurement should be recorded on the questionnaires. The first step to was measure weight of child was adjusted the pointer of the scale to zero level and take off the Childs heavy close and shoes then Hang the child on the scale and read the scale at level to the nearest 0.1kg and remove the child slowly and safely (WHO, 2008).

3.6.2. Microscopic Examination of Intestinal Parasite

The second step of data collection was be stool sample collation, fresh stool samples (about 2mg) were collected from study subjects in clearly labeled containers with wide mouth and screw cap. Appropriate demonstrations on how to collect the stool samples was conducted to the students to avoid possible contamination in the process of collection. The collected stool samples was stored in an icebox and transported to the examination center properly mixed with 10 ml of 10% formalin for preservation. According to centers for disease control and prevention 10% formalin is necessary to preserve stool specimen, it's all purpose fixation, is easy to prepare, have long shelf life and god preservation of morphology of helminthes egg, larvae, protozoan cysts and

coccidia, also awarded ISO (International organization for standardization) 20166-1:2018 by clinical laboratories. The samples were processed and analyzed using normal saline technique, normal saline is a liquid recommended for use in quality procured that requires the use of isotonic diluents and recommended by clinical and laboratory standard institute (CLIS) for preparation of parasite cell integrity and viability. To insure efficacy of the product, functional testing should be performed by the user accordance with established laboratory quality control procure with referenced ISO 3826-2:2008. Normal saline solution is composed of sodium chloride and water. Used for different purposes, is used as medication for patients as fluid and electrolyte replacement, red blood cell identification in laboratory. Concentration and Purity of Normal saline solution monitored by *abbemat refracto meters*, is measure salinity sodium chloride (NaCl) by refractive index in aqueous solution that's proportional to concentration it have internal peltier temperature control with an accuracy of 0.05⁰C. Olympus biological microscopic model of cx23 used for identification of parasite by using at magnification of 100X and 400X were used for identify the species and to estimation of number of eggs per gram of stool to determine intensity of infection burden at an individual level by trained laboratory technologist at W/ro Beletishachew health center and St. Peter hospital laboratories. The number and type each egg of each species on a recording from alongside the sample number according to the WHO guidelines (WHO, 1994: Anton Paar, 2021).

The microscope was calibrated before examination being, the first step of using normal saline were label a glass slide with the sample and the place a plastic template on top of it then Place a small amount of the fecal sample and press a piece of nylon screen on top, using a spatula, scrape the sieved fecal material through the screen so that only the debris remains and scrape up some of the sieved faces to fill the whole template and carefully lift off the template and place it a bucket of water mixed with concentrated detergent so that it can be reused after that Place one piece of the cellophane, Carefully remove the slide by gently sliding it side ways to avoid separating the cellophane strip next place the slide under microscope and examine the whole area in a systematic zigzag pattern then record the number and the type each egg of each species on a recording from alongside the sample number (WHO, 1994).

3.7. Data Management and Data Analysis

First the data was coded before data collection and checked for completeness and consistency then entered in the computer using EPI-INFO 7 software and then sex, age, height and weight transferred to WHO anthro plus software to convert nutritional data into Z-scores of the indices;

Stunting and Underweight/thinness were expressed by height for age Z-score (HAZ) and BMI for age Z-score (BAZ), respectively by using reference population standard of WHO 2007 in relation to the reference median of the national center for Health statistics (NCHS). Using <-2 standard deviations ($<-2SD$) of Z-score as a cut-off. In the weight for age statistical analysis, students who were > 10 years of age inappropriate indicator of nutritional status for older children experiencing the pubertal growth spurt. Then data was analyzed through SPSS 24 Descriptive summary using frequencies, graphs and cross tabs were used to present study results. Analysis will be carried out at two. Firstly, bivariate analyses were performed to determine the association of undernutrition and associated factors (intestinal parasite infections, age and sex). Statistical association was checked by 95% confidence interval and crude odd ratio. Secondly, the significant variables (p-value <0.05) observed in bivariate analysis were subsequently included in multivariate analysis. Finally, 95% confidence interval and adjusted odd ratio were checked and the significance variables were taken as associated factors of undernutrition value less than 0.05, 95% CI and odd ratio were considered as statistically significant.

3.8. Validity and Reliability of Data and Techniques

The measurement of quality assurance was be taken by providing adequate training and orientation for the data collector and supervisors. Weighing scales were checked and validated with standard weights every day before actual weighing of the children commenced and the stool cup also sterile, packed clearly labeled containers with wide mouth and screw cap. Appropriate demonstrations on how to collect the stool samples were conducted to the students to avoid possible contamination in the process of collection. From total positive samples for parasitic infection, 10% of them will randomly selected, processed and examine by senior laboratory technologist who did not have information about the previous result at St. Peter hospital laboratories. The result of examination was used for quality control for parasitic examination in the study.

3.9. Variables

3.9.1. Dependent Variable: Undernutrition (stunting, underweight/ thinness) and Intestinal parasite.

3.9.2. Independent Variables: Age, Sex, grade, income, Family size, education status of father and mother, occupational status of father and mother, average monthly household income, household family size, feeding program, Source of drinking

water, hand washing practices, status of fingernail, eating unwashed and uncooked fruit and vegetables, Deworming history and information about Intestinal parasite.

3.10. Ethical Considerations

The protocol of this study were reviewed and approved by the Addis Ababa health bureau post graduate research and institutional review board. The approval official letter of co-operation is written to concerned bodies; Lideta Sub City health office and Lideta Sub City educational office then lideta Sub City educational office was wrote latter for those selected schools. Oral informed consent will be duly obtained from all the study subjects, their parents and the school authority before embarking on the survey. Written permission was also obtained from the education authorities in Lideta Sub-city education office and Lideta Sub-city health office. The objectives and protocols of the research were thoroughly discussed with the community leaders and school management for proper amplification. It were agreed on that, participation in the research is intended and that subjects may pull out from the research at any time without prior notice. We will not force anyone to answer the questionnaire and also make sure that all the personal information of the respondents was confidential.

4. CHAPTER FOUR: RESULT AND DISCUSSION

4.1. Result

4.1.1. Socio-Demographic Characteristics of the Study Participants

Out of the total 415 students invited in the study, 65(15.7%) students were excluded from the analysis due to withdraw, incomplete information and inadequate stool sample size and giving a response rate was 84.3%. A total of 350 primary school children age ranges from 6 to 18 years were entitled for the data analysis and the mean (SD) age of students participated in the study was 11.8 (\pm 2.7) years. The numbers of male and female students participated in the study were near equal 180(51.4%) and 170 (48.6%). From total study participant 238 (68%) of the student use feeding program in the school but 112 (32 %) students does not use feeding program during the study period (Table 2).

Table 2: Socio-demographic characteristics of the school children lideta sub city, Addis Ababa Ethiopia, 2021.

Characteristics	Categories	Frequency, n	%
Age	6-10 years	116	33.1
	11-14 years	170	48.6
	>15 years	64	18.3
Sex	M	180	51.4
	F	170	48.6
Grade	1-4	135	38.4
	5-8	215	61.6
Education of mother	Cannot Read And Write	25	7.1
	Can Read and Write	112	32
	Primary school	148	42.3
	Secondary and above	65	18.6
Education of father	Cannot Read And Write	23	6.6
	Can Read and Write	67	19.1
	Primary school	160	45.7
	Secondary and above	99	28.3
Occupation of mother	Government Employee	67	19.1
	Privet Business	126	36

	House Wife	126	36
	Other	31	8.9
Occupation of father	Government Employee	93	26.6
	Privet Business	238	68
	Unemployed	16	4.6
	Other	3	0.9
Income(ETB*)	<3000	146	41.7
	>3000	204	58.3
Family size	<5	215	61.4
	>5	135	38.6
Feeding program	Yes	238	68
	No	112	32

*ETB-Ethiopian Birr

4.1.2. Environmental and Sanitation Characteristics

From total study participants 59.7% of them are use drinking water from splash or filtered water and 28.6% of school students does not trimmed their fingers at a time of data collection. Regarding Deworming history of study participant totally all school children's does not have Deworming history in the past one moth and also 42.6% study participants does not have information about intestinal parasite infection (Table3).

4.1.3. Anthropometric Characteristics

Anthropometric measurements of children according to height and weight measurements was assessed, the mean height 1.42 and the mean weight 34.1distribution of schoolchildren in 350 students. Regarding stunting and underweight from total study participants 16% and 24.3% were found (table 4). Anthropometric indicate that children stunting and underweight in lideta sub city which is higher than the national and regional prevalence and the graph is deviated to negative z-score or less than the reference population (Figure 4 and 5).

Table 3: Environmental and sanitation characteristics of the school children lideta sub city, Addis Ababa Ethiopia, 2021.

Characteristics	Category	Frequency, n	%
Source of drinking water	Pipe	125	35.7
	Water Tanker	17	4.9
	Splash(Filter)	208	59.4
Washing before meal	Yes	321	91.7
	No	29	8.3
Washing after latrine	Yes	282	19.4
	No	68	80.6
Fingernail trimmed	Yes	250	71.4
	No	100	28.6
Eating unwashed fruit and vegetables?	Yes	56	16
	No	294	84
Eating uncooked vegetables	Yes	67	19.1
	No	283	80.9
Deworming history	Yes	0	0
	No	350	100
Information about IPI	Yes	201	57.4
	No	149	42.6

*IPI-Intestinal Parasitic Infection

Table 4: Anthropometric characteristics of the school children lideta sub city, Addis Ababa Ethiopia, 2021.

Characteristics	Category	Frequency, n	%
Stunting	HAZ<-2 SD	56	16
	HAZ>-2 SD	294	84
Underweight	BAZ<-2SD	85	24.3
	BAZ>-2SD	265	75.7

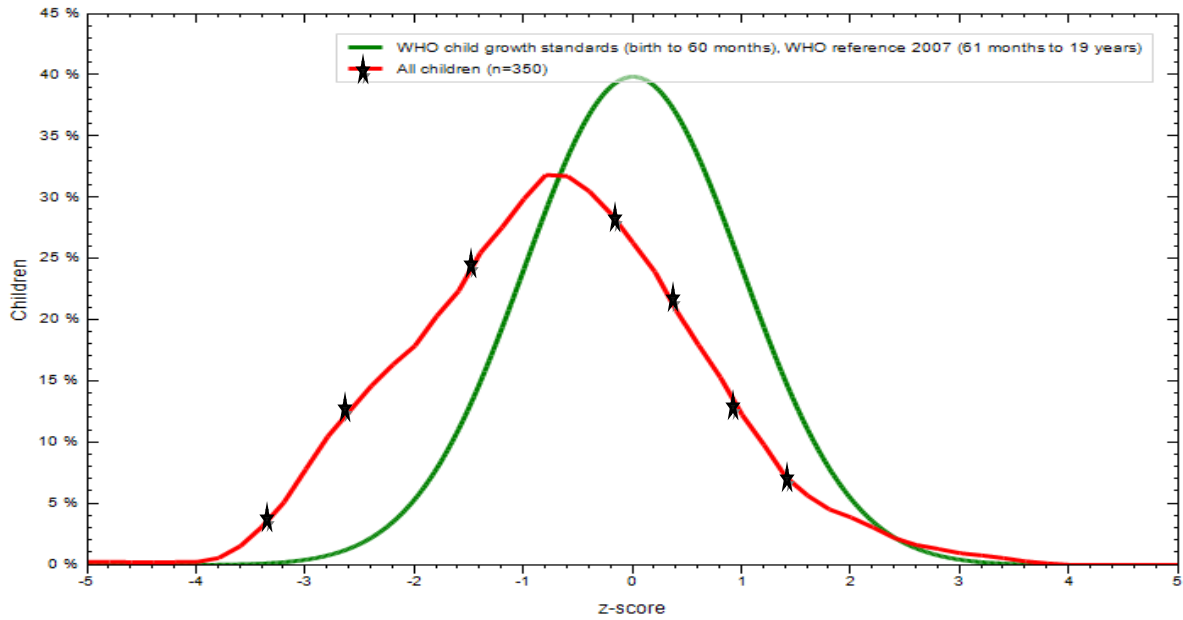


Figure 4: Height-for-age distribution as compared to standard population reference by sex combined with z-score below the-2SD.

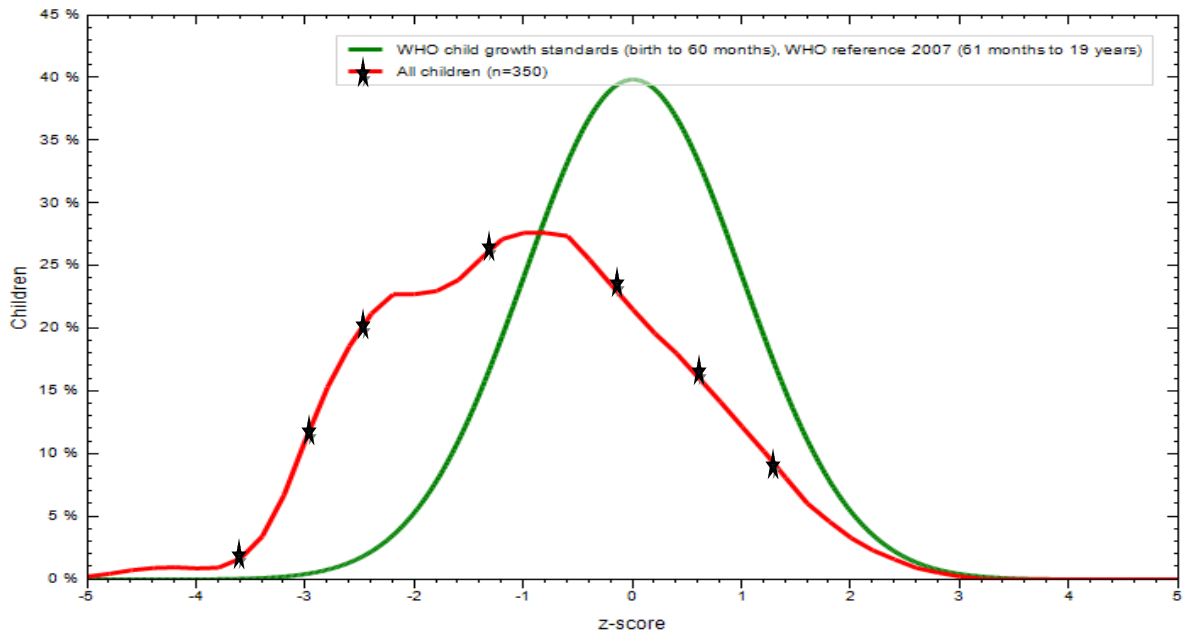


Figure 5: BMI for-age distribution as compared to standard population reference by sex combined with z-score below the-2SD.

4.1.4. Laboratory Findings

From total study participants 69(19.7%) 95% (CI: 15.7-24.3) of them have ova or parasite or infected by intestinal parasite from total infected study participant, from those *Ascaris lumbricoides* (7.4%), *Giardia lamblia*(6%), *Entamoeba histolytica*(4.9%), *Trichuris trichiura*(0.9), *Anchlostoma duodenale* (hookworm) (0.3) and *Enterobius vermicularis*(0.3). *A. lumbricoides* was with the high frequency 26 (7.4%) followed by *G. lamblia* accounting for 21 (6%), (Figure 6).

Table 5: Laboratory findings of the school children lideta sub city, Addis Ababa Ethiopia, 2021.

Characteristics	Category	Frequency, n	%
Laboratory findings	No ova parasite	281	80.3
	Have ova or parasite	69	19.7

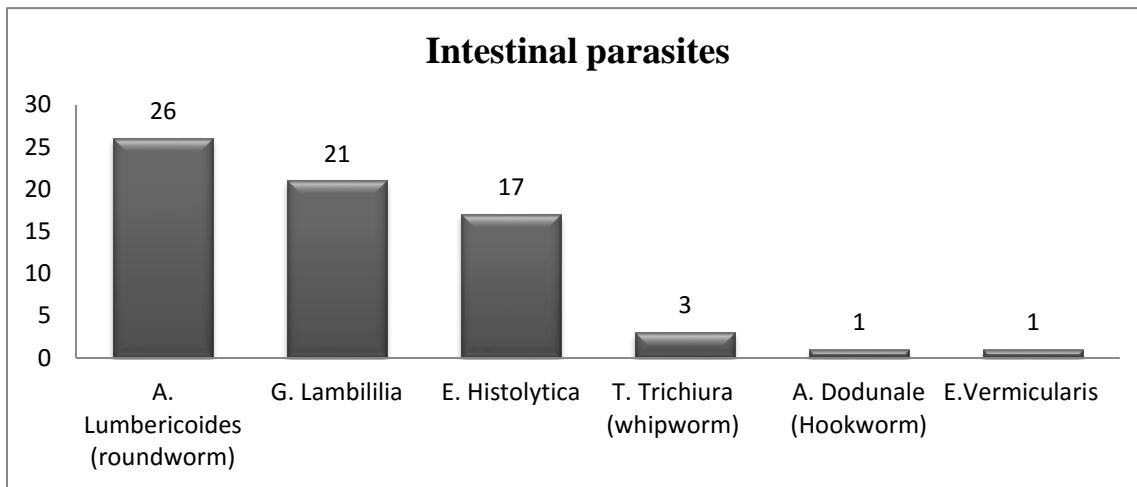


Figure 6: Frequency of intestinal parasites identified among school children in Lideta sub city, Addis Ababa Ethiopia, 2021.

4.1.5. Prevalence of Undernutrition and Its Associated Factors

Nutritional indicator analysis showed that out of the total 350 schoolchildren, the prevalence of undernourished was 36.9%, (95% CI: 31.7-41.7) were 16% (95% CI: 12.3-19.7) children are stunted (HAZ<-2SD). Regarding underweight 24.3% (95% CI: 19.7-28.9) schoolchildren were underweight (BAZ<-2SD). Prevalence of undernutrition higher among age group 11-14, 158(45.1%) than age group 6-10 were 54(15.4) and age group above 15 were 63(18%) not statically significance. similarly, prevalence of undernutrition was similar in sex 48% and 52% among male and female students, while not statically significance. The prevalence of the undernutrition is relatively higher among household income<3000 by 62(42.5%), as compared income>30007(3.4%), although statistically significant. Multivariate logistic regression model showed that students borne from family monthly income less than 3000 birr (AOR=1.9, 95% CI: 1.11–3.51), school feeding program (AOR=4.33, 95% CI: 1.97-9.51) intestinal parasitic infection (AOR=1.71, 95% CI: 2.4-3.15), were associated with undernutrition (Table 6).

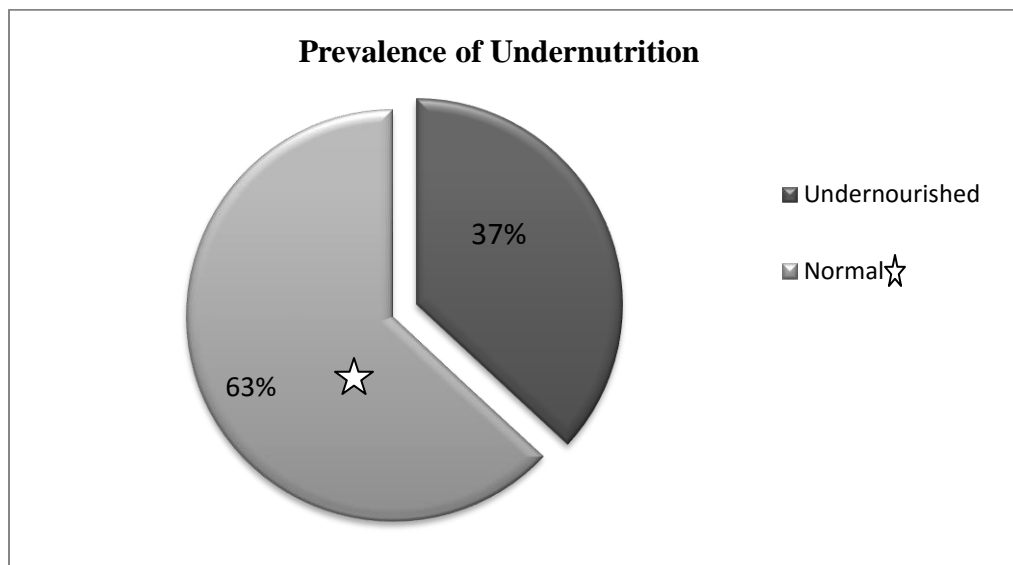


Figure 7: Prevalence of Undernutrition on school children in lideta sub city, Addis Ababa Ethiopia, 2021.

Table 6: Bivariate and multivariate logistic regression analysis of variables associated with undernutrition among school children in lideta sub city, Addis Ababa Ethiopia, 2021.

Variable	Categories	Nutritional status		Crude OR* (CI 95%)	Adjusted OR* (CI 95%)
		undernutrition	Normal		
Age	6-10 years	54(15.4)	62(17.7)	0.01(0.002-0.10)	0.008(0.001-0.06)
	11-14 years	158(45.1)	12(3.4)	0.20(0.02-0.81)	0.16(0.2-1.27) 1
	>15 years	63(18)	1(0.3)	1	1
Grade	1-4	73 (20.9)	62(17.7)	0.07(0.03-0.14)	0.33(0.13-0.81)
	5-8	202 (61.4)	13(3.7)	1	1
Occupation of mother	Governmental employee	47(13.4)	20(5.7)	1	1
	Private business	94(26.9)	32(9.1)	0.16(0.03-0.74)	0.24(0.03-1.61)
	House wife	105(30)	21(6)	0.20(0.04-0.89)	0.26(0.04-1.63)
	Other	29(8.3)	2(0.6)	0.34(0.07-0.81)	0.60(0.99-3.72)
Occupation of father	Governmental employee	79(22.6)	14(4)	1	1
	Private business	182(52)	56(16)	11(9.12-13.34)	17.7(0.5-2.60)
	Unemployed	13(3.7)	3(0.9)	6.5(5.70-7.31)	6(0.19-9.60)
	Other	1(0.3)	2(0.6)	8(5.74-7.32)	2.6(0.006-5.11)
Income (ETB*)	<3000	127(36.3)	19(5.4)	1	1.9(1.11-3.51)*
	>3000	148(42.3)	56(16)	2.5(1.42-4.48)	1
Feeding program	Yes	104(29.7)	8(2.3)	1	1
	No	171(48.9)	67(19.1)	5(2.35-11.03)	4.33(1.97-9.5)*
Laboratory findings	No ova parasite	215(61.4)	66(19)	1	1
	Have ova parasite	60(17.1)	9(2.6)	2.04(1.72-4.34)	1.71(2.43-3.15)*

*p-value<0.05 adjusted odd ratio for undernutrition status. *ETB-Ethiopian Birr * Adjusted Odd Ratio* Crude Odd Ratio

4.1.6. Prevalence of Stunting and Its Associated Factors

From total study participant the prevalence of stunting was 16% (95% CI: 12.3-19.7) from total stunted school children 46.6% of themes are age group between 11-14 years and 10.6% males it was highly prevalent than females. Univariate and multivariate analysis were performed on selected correlates of HAZ <-2SD for age Z- score. Of the grade (1-4) of student (AOR=4.6, 95% CI: 2.10-10.5), Income of household (AOR=2.26, 95% CI: 1.12-4.5) and education of mother (AOR=0.15 95% CI: 0.04-0.51) were significantly associated with stunting (HAZ < -2SD). Stunting does not associated with age of students, sex, , education of father, occupation of mother and father, number of family size and feeding program of school were not associated by Multivariate analysis.(Table 7).

Table 7: Bivariate and multivariate logistic regression analysis of variables associated with stunting among school children in lideta sub city, Addis Ababa Ethiopia, 2021.

Risk factors	Categories	Stunting		Nutritional status	Adjusted OR (CI 95%)
		stunted	normal		
Age	6-10 years	8(14.3)	108(36.7)	2.4(1.02-5.5)	0.87(0.24-3.21)
	11-14 years	26(46.6)	144(49)	7(2.9-10.1)	1.01(0.25-4.60)
	>15 years	22(39.3)	42(14.3)	1	1
Sex	Male	37(10.6)	143(48.6)	2(1.1-3.7)	1
	Female	19(5.4)	151(51.4)	1	1.71(0.91-3.36)
Grade	1-4	11(19.6)	124(42.2)	2.9(1.4-6)	1
	5-8	45(80.4)	170(57.8)	1	4.6(2.10-10.5)*
Education of mother	Cannot Read and Write	15(26.8)	10(3.4)	0.08(0.02-0.21)	1
	Can Read and Write	12(21.4)	100(34)	0.09(0.36-0.23)	0.05(0.01-0.16)*
	Primary school	18(32.1)	130(44.2)	0.13(0.04-0.38)	0.08(0.03-0.26)*
	Secondary and above	11(19.6)	54(18.4)	1	0.15(0.04-0.51)*
Education of Father	Cannot Read and Write	15(26.8)	8(2.7)	1	1
	Can Read and Write	4(7.1)	63(2.15)	0.03(0.009-0.12)	0.14(0.22-1.91)

	Write				
	Primary school	21(37.5)	139(47.4)	0.08(0.03-0.21)	0.34(0.05-1.96)
	Secondary and above	16(28.6)	83(28.3)	0.10(0.03-0.28)	0.50(0.08-3.20)
Income(ETB*)	<3000	33(58.9)	113(38.4)	2.2(1.2-4.1)	2.26(1.12-4.5)*
	>3000	23(41.1)	181(61.6)	1	1
Family size	<5	29(51.8)	186(63.3)	1	1
	>5	27(48.2)	108(36.7)	0.62(0.35-0.91)	0.93(0.44-1.94)
Laboratory findings	No ova parasite	37(66.1)	244(83)	1	1
	Have ova parasite	19(33.9)	50 (17)	2.5(1.33-4.7)	0.77(0.28-2.00)

*p-value<0.05 adjusted odd ratio for stunting status. *ETB-Ethiopian Birr * Adjusted Odd Ratio*

Crude Odd Ratio

4.1.7. Prevalence of Underweight and Its Associated Factors

From total study participant the prevalence of underweight was 24.3%, from total underweight school children 61.2% of them were females and student were born from family size >5 was 58.2%. Univariate and Multivariate analysis were performed on selected correlates of BAZ <-2SD for age Z- score. Among the socio-demographic determinants, the presence of Intestine Parasite Infection (AOR=4.7, 95% CI: 1.8-11.9), school feeding program (AOR=4.9, 95% CI: 2.1-11.3) and family were >5 members (AOR=2.25, 95% CI: 1.12-4.5) were significantly associated with underweight (BAZ <-2SD). underweight does not associated with age of students, grade of student, education of mother and the father ,occupation of mother and father ,number of family size and household income were not associated with underweight (Table 8).

Table 8: Bivariate and multivariate logistic regression analysis of variables associated with underweight among school children in lideta sub city, Addis Ababa Ethiopia, 2021.

Risk factors	Categories	Nutritional status		Crude OR (CI 95%)	Adjusted OR (CI: 95%)
		underweight	normal		
Sex	M	33(38.8)	147(55.5)	1	1
	F	52(61.2)	11(44.5)	1.9(1.19-3.23)	1.81(0.87-3.70)
Occupation of mother	Governmental employee	11(12.9)	56(21.1)	1	1
	Private business	29(34.1)	97(36.6)	0.27(0.10-0.71)	0.04(0.03-1.11)
	House wife	32(37.6)	94(35.5)	0.41(0.18-0.94)	0.36(0.10-1.20)
	Other	13(15.3)	18(6.8)	0.47(0.20-0.90)	0.23(0.06-0.82)
Income(ETB)	<3000	57(67.1)	89(33.6)	4.01(2.3-6.71)	1.13(0.57-3.1)
	>3000	28(32.9)	176(66.4)	1	1
Family size	<5	35(41.2)	180(52.8)	3.01(1.80-8.02)	2.25(1.12-4.5)*
	>5	50(58.2)	85(47.2)	1	1
Feeding program	Yes	74(87.1)	38(14.3)	1	1
	No	11(12.9)	222(85.7)	4.01 (1.91-8.20)	4.9(2.1-11.3)*
Laboratory findings	No ova parasite	57(67.1)	224(84.5)	1	1
	Have ova parasite	28(32.9)	41(15.5)	2.61(1.51-4.70)	4.7(1.8-11.9)*

*P-value <0.05 adjusted odd ratio for underweight status. *ETB-Ethiopian Birr * Adjusted Odd Ratio* Crude Odd Ratio

4.1.8. Prevalence of Intestinal Parasitic Infection and Its Associated Risk Factors

Microscopic stool sample examination using direct microscope with normal saline techniques showed that infections with various intestinal helminthes and protozoan parasites were found in lideta sub city elementary schoolchildren. A total of 415 students, from grade 1 to 8 included in the study, of these sixty five (65) study subjects did not provide a complete data for analysis because of incomplete data and inadequate stool sample. Out of total study subject examined six (6) species of intestinal parasites were identified with an overall prevalence was 69(19.7%) 95% (CI: 15.7-24.3) intestinal parasitic infections in schools children's. The rates of intestinal parasitic infections higher in age group, age group above 15 years (34.4%) as compared to age (17.2%) 6-10 and age 11-14(15.9%) years. similarly; rates of intestinal parasitic infections were 25% and 14.1% among male and female students, respectively. The prevalence of the intestinal parasitic infection is relatively higher among household income<3000 by 62(89.9%), as compared income>3000, 7(10.1%), although statistically significant 5% CI.

According to multivariate logistic regression model, age group 6-11 (AOR=0.27; 95% CI: 0.09-0.81), student parents with income less than 3000(AOR=10.5; 95% CI: 3.96-12.23), water drinking from splash(filtered) (AOR=0.13 95% CI: 0.04-0.39), washing their hands regularly after vesting latrine(AOR=5 95% CI: 2.37-13.06), untrimmed fingernails (AOR=4.37; 95% CI: 1.89-10.11), eating regularly uncooked and unwashed fruit and vegetables (AOR=3.92; 95% CI:1.48-10.33) and (AOR=3.7; 95% CI:1.47-9.44), were significantly associated from intestinal parasitic infection (Table 9).

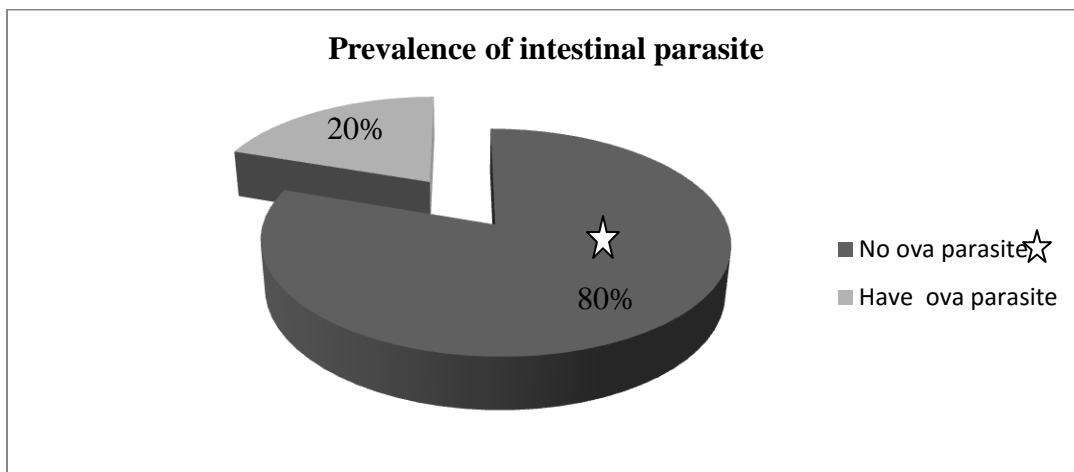


Figure 8: Prevalence of intestinal parasite in school children lideta sub city, Addis Ababa Ethiopia, 2021.

Table 9: Bivariate and multivariate logistic regression analysis of variables associated with parasitic infection among school children in lideta sub city, Addis Ababa Ethiopia 2021.

Risk factors	Categories	IPIs status		Crude OR (CI 95%)	Adjusted OR (CI 95%)
		Have ova or parasite	No ova or parasite		
Age	6-10 years	20(17.2)	96(34.2)	0.39(0.19-0.80)	0.27(0.09-0.81)*
	11-14 years	27(15.9)	143(50.9)	0.36(0.18-0.69)	0.45(0.15-1.36)
	>15 years	22(34.4)	42(14.9)	1	1
Sex	Male	45(25)	135(48)	2(1.17 -3.50)	2.2(0.92-5.50)
	Female	24(14.1)	146(52)	1	1
Education of mother	Cannot Read and Write	18(72)	7(2.5)	0.2(0.07-0.52)	0.86(0.15-4.70)
	Can Read and Write	38(33.9)	74(26.3)	0.02(0.01-0.07)	0.33(0.05-2.01)
	Primary school	9(6.1)	139(49.5)	0.02(0.01-0.09)	0.09(0.007-1.20)
	Secondary and above	4(6.2)	61(21.7)	1	1
Education of father	Cannot Read and Write	17(73.9)	6(2.1)	4.30(1.21-5.22)	1(0.07-13.70)
	Can Read and Write	22(32.8)	45(16.1)	7.12(2.02-9.01)	3.7(0.47-9.20)
	Primary school	24(15)	136(48.6)	2.70(1.10-70.01)	0.99(0.07-13.6)
	Secondary and above	6(6.1)	93(33.2)	1	1
Occupation of mother	Governmental employee	2(3)	65(23.1)	1	1
	Private business	19(15.1)	107(38.1)	5.11(1.01-8.41)	1.30(0.16-11.72)
	Unemployed	35(27.8)	91(32.4)	7.10(2.01-11.1)	2.70(0.33-12.01)
	Other	13(41.9)	18(6.4)	12.1(4.11-16.21)	4.21(0.38-4.70.21)
Income(ETB)	<3000	62(42.5)	84(30)	2.01(1.90-4.7)	10.51(3.96-12.23)*
	>3000	7(3.4)	197(70)	1	1
Family size	<5	32(46.4)	183(65)	2.01(1.20-3.60)	1.01(0.34-2.80)

	>5	37(53.6)	98(35)	1	1
drinking	Pipe	50(72.5)	75(26.7)	1	1
water	Water Tanker	11(16)	6(2.1)	2.70(0.95-8.11)	1.4(0.26- 7.8)
	Splash(Filter)	8(11.6)	200(71.2)	0.60(0.02-0.13)	0.13(0.04-0.39)*
Washing	Yes	53(76.8)	268(95.4)	1	1
hands before	No	16(23.2)	13(4.6)	6.20(2.82-13.6)	0.78(0.25-2.30)
the meal					
Washing	Yes	26(37.7)	256(91)	1	1
hands after	No	43(62.3)	25(9)	1.60(1.10-3.20)	5(2.37-13.06)*
latrine					
Fingernail	Yes	17(24.6)	233(83)	1	1
trimmed	No	52(75.4)	48(17.1)	14.8(7.91-27.80)	4.37(1.89-10.11)*
Eating	Yes	27(40)	29(10.3)	5.02(3.11-10.01)	3.92(1.48-10.33)*
unwashed	No	42(60)	252(89.7)	1	1
fruit and					
vegetables?					
Eating	Yes	37(53.6)	30(10.7)	9.30(5.01-17.11)	3.7(1.47-9.44)*
uncooked	No	32(46.4)	251(89.3)	1	1
vegetables					
Information	Yes	15(21.7)	186(66.2)	1	1
IPI	No	54(78.3)	95(33.8)	7.04(3.78-13.11)	0.60(0.22-1.6)

*<0.05 adjusted odd ratio for parasitic infection. *ETB-Ethiopian Birr. * Adjusted Odd Ratio.

* Crude Odd Ratio. *IPI-Intestinal Parasitic Infection

4.2. Discussion

This study assessed the relationship between undernutrition of school children with intestinal parasitic infections in Lideta sub city, Addis Ababa Ethiopia. Compared to what has been reported earlier from different parts of Ethiopia and other countries, the prevalence undernutrition for the present study populations were higher from some and lower from others.

In this study the prevalence of undernutrition was 36.9% (95% CI: 31.7 - 41.7). This result were almost the same the study done Addis Ababa town (Dawit D. *et al.*, 2015), Bahir dar town (Tamirat H. 2017) and Durbet town (Tilahun A. *et al.*, 2015) were 31%, 41.6% and 32.2% respectively; this may be due to the same population characteristics and nutritional habit. But higher than the study done in Adama town which was 21.2% (Pawlos, *et al.*, 2011), this may be due to the nutritional habit and socio economic status of the population. The prevalence of undernutrition in this study were lower than the study done in hawassa town (Alemneh K. *et al.*, 2017), and Venezuela Yanomami (Lilly, *et al.*, 2013) which were 53.3% and 84% this difference may be due to the poverty, population characteristics nutritional habit, socio economic status and sample size.

Stunting is a chronic form of undernutrition and direct child physical growth failure indicator that happens because of long time nutrition and related deficits. the prevalence of Stunting was 16% (95% CI: 12.3-19.7), this result were almost the same the study done Addis Ababa (Dawit D. *et al.*, 2015), Adama town (Pawlos, *et al.*, 2011), Bahir dar town (Tamirat H., 2017), Hadiya (Abebe H. *et al.*, 2017) Nepal (Joshi, *et al.* 2012), Nepal (Shrestha, *et al.*, 2020) and urban slum India (Srivastava, *et al.*, 2012) were 19.6% 12.6%, 18.3%, 16.1%, 13%, 18.9% and 18.5% respectively; this may be due to the nutritional habit, biological, maternal, socio-cultural, environmental, and politico-economical. But higher than the study done in durbet town which was 11.2% (Tilahun A. *et al.*, 2015), this may be due to the nutritional habit and socio economic status of the population. The prevalence of undernutrition in this study were lower than the study done in Northwest Ethiopia, fogera district (Hunegnaw M. *et al.*, 2013) 30.7%, hawassa town (Alemneh K., *et al.*, 2017) 41%, Jimma town (Zelege M. *et al.*, 2020) 21%, north west Ethiopia (Bemnet A. *et al.*, 2013) 25.2%, Uganda (Harold, *et al.*, 2010) 22.5% and 70% and 55% in Mexico (Chanal and Larrainzar towns) (Gutierrez-Jimenez, *et al.*, 2013) were this difference may be due to the nutritional habit, environmental factor and socio economic and cultural status.

Underweight is due to current and acute inadequate nutrition, this study show that the prevalence of Underweight was 24.3% (95% CI: 19.7-28.9). This result were almost the same study done by EMDHS 2019, in Bahir dar town (Tamirat H. 2017), Durbete town (Tilahun A. *et al.* 2015) and

hawassa town (Alemneh K. *et al.*, 2017) were 21%, 25.9% 27.1% and 22% respectively; this may be due to the same population characteristics and nutritional habit. But higher than the study done in Addis Ababa which was 15.9% (Dawit D. *et al.* 2015), Adama town (Pawlos R. *et al.*, 2011) 7.2%, Jimma town (Zelege M. *et al.*, 2020) 6.9%, north west Ethiopia (Bemnet A. *et al.* 2013)15.1%, Uganda (Harold, *et al.* 2010) 5.3% and 5.8% in chain (Ming, *et al.*, 2019) this may be due to the nutritional habit, socio-politico and economic status of the population. The prevalence of undernutrition in this study were lower than the study done in Somali and Afar (Alemneh K., *et al.*, 2017) which were both 32% and 42.2% in Hadiya (Abebe H. *et al.*, 2017) this difference may be due to the nutritional habit, environmental factor and socio economic status.

The result of this study reveals that pre-school children were infected with various intestinal parasites. The overall prevalence of intestinal parasitic infections amongst the schoolchildren was 19.7% (95% CI: 15.7-24.3), which is low compared to different studies conducted in Adama town (Pawlos R. *et al.*, 2011) 35.5%, Bahir dar town (Tamirat H. 2017)52.4%, hawassa (Alemneh K., *et al.*, 2017) 51.3%, Jimma (Zelege M. *et al.*, 2020) 68.6%, Gurage (Admasu H. *et al.*, 2017) 42.1, North East Ethiopia, Jawi town (Baye S. *et al.*, 2019)57.8%, Ghana (Duedu, *et al.*, 2015), 15.8%, Uganda (Buzig, *et al.*, 2015) 32.8% and chain (Ming, *et al.*, 2019) 41.8%. Similarly, in northwest of Ethiopia (Bemnet A. *et al.*, 2013) 22.7%, Harbu Town (Daniel G. *et al.*, 2020) 21.5%, and Uganda (Francis, 2012)16%, the prevalence of intestinal parasitic was nearly equal with this study. Totally from this study explore six different parasites from both helminthes and protozoan parasite the most frequently found parasite in this study was *A. lumbricoides* 8(14.3%), followed by *G.lambliia* 5(8.9%), it have similar frequencies with study in hawassa town(Alemneh K., *et al.*, 2017) and Chenchu town (Ashenafi and Mohammed, 2014), in Southern Ethiopia.

The associated risk factors for undernutrition according to this study were monthly house hold income, school feeding program and presence of intestinal parasitic infection significantly associated. Household income <3000 by 62(42.5%), as compared income>3000(3.4%), although statistically significant, majority of children does not use feeding program of school were highly prevalent among student were use feeding program was 104 (29.7%) and 171(48.9%), Schoolchildren were does not use school feeding program were found to be 4.33 times more likely to be undernourished as compared to the respective student using school feeding program (AOR=4.33, 95% CI: 1.97-9.51). Schoolchildren borne from family monthly income less than 3000 birr were found to be 1.9 times more likely to be undernourished as compared to the respective income greater than 3000 birr category (AOR=1.9, 95% CI: 1.11–3.51). Study done in Bahir dar town (Tamirat H. 2017) and Nigeria (Rufina, *et al.*, 2018) monthly house hold income

main risk factor for undernutrition. The other risk factor for undernutrition was intestinal parasitic infection according to this study it also agree with Bahir dar town (Tamirat H. 2017), hawassa town (Alemneh K. *et al.*, 2017), Cameron (Garba and Carl, 2013), chain (Guan and Han, 2019), Malaysia (Rajoo, *et al.*, 2017), Ghana (Duedu, *et al.*, 2015) and Mexico (Gutierrez-Jimenez, *et al.*, 2013) have strong association with undernutrition and intestinal parasitic infection. School feeding program was the most important hold up for school children for their nutritional statuses especially for immediate cause of undernutrition, according to this study School feeding program and undernutrition have association it is due to social, economic and school feeding program.

This study show that stunting strongly associated with grade of students, educational status of mother and monthly house hold income but stunting does not associated with intestinal parasite. Grade category with 5-8 were found to be 4.6 times more likely to be undernourished as compared to the respective student grade 1-4 (AOR=4.6, 95% CI: 2.1-10.5). Schoolchildren were born from family Income<3000 were found to be 2.26 times more likely to be undernourished as compared to the respective family Income<3000 (AOR=2.26, 95% CI: 1.12-4.5). Children being borne from a mother with primary and above school education were found to be protective from stunting their children and it showed reduction by 85% from stunting (probability to be stunted is 0.15) (AOR: 0.15, 95% CI: 0.04-0.51) this finding does not agree with other similar scholars it may due to socio-economic, cultural and educational stats . House hold income was strongly associated which likely affect directly nutritional status of the children, Which is in concurrence with other studies reported from Adama town (Pawlos R. *et al.*, 2011), Jimma town (Zelege M. *et al.*, 2020), hawassa town (Alemneh K. *et al.*, 2017), Malasiya (Rajoo, *et al.*, 2017). Grade of student also one of risk factor for stunting according to this study which is agreement with other studies reported from elsewhere in chain (Guan and Han, 2019).

In this study family size, school feeding program and intestinal parasitic infection are strongly associated with underweight but age of student, sex, grade, income of house hold, education and occupation parents or guardians does not associated with under underweight. School children who use school feeding program was strongly associated with underweight by (AOR=4.7, 95% CI: 1.8-11.9). House hold family size which is concurrence with other studies reported from Addis Ababa (Dawit D. *et al.* 2015), Durbete town (Tilahun A. *et al.*, 2015) and chain (Guan and Han, 2019) house hold family size was strongly associated which likely affect directly nutritional status of the children. Intestinal parasitic infection was strongly associated in this study concurrence with other studies reported from Bahir dar town (Tamirat H. 2017) and Hawassa town (Alemneh K. *et al.*, 2017). Additionally study done in Jimma town (Zelege M. *et al.*, 2020), Gurage (Admasu H. *et*

al., 2017), northwest of Ethiopia (Bemnet A. 2013) and Uganda (Harold, *et al.*, 2010) have significance association with underweight. A study done in Addis Ababa (Solomon and Addisu, 2021), Meket woreda (Yeshalem and Azezu, 2020), Boricha district (Mastewal Z. *et al.*, 2018) state that school feeding program are strongly associated with underweight and agreement with this study, this cloud be by socio-economic factory, environmental factory, feeding practice or school feeding program.

The risk factors for parasitic infections among school children different place to place but the most common was habits, poor water supply and lack of environmental sanitation, socio economic status, especially where children eat, drink, exercise development activities and play. In addition, low body immune system response malnourished children might be responsible for high infection rate as it is discussed in here study (Alemneh K. *et al.*, 2017). In this study intestinal parasitic infection are strongly associated with age of participant, environmental and sanitation (washing hands regularly after visiting latrine, untrimmed, eating unwashed fruit and vegetables, eating uncooked vegetables) and house hold income. Similarly study done in Bahir dar town (Tamirat H. 2017) risk of parasitic infection was significantly increased with unclean finger and irregular hand washing habit also in agreement with study in Jawi town northwest, Ethiopia (Baye S., *et al.*, 2017) and North Western Tigray (Tsega T. *et al.*, 2017). Additionally 28 (32.9%) children were underweight were infected with intestinal parasites were significantly associated p-value <0.05 CI: 4.7(1.8-11.9) this study concurrence with Bahir dar town (Tamirat H. 2017), Ghana (Duedu, et al. 2015), Cameroon (Garba and Carl, 2010) and Malaysia (Rajoo, *et al.*, 2017) underweight increased with intestinal parasites, also in Hawassa town (Alemneh K. *et al.*, 2017) and Nigeria (Opara, *et al.*, 2012) strongly associated by p-<0.001. Age of student also one factor for parasitic infections it is strongly associated in this study but does not agree with other scholars it cloud be by status of Deworming level of student, care of family, personal and environmental factors.

5. CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

The prevalence of undernutrition was higher in the study area when compare with similar study in lideta sub city. Undernutrition was a common health problem of the school-age children and it showed strong positive correlation with prevalence of IPIs and also strongly associated with house hold income, school feeding program. Prevalence of underweight strongly associated with household family size, school feeding program and IPIs, but Prevalence of stunting does not associated with intestinal parasitic infections, stunting may be due to a prolonged shortage of a balanced diet and IPIs was not risk factors for stunting, but grade of student, educational status of mother and monthly house hold income are major risk factors for stunting according to this study, similarly the prevalence of intestinal parasitic infections correlated strongly with both socio demographic, environmental and sanitation risk factors. All school students have no history of Deworming in the past 3 weeks on those school children the prevalence of underweight was higher this may be due high prevalence of intestinal parasitic infections, the consequences Un-Deworming student may be undernourished due to food insecurity by affecting one pillars of food security. The nutritional status of schoolchildren in the present study showed that undernutrition was highly prevalent compared to the NCHS international reference standard, which correlated well with both socio-demographic and environmental and sanitation risk factors of undernutrition and the presence of IPIs. The nutritional status of schoolchildren as determined by mean Z-score for, height-for-age and BMI-for-age of was lower than in WHO standards.

5.2. Recommendations

1. According to this study school feeding program was preventive from undernutrition and it should be continued and by include those children on school feeding program it secure their food security.
2. To ministry of health or children health and nutrition directorate School-based Deworming should been advocate it is highly cost-effective public health measure, it should be support food security program by Deworming and treat protozoan parasites by campaign, schedule or twice a year without interruption using health extension workers with follow-up evaluation of infection prevalence.
3. Strengthen health education program for schoolchildren and parents and/or guardians on how IPIs are transmitted and prevented improvement of personal hygiene, environmental sanitation as well as hand washing habit after using toilet, terming their finger usually, and regularly by washing fruit and vegetables before eating.
4. To minister of education and lideta sub city education office to be focused on prevention and control measures can focus on regular school health education programmes on the prevention of intestinal parasitic infections, by treating school water pipe or by using water filtration mechanism.

REFERENCE

- Abebe Alemu, *et al.*, (2011). Soil transmitted helminths and schistosoma mansoni infections among schoolchildren in Zarima town, northwest Ethiopia. *BioMed Central Infect Dis.* 9 (11) 1-5.
- Abebe Haile and Nigusse Temesgen (2017). Determinants of Nutritional Status of Under-Five Children in Ethiopia: With Particular Reference to Anelmo woreda, Hadiya Zone, Southern Nations, Nationalities and Peoples Region, *Agriculture and Food Sciences Research* 4(2):45-5.
- Abraham Degarege and Birehanu Erko, (2013). Association between intestinal helminthes infections and underweight among school children in Tikur Wuha Elementary School, Northwestern Ethiopia, *J. of InfectPublic Health.* 6(2):125-133.
- Abraham Degarege, Abebe Animut, Girmay Medhin, Mengistu Legesse, and Birehanu Erko (2014). The association between multiple intestinal helminthes infections and blood group, anemia and nutritional status in human populations from Dore Bafeno, southern Ethiopia, *J. Helminthology.*88 (2): 1-5
- Adenuga W.U., T.A. Obembe, K.O. Odebunmi, and M.C. Asuzu (2017).Prevalence And Determinants Of Stunting Among Primary School Children In Rural And Urban Communities In Obafemi Owode Local Government Area, Southwestern Nigeria *Med.* 15(1): 7-15.
- Admasu Haile. Temesgen Abera and Daniel Dana. (2017). The Prevalence of Intestinal Parasitic Infection and Associated Factors Among Primary School Children in Gurage Zone, South Ethiopia, *Journal of Pharmacy and Alternative Medicine.*15(2): 2-10.
- Akina Shrestha, Christian Schindler, Peter Odermatt, Jana Gerold, Séverine Erismann, Subodh Sharma, Rajendra Koju, Jürg Utzinger, and Guéladio Cissé(2020) utritional and health status of children 15 months after integrated school garden, nutrition, and water, sanitation and hygiene interventions: a cluster-randomised controlled trial in Nepal *BioMed Central Infect Public Health* 20(15)10-15.
- Akoto Osei, PoojaPandey, David Spiro, Jennifer Nielson, Ram Shrestha, ZamanTalukder, Victoria Quinn, and Nancy Haselow (2010). Household food insecurity and nutritional status of children aged 6 to 23 months in Kailali District of Nepal. *Food and Nutrition Bulletin* 31(4)3-7.

- Akua Obeng Forson , Isaac Arthur, Michael OluTaiwo, Kathrine Korkor Glover, Prince Jonathan Pappoe Ashong² and Patrick F. and Ayeh Kumi, (2017). Intestinal parasitic infections and risk factors: a cross-sectional survey of some school children in a suburb in Accra, Ghana. *BioMed Central Infect* 10(485):5-8.
- Alemneh Kabeta, Sintayehu Assefa, Dejene Hailu and Getenesh Berhanu (2017). Intestinal parasitic infections and nutritional status of pre-school children in Hawassa Zuria District, South Ethiopia African. *Journal of Microbiology Research*, 11(31): 51-53.
- Amanuel Yoseph. and Hunachew Beyene (2020). The high prevalence of intestinal parasitic infections is associated with stunting among children aged 6–59 months in Boricha Woreda, Southern Ethiopia: a cross sectional study *BioMed Central Infect Public Health*, 2(8):1-2.
- Anton Paar GmbH (2021). quality control of saline solution.1(1):11-15.
- Anurag Srivastava, Syed E Mahmood, Payal M Srivastava, Ved P Shrotriya and Bhushan Kumar (2012). Nutritional status of school-age children – A scenario of urban slums in India Archives of Public Health, 70(8):12-22
- Ashenafi Abossie and Mohammed Seid (2014). Assessment of the prevalence of intestinal parasitosis and associated risk factors among primary school children in Chench town, Southern Ethiopia *Biomed Central Infect Public Health* 2014, 14(166):12.
- Banchiamlak Mekonnen, Berhanu Erko and Mengistu Legesse (2014). Prevalence of Intestinal Parasitic Infections and Related Risk Factors among Street Dwellers in Addis Ababa, Ethiopia. *Journal of Tropical Diseases*, 2(1): 2-7.
- Baye Sitotaw, Haileyesus Mekuriaw and Destaw Damtie (2019) Prevalence of intestinal parasitic infections and associated risk factors among Jawi primary school children, Jawi town, northwest Ethiopia *Biomed Central Infectious Diseases* 19(341):11-15.
- Bemnet Amare *et al.*, (2013). Nutritional status, intestinal parasite infection and allergy among school children in Northwest Ethiopia. *Biomed Central Pediatrics*, 13(7): 23-25.
- Center for disease control and prevention (CDC), (2020). <https://www.oracle.com> accessed at 2020.
- Chuchard Punsawad *et al.*, (2018). Prevalence of intestinal parasitic infections and associated risk factors for hookworm infections among primary schoolchildren in rural areas of Nakhon Si Thammarat, southern *Biomed Central Public Health* 18 (1):11-17.

- CI Ndukwu, I Egbonu, TO Ulasi and JC Ebenebe(2014) Determinants of undernutrition among primary school children residing in slum areas of a Nigerian city, 2(2):23-35.
- Daniel Gebretsadik, Melkam Tesfaye, Aderaw Adamu and Gashaw Zewde (2020). Prevalence of Intestinal Parasitic Infection and Its Associated Factors Among School Children in Two Primary Schools in Harbu Town, North East Ethiopia: Cross-Sectional Study journal: Pediatric Health, Medicine and Therapeutic, 12(2):2-5.
- Dawit Degarege, Abraham Degarege and Abebe Animut (2015) Undernutrition and associated risk factors among school age children in Addis Ababa, Ethiopia *Biomed Central Public Health* 15(375):11-23.
- Destaw Damtie, Baye Sitotaw, Sissay Menkir, Bizuayehu Kerisew and Kedir Hussien(2021). Human Intestinal Parasitic Infections: Prevalence and Associated Risk Factors among Elementary School Children in Merawi Town, Northwest Ethiopia *Journal of Parasitology Research*. 9(4):1-3
- Edward Buzigi, (2015), Prevalence of Intestinal Parasites, and its Association with Severe Acute Malnutrition Related Diarrhoea, *Journal of Biology, Agriculture and Healthcare*,5(2); 12.
- Eglal Ahmed Qasem, Wadhah Hassan Edrees, Wadee Abdullah Al-Shehari and Mohammed Ali Alshahethi (2020) Frequency of intestinal parasitic infections among schoolchildren in Ibb city-Yeme, *Journal of Pharmaceutical Research* 5 (2);42-46.
- Ethiopia Mini Demographic and Health Survey (EMDHS) (2019).Federal Ministry of Health Addis Ababa, Ethiopia 1(1); 11.
- Federal Democratic Republic of Ethiopia (FDRE). (2019). Food and Nutrition Policy, 1(1): 3-7.
- Federal Democratic Republic of Ethiopia Ministry of Health Nutrition, (2017). Module for Health Hotline Counselors April, 1(1): 121-129.
- Food and Agriculture Organization (FAO) (2013). State of Food Insecurity in the World and Food Security Statistics 5(3): 2-5.
- Food and Agriculture Organization (FAO), (2019) State of Food Security and Nutrition in the World, Rome, Italy, 11(6): 4-5.
- Freeman MC, Akogun O, and Belizario V, (2020.) Challenges and opportunities for control and elimination of soil-transmitted helminth infection beyond. *Plos Negl Trop Disease*; 13(4):2-5.

- Garba C.M.G and Carl M. F. Mbofung (2010). Relationship between Malnutrition and Parasitic Infection among School Children in the Adamawa Region of Cameroon, *Journal of Nutrition* 4(16): 2-4.
- Guyatt HL. (2010) Intestinal nematode affects productivity in adulthood. *Parasite Today, PubMed* 3(4) 153-8.
- Harold, A.; Konde-Lule, J.; Sebuliba, I.; Bundy, D.; Hall, A.(2010) Effect on weight gain of routinely giving albendazole to preschool children during child health days in Uganda. Cluster randomized controlled trial. *Biomed Central Journal* 12 (7):1-4.
- Hunegnaw Mekonnen, Takele Tadesse and Teresa Kisi (2013) Malnutrition and its Correlates among Rural Primary School Children of Fogera District, Northwest Ethiopia, *Nutritional Disorders & Therapy* ISSN: 2161-0509, 2(4):81-95.
- Javier Gutierrez-Jimenez¹ *et al.*, (2013) Malnutrition and the presence of intestinal parasites in children from the poorest municipalities of Mexico *J Journal Infection*; 7(10):741-747.
- Joshi HS, Gupta R, Joshi M C, and Mahajan Vipul, (2011). Determinants of Nutritional Status of School Children - *NJIRM*; Vol. 2(1): 1-6.
- K. Korzeniewski, A Lass, A Augustynowicz and M Konior (2020). The prevalence of intestinal parasitic infections among Kosovar and Serbian school-children in Kosovo. *Helminthologia* 57 (3):276
- Kenneth N. Opara,; Nsima I. Udoidung, P; Dominic C. Opara,; Okpok E. Okon,; Uwa E. Edosomwan, and Anietie J. Udoh (2012). The Impact of Intestinal Parasitic Infections on the Nutritional Status of Rural and Urban School-Aged Children in Nigeria. *International Journal of MCH and AIDS*, 1(1): 68-75.
- Keutchazoue G, Vincent K, Noumedem A and Yamssi C (2020). Risk Factors Associated with Prevalence and Intensity of Gastro-Intestinal Parasitic Infections within Households in Tonga Sub-Division, West Region, Cameroon *J Infect Dis Epidemiol*, 6(123): 1-5.
- Knopp S., Mohammed K.A.I., Khamis S., Mgeni A.F, Stothard J.R., Rollinson D., Marti H. and Utzinger J.(2012). Spatial distribution of soil-transmitted helminths, including *Strongyloides stercoralis*, among children in Zanzibar, *Geospatial Health*, 3(1): 47-56.
- Kwabena O. Duedu, Eric Peparah, Isaac Anim-Baidoo and Patrick F. Ayeh-Kumi (2015). Prevalence of Intestinal Parasites and Association with Malnutrition at a Ghanaian Orphanage. *Libertas Academica Human Parasitic Diseases*. 11(25):5-9.

- Legese Chelkeb, Zeleke Mekonnen, Yonas Alemu and Daniel Emanu (2020). Epidemiology of intestinal parasitic infection in preschool and school age Ethiopian children a systematic review and meta analysis, *Biomed Central public health* 2(3): 2-6.
- Lideta sub city health office, (2019). Three year health and communication bulletin, Addis Ababa Ethiopia, 1(1):2-4.
- Lilly M. Verhagen *et al.*, (2013). Significant Associations with Intestinal Parasites and Anemia. *plos one* 8(10):7-9.
- LR. Pullan and SJ Brooker (2012). The global limits and population at risk of soil transmitted helminth infections. *Parasit Vectors*; 5(81):1-15.
- Lwanga Francis, Barbara Eva Kirunda and Christopher Garimoi Orach, (2012). Intestinal Helminth Infections and Nutritional Status of Children Attending Primary Schools in Wakiso District, Central Uganda *Int. J. Environ. Res. Public Health*,2(8):1-9.
- Mastewal Zenebe, Samson Gebremedhin, Carol J. Henry and Nigatu Regassa (2018). School feeding program has resulted in improved dietary diversity, nutritional status and class attendance of school children. *Italian Journal of Pediatrics* 44(16): 1-7.
- Ming Guan and Bingxue Han (2019). Association between intestinal worm infection and malnutrition among rural children aged 9–11 years old in Guizhou Province, China, *Biomed Central Public Health* 12(22):3-8.
- Ministry of Health (2016/17). Health and Health Related Indicators. Planning and Programming Department, FMOH, Addis Ababa, Ethiopia, 1(1):2-4.
- Mohammad Javad Abbaszadeh Afshar , Maryam Barkhori Mehni, Mostafa Rezaeian, Mehdi Mohebali Vali Baigi, Somayeh Amiri, Mohammad Bagher Amirshakari, Ruhollah Hamidinia And Mohammad Samimi (2020). Prevalence And Associated Risk Factors Of Human Intestinal Parasitic Infections: A Population-Based Study In The Southeast Of Kerman Province, Southeastern Iran *Biomed Central Infectious Diseases*, 20(12):1-4.
- Mulumebet Tadesse, Beyene Dobo and Melese Birmeka (2019). Prevalence and associated risk factors of intestinal parasitic infections among school children in Bamo no. 2 primary school, Adele town, East Arsi, Ethiopia. *Sub-Saharan Afr J Med*; 6(12) :77-85.
- Nam Linh Nguyena, Bizu Gelayea, Nigusu Aboset, Abera Kumie, Michelle A. Williams, and Yemane Berhane (2012). Intestinal Parasitic Infection and Nutritional Status among School Children in Angolela, Ethiopia *J Prev Med Hyg.*, 53(3): 157–164.

- NCHS (National Center for Health Statistics) (1974) Growth Curves for Children Publication. 11(33):78-160.
- Nutrition assessment, counseling and support (NACS), (2016) reference manual for training health facility based service provider's dar es selam, Tanzania, 3(2):5.
- Osei A., houser,R., Bulusu, s., joshi, t., and Hamer,d. (2010). Nutrition status of primary schoolchildren in Garhwali Himalayan villages of Indian. Food and nutrition bulletin, 1(31):222-233.
- Papier K., Gail M., Wiliams, Ruby Luceres-Catubig, Faruk Ahmed, Remigio M. Olveda, Donald P. Mcmanus, Deli Achy, Thoa N,P. Chua, Darren J.Gray, Allen G.P. Ross (2014). Childhood malnutrition and parasitic helminth interaction clinical infectious disease, *clinical infectious diseases* 59(2):232-243.
- Paula C Hernández, Liliana Morales, Jacqueline Chaparro-Olaya, Diana Sarmiento, Juan Felipe Jaramillo, Gustavo A Ordoñez, Fabian Cortés and Lizeth K Sánchez (2019). Intestinal parasitic infections and associated factors in children of three rural schools in Colombia. *PloS one* 14 (7):9-11.
- Pawlos Reji, Getachew Belay, Berhanu Erko, Mengistu Legesse and Mulugeta Belay (2011) Intestinal parasitic infections and malnutrition amongst first-cycle primary schoolchildren in Adama, Ethiopia *Afr J Prm Health Care Fam Med.*, 3(1):198.
- Rufina N. B. Ayogu, Ifeoma C. Afiaenyi, Edith U. Madukwe and Elizabeth A. Udent BMC Public Health (2018). Prevalence and predictors of undernutrition among school children in a rural South-eastern Nigerian community: a cross sectional studies 18(587):9-12).
- S Sai Teja, SR Swarna, D Jeyakumari and Vignesh Kanna (2020). A study on intestinal parasitic infections among school children in Karaikal *Tropical Parasitology* 10 (2): 79-81.
- Séverine Erismann, Astrid M. Knoblauch, Serge Diabougua, Peter Odermatt, Jana Gerold, Akina Shrestha, Grissoum Tarnagda, Boubacar Savadogo, Christian Schindler, Jürg Utzinger, and Guéladio Cissé, (2017) Prevalence and risk factors of undernutrition among schoolchildren in the Plateau Central and Centre-Ouestmregions of Burkina Faso *Infectious Diseases of Poverty* 6(17):1-6.
- Solomon Muluken Ayehu and Addisu Tadesse Sahile (2021) Body Mass Index and Associated Factors of School Absenteeism by School Feeding Program at Selected Primary Schools in Addis Ababa, Ethiopia: A Comparative Study. *Hindawi Scientifica* Article ID 6671468, 2(3): 1- 7.

- Srivastava A, Mahmood SE, Srivastava PM, Shrotriya VP, Kumar B. (2012). Nutritional status of school-age children, a scenario of urban slums in India. *Arch Public Health*. 70(8):10.
- T H Jafar, Z Qadri, M Islam, J Hatcher, Z A Bhutta, N Chaturvedi (2014) Rise in childhood obesity with persistently high rates of undernutrition among urban school-aged Indo- Asian children *Biomed Central Journals Arch* ;12(93):373–378.
- Tamirat Hailegebriel (2017). Prevalence of intestinal parasitic infections and associated risk factors among students at Dona Berber primary school, Bahir Dar, Ethiopia. *Biomed Central infectious diseases*, 17(1):362.
- The Federal Democratic public of Ethiopia (FDRE), (2008). National Nutrition Strategy Federal Ministry of Health Addis Ababa, Ethiopia, 1(1):28.
- Tilahun Alelign, Abraham Degarege and Berhanu Erko (2015). Soil-Transmitted Helminth Infections and Associated Risk Factors among Schoolchildren in Durbete Town, Northwestern Ethiopia. *J.Parasitol* 32(221):13-4.
- TS Chandrashekhar, HS Joshi, M Gurung, SH Subba, MS Rana, PG Shivananda(2020). Prevalence and distribution of intestinal parasitic infestations among school children in Kaski District, Western Nepal. *College of Medical Sciences, University of Benin*, 11(224):1-7.
- Tsega Teshale, Shewaye Belay, Desalegn Tadesse, Abraham Awala and Girmay Teklay (2018) Prevalence of intestinal helminths and associated factors among school children of Medebay Zana wereda; North Western Tigray, Ethiopia *Biomed Central* 11(444):10.
- United Nations Children’s Funds (UNICEF) (2012). The situation of boys and girls in Ethiopia, 1(1):15.
- United Nations Children’s Funds (UNICEF), (2013). Improving Child Nutrition: The achievable imperative for global progress, New York, 2(11):16.
- United Nations Children’s Funds (UNICEF), World health organization (WHO) and World Bank group (2019). Level and trends in child malnutrition, 4(12):1-11.
- United Nations Children’s Funds (UNICEF): (2015) for every child every right special session on children documents and the convention on the rights of the children. New York. 9(12):19.
- Vincent P Gyang et al., (2019) Intestinal parasitic infections: current status and associated risk factors among school aged children in an archetypal African urban slum in Nigeria *Journal of Microbiology, Immunology and Infection* 52 (1): 10-13.

- World Health Organization (2018). Soil-transmitted helminthes; eliminating soil-transmitted helminthes as a public health problem in children, 12(120):3-12.
- World Health Organization (WHO) (2010) part 1: health-related millennium development goals, Geneva. 3 (11): 22-31.
- World health organization (WHO) (2012). Soil transmitted helminthes. From www.who.int/intestinal_worms/en/ (Accessed on June 10, 2021).
- World Health Organization (WHO) (2013). Neglected tropical diseases: prevention, control, elimination and eradication: report by the Secretariat. World Health Organization, <https://apps.who.int/iris/handle/10665/78631> (Accessed on June 10, 2021).
- World Health Organization (WHO) (2019). Fact Sheet, Soil-Transmitted Helminthes Infections, Geneva, Switzerland, 3(11): 1-13.
- World Health Organization (WHO) (2020). Global distribution and prevalence of soil transmitted helminthes infections. Geneva: World Health Organization key fact sheet, 10(10): 1-13.
- World Health Organization (WHO) 2008. Training Course on Child Growth Assessment. Geneva, Switzerland 2(5):12-19.
- World Health Organization (WHO) Guideline (2017). Preventive chemotherapy to control soil-transmitted helminthes infections in at-risk population groups. Geneva, Switzerland. Licence: CCBY-NC-SA 3.0 IGO 4(5):1-8.
- World Health Organization (WHO). (1994). Kato Katz technique, bench aids for diagnosis intestinal parasites, 1(1): 1-14.
- Yafet Kesete, Huruy Tesfahiwet, Ghimja Fessehaye, Yohana Kidane, Yafet Tekle, Asmerom Yacob, and Biemnet Seltene (2020). Assessment of Prevalence and Risk Factors for Intestinal Parasitosis, Malnutrition, and Anemia among School Children in Ghindae Area, Eritrea, *Journal of Tropical Medicine*, 2(12):10.
- Yamuna Rajoo, Stephen Ambu, Yvonne Ai Lian Lim, Komalaveni Rajoo, Siew Chang Tey, Chan Woon Lu and Romano Ngui, (2017). Neglected Intestinal Parasites, Malnutrition and Associated Key Factors: A Population Based Cross-Sectional Study among Indigenous Communities in Sarawak, Malaysia Neglected Intestinal Parasites, *PLoS ONE* 12(1): 6.
- Yeshalem Mulugeta Demilew and Azezu Asres Nigussie (2020) The relationship between school meals with thinness and stunting among primary school students, in Meket Wereda,

Ethiopia: comparing schools with feeding and non feeding program. *Biomed Central Nutrition* 6(34):1-10.

Yirgalem G/hiwot, Abraham Degarege and Berhanu Erko, (2014). Prevalence of Intestinal Parasitic Infections among Children under Five Years of Age with Emphasis on *Schistosoma mansoni* in Wonji Shoa Sugar Estate, Ethiopia, *Plos ONE* 9(10):2-4.

Zelege Mekonnen, Derartu Hassen, Serkadis Debalke, Abebaw Tiruneh, Yaregal Asres, Legesse Chelkeba, Endalew Zemene and Tefera Belachew (2020). Soil-transmitted helminth infections and nutritional status of school children in government elementary schools in Jimma Town, Southwestern Ethiopia *SAGE Medicine* 8(12): 1–10.

APPENDICES

Appendix I: Information Sheet and Informed Consent Form

Participant Information Sheet and Informed Consent Form

Hello, my name is _____ I am working as a data collector for the study being conducted in this school by Addis Ababa University college of Development Studies Center for Food Security. I kindly request you to lend me your attention to explain you about the study and being selected as the study participant.

All the information, which you are being, asked to provide in this questionnaire will be kept strictly confidential and will be used only for study purposes. The interview is voluntary and you have the right to participate or not to participate or to refuse any time during the interview. Your refusal will not have any effect on study. However, your participation is important to full fill the study purpose.

I hope that you will be frank and honest in providing answers to the following questions:

Do you agree to answer the following questions to the best of your ability?

Yes **No**

If your answer is yes, please continue responding to the interviewer,

Thank you in helping for this important study.

Date: ____ / ____ / _____

Signature: _____

Addis Ababa University college of Development Studies Center for Food Security.

Tel: +251-111-54-41-94

Email: cdc@aau.edu.et

Web: WWW.aau.edu.et/cds

Appendix II Questionnaire

Questionnaire for Undernutrition and intestinal Parasite among primary School Children in Lideta sub city, Addis Ababa, Ethiopia.

Name of the interviewer _____ Date: _____

Name of the School _____ Study code _____

The purpose of this research is to assess the prevalence of Undernutrition and Infection Parasite in the primary School; I would like to ask questions in this respect.

I. Socio-demographic characteristics of the study participants

No	Question	Coding Categories
101	Age	(_____)
102	Sex	1.Male 2.Femal
103	Grade	(_____)
104	Educational status of the mother	1. Cannot Read And Write 2. Read and Write 3. Primary 4.Secondary and above
105	Educational status of the father	1. Cannot Read And Write 2. Read and Write 3. Primary 4.Secondary and Above
106	Occupation status of the mother	1. Government Employee 2. Privet Business 3. House Wife 5. Other Specify(_____)
107	Occupation status of the father	1. Government Employee 2. Privet Business 3. House Wife 5. Other Specify(_____)
108	Household income	(_____)
109	Family size of the household	(_____)
110	Do You Use Feeding Program in School	1. Yes 2. No

I. Environmental and sanitation related characteristics of the study participants

No	Question	Coding Categories
201	Source of drinking water	1. Pipe 2. Water Tank 3. Splash(Filter)
202	Do you wash your hands regularly before the meal?	1. Yes 2.No
203	Do you wash your hand regularly after visiting latrine?	1. Yes 2.No
204	Fingernail trimmed at the time of data collection.	1. Yes 2. No
205	Do you eat regularly unwashed fruit and vegetables?	1. Yes 2.No
206	Do you eat regularly uncooked vegetables?	1. Yes 2.No
207	Deworming history in the last one month?	1. Yes 2. No
208	Do you have information about intestinal parasitic infection?	1. Yes 2. No

II. Anthropometry characteristics of the study participant

301	Height	(_____)
302	Weight	(_____)

III. LABORATORY FINDINGS

401	1. Result of microscopic examination	1. No Ova or Parasite 2. T. Trichiura (whipworm) 3. A. Lumbericoides (roundworm) 4. A. Dodunale (Hookworm) 5. G. Lambilia (Blood flukes) 6. E. Histolytica 7. Other(Specify)_____
-----	--------------------------------------	---

Appendix III:

በ አማርኛ ትረጉም የተዘጋጀ የመረጃ መሰብሰቢያ መጠይቅ

ከመጠይቁ በፊት የተጨማሪውን ስምምነት ማረጋገጫ ቅፅ፡፡

ስላምታዬን እያቀረበኩ! ስሜ _____ እባላለሁ እኔ መረጃ ስብሰቤ ስሆን በዚህ ትምህርት ቤት ውስጥ በአዲስ አበባ ዩኒቨርሲቲ በሀገር ልምትና ምግብ ዋስትና ኮሌጁ ጥናት የሚከናወን ስሆን ይህንን ጥናት በምግብ እጥረት የተጎዱ ህፃናት የምን የክልል በሆድ ጠገኛ ትልትል የተቃሉ በሚል ከዚህም ጋራ ተያይዞ የጤና ችግሮችን የሚያሳይ መረጃ ለመስብስብ ሲሆን የጥናቱን ውጤት እንደመነሻ በመጠቀም በመንግስት እና በባለድርሻ አካላት በኩል የሚወጡ ፖሊሲዎች፣ ህጎች የሚሻሻሉበትን ምንገድ እና የህፃናት ጤንነትን ለማሻሻል የሚያስችል ዜድን ለመፍጠር ነው፡፡

ሁሉም በዚህ መጠይቅ ውስጥ የምትመሳቸው መረጃዎች በሚገባ ሚስጥር ይያዛሉ የስጡትም መረጃ ጥቅም ላይ የሚውልው ለዚህ ጠናት ብቻ ይሆናል፡፡ ቃለመጠይቁ ፍቃደኝነት ላይ የተመሰረተ ሲሆን እርሶዎ በጥናቱ ውስጥ የመሳተፍ ያለመሳተፍ መብትዎ የተጠበቀ ነው፡፡ በጥናቱ ውስጥ አልሳተፈም በማለዎ እረሶ እና ቤተሰብዎ በትምህርት ቤቱ ውስጥ በሚያገኙት አገልግሎት ላይ ምንም አይነት ተፅዕኖ አይኖረውም ነገረግን በጥናቱ ተሳታፊው የሚሰጡትን መረጃ የጥናቱ አላማ ለማሳካት እና በህፃናት ላይ የሚድረስውን የጤና ችግር ለመፍታት እና ለውጥ ለማምጣት ከፍተኛ ጠቀሜታ አለው፡፡

እባክዎን በዚህ ጥናት ለመሳተፍ ፍቃደኛን ሆኑ ወይስ አይደሉም?

- 1.አዎ 2.አይ

መልስዎ አዎ ከሆነ ጥያቄውን መመለስዎትን ይቀጥሉ

በአጠቃላይ በዚህ ጠቃሚ ጥናት ስለረዱን ክልብ እናመሰግናለን!!!

ቀን: / _____ /ዓ.ም ፊርማ: _____

ጥናቱን የሚሰራው ባለቤት አድራሻ:

ሞባይል ስልክ: +251919155566 ኢሜል: eyuelb1@gmail.com

አዲስ አበባ ዩኒቨርሲቲ ሀገር ልምት ኮሌጁና የምግብ ዋስትና ማዕከል

ስልክ ቁ: +251-111-54-41-94 ኢሜል: cdc@aau.edu.et

ዌብ: WWW.aau.edu.et/cds/

Appendix IV

በአማራጭ የተዘጋጅ የተመጣጠነ ምግብ እጥረትና አንጀት ጥጆች ትላትል በልደታ ክ/ከተማ በአንደኛ ደረጃ ት/ቤት ተማሪዎች ላይ የሚያሳይ መጠይቅ አዲስ አበባ፣ ኢትዮጵያ.

መረጃ ሰብሳቢ ስም: ቀን: _____ / _____ / _____ 9.ም

የት/ቤቱ ስም: ቀን: _____ / _____ / _____ 9.ም

ክፍል 1: ማህበራዊና የሥነ-ምጣኔ መጠይቆች

እባክህህን የሚከተሉትን ጥያቄዎች ከልብህህ ሆነው እንዲመልሱልን በማክበር እንጠይቃለን

ተቁ	ጥያቄዎች	የጥያቄው ኮድ
101	እድሜ?	(-----)
102	ጾታ?	1.ወንድ 2.ሴት
103	ስንተኛ ክፍል ነሽ/ነህ?	(-----)
104	የእናትህ የትምህርት ደረጃ?	1.ያልተማረች 2.ማንበብና መጻፍ የምትችል 3.የመጀመሪያ ደረጃ የተማረች 3.ሁለተኛ ደረጃ የተማረች
105	የአባትህ የትምህርት ደረጃ?	1.ያልተማረች 2.ማንበብና መጻፍ የምትችል 3.የመጀመሪያ ደረጃ የተማረች 3.ሁለተኛ ደረጃ የተማረች
106	የእናትህ የስራ ሁኔታ?	1.የመንግስት ተቀጣሪ 2.የግል ተቀጣሪ 3.የቤት እመቤት 4.ሌላ ካለ (-----)
107	የአባትህ የስራ ሁኔታ?	1.የመንግስት ተቀጣሪ 2.የግል ቢዝነስ 3.ስራ የሌለው 4.ሌላ ካለ (-----)
108	የቤተሰቡ የወር ገቢ?	(-----)
109	የቤተሰብ ብዛት?	(-----)

110	የትምህርት ቤት ምገባ ተጠቃሚነት/ነህ?	1.አዎ	2.አይ
-----	--------------------------	------	------

ክፍል 2 የግል እና የአካባቢ ንጽህና ንጥረያሳዩ መጠይቆች

ተ.ቁ	ጥያቄዎች	የጥያቄው ኮድ	
201	የመጠጥ ውሃ ከየት ነው የምትጠቀሟቸው/መው?	1.ከቧንቧ	2.ከታንክር
		3.ከተጣራ	4.ሌላካለ (--)
202	ምግብ ከመብላትሽ/ህ በፊትና በኋላ ሁል ጊዜ እጅሽን/ህን ትጣጠቢያለሽ/ህ?	1.አዎ	2.አይ
203	ሽንት ቤት ከገባሽ/ህ በኋላ እጅሽን/ህን መሳሙናና በውሃ ሁል ጊዜ ትጣጠቢያለሽ/ህ?	1.አዎ	2.አይ
204	የተማሪው ጥፍር ተቆርጧል?	1.አዎ	2.አይ
205	ያልታጠበ አትክልት ናፍራርሬ ሁል ጊዜ ትበይ/ትበላ ነበር?	1.አዎ	2.አይ
206	ያልበሰሉ አትክልቶችት ሁል ጊዜ በይ/ትበላ ነበር?	1.አዎ	2.አይ
207	የአንጀት ትላትል መድሃኒት በዚህ አንድ ወር ወስደሻል/ወስደሃል?	1.አዎ	2.አይ
208	ስለ አንጀት ጥገኛ ትላትል ከዚህ በፊት ሰምተሽ/ህታ ውቂያለሽ/ህ?	1.አዎ	2.አይ

ክፍል 3 አንትሮፖሜትሪክ ልኬት

301	ቁመት ልኬት?	_____
303	ክብደት ልኬት?	_____

ክፍል 4 የምርመራ ግኝት

401	የማይክሮስኮፕ ምርመራው ጤት	1.አቫ/ፓራሳየት-የሌለበት 2.ቲ.ትሪኪዩሪክ (ዊፕዋርም) 3.ኤ.ሉ.መበሪኮኢድስ (ራውንድዋርም) 4.ኤ.ዶዱናኤል (ሁክዋርም) 5.ጃ.ላምቢላ 6.ኢ.ሂስቶሎጂካ 7.ሌላካለ _____
-----	-------------------	--