ADDIS ABEBA UNIERSTIY SCHOOL OF GRADUTE STUDENT CENTER OF FOOD SCIENCE AND NUTRITION

SCHOOL MEAL NUTRITION ADEQUACY AND NUTRITIONAL STATUS OF SCHOOL CHILDREN IN SELECTED PRIMARY SCHOOLS, ADDIS ABEBA, ETHIOPIA

A THESIS SUBMITTED IN FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF FOOD SCIENCE AND NUTRITION IN THE SCHOOL OF FOOD SCIENCE AND NUTRITION COLLEGE, ADDIS ABEBA UNIVERSITY

BY: NARDOS ALEMAYEHU

ADVISOR: ASSOCIATE PROFESSOR KELBESSA URGA

NOVEMBER 2018

DECLARATION

I, Nardos Alemayehu declare that this thesis is my own work under the supervision of Associate Professor Kelbessa Urga. All the references to other works have been appropriately acknowledged.

NARDOS ALEMAYEHU

Signature:______________________ Date:__________________________

FINAL THESIS APPROVAL FORM

As participants of the Board of Examiners of the final MSc open defence, we declare that we have read and evaluated the thesis prepared by Nardos Alemayehu under the title allowed "SCHOOL MEAL NUTRITION ADEQUACY AND NUTRITIONAL STATUS OF SCHOOL CHILDREN IN SELECTED PRIMARY SCHOOLS, ADDIS ABEBA, and ETHIOPIA" and recommend for the degree of Masters of food science and nutrition.

ADVISORS' AND EXAMINER'S APPROVAL

We confirm that this thesis is submitted with our approval as her advisor and examiner.

ASSOCIATE PROFESSOR KELBESSA URGA - ADVISOR

Signature:______________________ Date:__________________________

DOCTOR ZELALEM DEBEBE – INTERNAL EXAMINER

Signature:______________________ Date:__________________________

DOCTOR AWAKE KEBEDE – EXTERNAL EXAMINER

Signature:______________________ Date:__________________________

// ACKNOWLEDGEMENTS
ACKNOWLEDGEMENTS

First of all I would like to give thanks to the Almighty God who is the source and meaning of my life and the reason to reach here.

I sincerely thank with great respect my advisor Professor Kalbessa Urga of Addis Abeba University 4 Kilo Campus for their tireless effort to assist me through their professional guidance during my thesis work. I wish to thank Dr.Ashagre, Addis Abeba University 4 Kilo Campus for his professional support and guidance during the course of my study.

My thanks and appreciation goes to all the school head and teachers who helped during my data collection and also study subject parents for their willingness. I am also thanking the health extension worker from N/S/L/S/City, Woreda 01 Health Office, Woreda 08 Health Office, and Woreda 12 Heath Center for helping me during data collection time.

All my success would not have happened without the will and help of God and to this I praise and thank Him for all who have impacted on me in one way or the other. May the Lord’s name be glorified forever.

Contents

DECLARATION i
ACKNOWLEDGEMENTS ii
LIST OF TABLES v
LIST OF FIGURES v
ABBREVIATION AND ACRONYMS vi
STANDARD DEFINITION OF TERMS vii
ABSTRACT viii
1. CHAPTER ONE: INTRODUCTION .... - 1 -
1.1. Background of the study .... - 1 -
1.1. Statement of the problem .... - 4 -
1.2. Significance of the study .... - 5 -
1.4. Objective of the study .... - 6 -
1.4.2. Specific objectives .... - 6 -
1.5. Research questions .... - 6 -
2. CHAPTER TWO: LITERATURE REVIEW .... - 7 -
2.1. Introduction .... - 7 -
2.2. Malnutrition and factors affecting nutritional status .... - 9 -
2.2.1. Malnutrition in school age children .... - 9 -
2.2.2. Factors affecting the nutritional status of school age children .... - 12 -
2.3. Consequences of malnutrition in children .... - 15 -
2.3.1. Impairment of physical and cognitive development .... - 15 -
2.3.2. Poor school performance .... - 16 -
2.3.3. Less economic productivity .... - 18 -
2.4. Importance of school meal .... - 22 -
2.5. Improvement area for nutrition status and nutrient adequacy of school age children .... - 23 -
2.5.1. Initiate and promote the awareness of nutrition: .... - 23 -
2.5.2. Develop and activate food fortification programs: .... - 23 -
2.5.3. Strengthen the existing policies: .... - 23 -
2.5.4. Creation of Public-Private partnerships: .... - 24 -
2.5.5. Water, Sanitation and hygiene (WASH) activities: .... - 24 -
2.5.6. Developing a guideline: .... - 24 -
2.6. Methods of assessing dietary adequacy and nutritional status of school age children .... - 25 -

2.6.1. Dietary assessment ....- 25 -
2.6.2. Measurement of nutritional status ....- 25 -
3. CHAPTER THREE: STUDY METHODOLOGY ....- 27 -
3.1. Study design and area..- 27 -
3.2. Study population ....- 27 -
3.3. Inclusion criteria ....- 27 -
3.4. Exclusion criteria ....- 27 -
3.5. Sample size and sampling criteria ....- 28 -
3.5.1. Sampling methods ....- 28 -
3.6. Method of data collections..- 28 -
3.7. Data analysis..- 29 -
3.7.1. Nutritional status of the students..- 29 -
3.7.2. Adequacy of nutrient meal intake ....- 30 -
3.7.3. Dietary diversity Scores..- 31 -
3.8. Ethical and human subject's issues ....- 33 -
4. CHAPTER FOUR: RESULTS AND DISCUSSIONS..- 34 -
4.1. Results ....- 34 -
4.1.1. Socio-demographic description of the study subject and parents ....- 34 -
4.1.2. Nutritional status of the study subjects..- 38 -
4.1.3. Meal composition and dietary diversity scores ....- 44 -
4.1.4. Energy and dietary nutrient adequacy ....- 45 -
4.2. Discussions..- 53 -
4.2.1. Nutrition status of the study subjects..- 53 -
4.2.2. Adequacy of nutrient intake and dietary diversity score ....- 54 -
4.2.2. Dietary Diversity Score of the study subjects..- 56 -
5. Conclusions and Recommendations..- 56 -
5.1. Conclusions..- 56 -
5.2. Recommendations..- 57 -
6. Limitation of the study and data weakness ....- 58 -
References..- 59 -
APPENDIX..- 66 -
APPENDIX 1) Parent consent form in English and Amharic ....- 66 -
APPENDIX 2) 24-dieatry recall form in English and Amharic ....- 68 -
APPENDIX 3) WHO Growth charts– Height-for-age & BMI-for-age......................................- 70 -

LIST OF TABLES

Table 1: Nutritional status of school age (10-13) children in Ethiopia..- 11 -
Table 2: Sample size determination ....- 28 -
Table 3: Food groups to assess the DDS of an individual as per FAO 2011 ....- 32 -
Table 4: Socio-demographic characteristics of the study subject and parents ....- 35 -
Table 5. Anthropometric measurement of the study subjects at LPS...- 38 -
Table 6: Anthropometric measurement of study subjects at APS...- 38 -
Table 7: Anthropometric measurement of the study subjects at HPS..- 39 -
Table 8: Prevalence of malnutrition of the study subjects ....- 44 -
Table 9: Breakfast consumption of the study subject on Saturday and Sunday at home ....- 46 -
Table 10: Meal consumption of the study subject at home during weekend.................................- 46 -
Table 11: Home meal nutrient dietary intake of the study subjects (After school and dinner).....- 47 -
Table 12: Weekly Menu of the School Feeding Program..- 48 -
Table 13: Nutritional value of the five days school meal..- 50 -
Table 14: RDA % from the school meal dietary intake of the study subject ....- 51 -
Table 15: RDA % from school meal...- 51 -
Table 16: RDA % of the school meal and home meal ....- 52 -

LIST OF FIGURES

Figure 1: Students repetitions rate by nutritional status ....- 17 -
Figure 2: Students repetitions rate associated with stunting ....- 18 -
Figure 3: Causal framework for child malnutrition...- 20 -
Figure 4: Social and Economic Impact of Child Under nutrition ....- 21 -
Figure 5: Cut-off points of percentile and Z-scores ....- 30 -
Figure 6:Income status of targeted households per month in ETB...- 36 -
Figure 7: Occupation of the study subject parents ....- 37 -
Figure 8: Analysis of nutritional status of the study subjects in all schools ....- 39 -
Figure 9: Nutritional status of the study subject for age group 4-6 years old ....- 40 -
Figure 10: Nutritional status of the study subject for age group 7-10 years old ....- 41 -
Figure 11: Nutritional status of the study subject for age group 11-14 years old ....- 42 -
Figure 12: Food groups consumed in the past 7 days (7 day 24-hour recall)...- 45 -

ABBREVIATION AND ACRONYMS

APS	-	Agazian No. 2 Primary School
BMI	-	Body Mass Index
DDS	-	Dietary Diversity Score
DHS	-	Demographic Health Survey
FAO	-	Food and Agricultural Organization
FVS	-	Food Variety Score
FFQ	-	Food Frequency Questionnaires
HEW	-	Health Extension Worker
HPS	-	Hana Primary School
IDA	-	Iron Deficiency Anemia
IDD	-	Iron Deficiency Disorder
LPS	-	Lafto Primary School
N/S/L/S/C	-	Nifas Silk Lafto Sub City
SSA	-	Sub-Saharan Africa
SD	-	Standard Deviation
SFP	-	School Feeding Program
RDA	-	Recommended Dietary Allowance
WASH	-	Water, Sanitation and Hygiene
WHO	–	World Health Organization
WFP	-	World Food Program
UNICEF	-	United Nations Children’s Fund
USDA	-	Untied State Department of Agriculture

STANDARD DEFINITION OF TERMS

Mal-nutrition - Indication of nutritional status for under nutrition, over nutrition and micronutrient deficiency of an individual

Wasting - Indication of nutritional status for acute or short term malnutrition (emergency situation) of an individual

Stunting - Indication of nutritional status for chronic or long term malnutrition (development) of an individual

Underweight - Indication of nutritional status for both acute and chronic malnutrition (nutritional trends) of an individual

ABSTRACT

Background: School children malnutrition is unresolved public health issues especially in developing countries which creates negative intergenerational consequence as of a mother who affected by malnutrition can give birth a child with malnutrition problem and it continue the next generation too . Even though the school is a good setting to provide health and nutrition services to vulnerable school children, most of the time school-age children didn't get a chance to be included in health and nutrition surveys. Therefore, this study is conducted to assess the adequacy of school meal and nutritional status of the children in order to do effective intervention for the most vulnerable children.

Objective: The aim of this study was to assess the dietary intakes and nutritional status of School Children participating in Non-Government Organization sponsored school feeding programme in three Primary Schools in Nifas Silk Lafto Sub City Addis Ababa Ethiopia.

Methodology: A sample of 176 school children, aged 4-15 years was selected to conduct the study. A cross sectional survey was used to obtain data from 176 school age children and parents. The 7 days24-hour dietary recall method was used to collect data of the children's dietary intakes. Nutrient intake adequacy analysis is done based on Ethiopia Food Composition Table, United States of Agriculture Nutrition data base and other recognized website. Children's anthropometric measurements were taken and analysis were computed using WHO Anthro and WHO Anthro-plus software to assess the children nutritional status.

Results: The result of the anthropometry assessments shows that 26% stunted; 16 % underweight; 2% overweight and 56 % normal in participated children. The result for nutrient intake adequacy revealed that Energy 59%, Protein 127 %, Fat 132%, Calcium 39%, Iron 71%, Iodine 118 %, Vitamin A 83 %, Vit.B1 95 %, Vit.B2 72 %, Vit.B3 178 % and Vit.C 232 %. This shows only calcium content is below 50 % of the RDA and Energy is inadequate, except calcium and energy the rest met the RDA % for the day.

Conclusion: It can be concluded that school children nutrition status can be improved with a little efforts by providing adequate and recommended health and nutrition intervention. The school meal needs some adjustment in order to provide the meal by adding all type of food groups to keep the dietary diversity score balance.

Key Word: School children, Malnutrition, nutrient adequacy, nutritional status, anthropometry

1. CHAPTER ONE: INTRODUCTION

1.1. Background of the study

Due to poverty and food security problem of the family children will be exposed to inadequate diet and frequent infections which can lead them to malnutrition. Inadequate food intake and the dietary quality of the child affect the nutritional status (Ma'alin, Birhanu, 2016). It is known that good health and nutrition has direct impact on child educational achievement, growth and development. That is why there is a continuing effort to eradicate malnutrition problem (Ma'alin, Birhanu, 2016).

Worldwide malnutrition is a children public health concern especially among under five and school age (Awel & Hebo, 2016). Study shows that globally, there were 165 million stunted, 99 million underweight, and 51 million wasting children in 2012 (Endris & Dube,2017).

The vulnerability of childhood malnutrition increases in developing countries which have a problem of resource limitation. For school age children malnutrition has a negative consequence like low school performance, school absenteeism, poor performance and early school dropout. On the other hand healthy and nourished children have better school performance and will be productive adults as they grow for the economic growth of a nation (Bronner, E. A. 2015).

Child malnutrition continues to be the leading public health problem in developing countries and its effect is long lasting and goes beyond childhood such as decreases the educational achievement and labor productivity and raises the risk of chronic illnesses in later age (Endris & Dube, 2017).

In Ethiopia child malnutrition is still a public health issue (Awel & Hebo, 2016). Nutrition is a very basic need which has intergenerational positive and negative impacts on the life of individual. School age children if they couldn't meet their nutritional need will suffer and be unable to use their full genetic developmental potential (FirehiwotMesfin, 2014). They are the future hope of any country and if they get well nourished, they can make optimal use of their skills, talents and energies today, as well as be healthy and responsible citizens and parents of healthy babies tomorrow (Awel & Hebo, 2016).

On the other side they are easily exposed for malnutrition and for its consequences, because it is the dynamic period of physical growth and mental development (Awel & Hebo, 2016).

Study shows that in 2010, the global prevalence of malnutrition among school-age children as indicated by the prevalence of stunting, was approximately 28% (171 million children), with Eastern Africa suffering a higher rate of 45% (Hall & Kassa, 2008).

Even though there is a high effort to eradicate malnutrition, some studies which are done on the nutritional status of school age children in different region of Ethiopia showed that the prevalence of under-nutrition ranges between 23.3%-50% which shows under-nutrition as unresolved problem in Ethiopia in 2008 (Hall & Kassa, 2008;Mekasha & Zerfu 2009; Reji, P., &Belay, G.2011).

Schools are practical places to provide multiple health and nutrition intervention programs such as nutrition and health education, different nutrition and health services, providing nutritious meal and supplementation of micronutrients in order to improve the health and nutrition of school age children (Handa & Ahamad, 2008). Nutritional status and their knowledge on nutrition have great impact on students' health, cognition, performance, food choice and finally their achievements on education (Handa & Ahamad, 2008). So that the school is the best place to create and provide opportunities for the students in order to gain sufficient knowledge about nutrition (Handa & Ahamad, 2008).

Nutritional status is the state of an individual health which is affected by nutrient intake and utilization of the body. To keep the health of the children the food intake must play a role in order to provide sufficient energy and nutrients to promote optimal physical, social, cognitive growth and development. Inadequate energy and nutrients affects negatively and results in poor outcomes including growth retardation, iron deficiency anemia, poor academic performance and development of psychosocial difficulties (TUNJE, DR DORCAS SUPA).

There are several health and nutrition intervention services in developing countries, including Ethiopia, but there is a gap regarding the knowledge of nutritional status of school age children(Awel & Hebo, 2016).Nutritional status of children can be an indicator of the overall health, development and growth condition(Hart, K.&H., Bishop, 2002).

School-based nutrition and health intervention has a power to cover 100% school age children which are from different families, culture, socioeconomic status, religion and ethnicity. As a result, it can create effective nationwide change through the children by promoting healthier and nutrition behaviours and also by creating good dietary habits. Well planned nutrition education and influence on food choice in schools has positive impacts for school age children food choice (Ara, R.& Hoque, S. 2011).

Even-though, the school is a good setting to provide health and nutrition services to vulnerable children, school-age children didn't get a chance to be included in health and nutrition surveys and an up-to-date overview of their nutritional status across the world is not available (Berkman, D. S. 2002; Kuklina, E. V 2006;Walker, S. P 20017; Uauy, R., 2008; Theron, M.,2017; Srivastava, A.,2012). In developing countries including Ethiopia, nutritional problems and infectious diseases are common related concern and also nutritional status of school age children is not yet improved and there is no clear study about their status (Herrador, Z, 2014).

This study is therefore conducted to assess the adequacy of the school meal and the nutritional status of the children in selected primary schools at Nifas Silk Lafto Sub City (N/S/L/S/C) Addis Ababa. These results could be used to design and develop measures targeting school children to improve their nutritional status and meal planning for school menu in School Feeding Programs (SFP).

1.1. Statement of the problem

It is known that malnutrition problem is a nutritional and health concern around the world which can cause negative intergenerational consequence on human health, growth, economy, educational and work performance. Studies show that school age children who are affected by malnutrition have poor school performance, inhibited physical and mental development. Malnourished students have impaired intellectual achievement which can lead to poor work capacity and efficiency when they reach to adulthood (Best, C. & Neufingerl, N. 2010;Ara, R.& Hoque, S. 2011).

Improving school age children' nutritional status and adequate nutrient intake have positive impact on their school performance, achievements, and future work capacity as a result it creates health and effective generation. To improve the nutritional status, to implement evidence-based nutrition intervention program and solve any nutritional problem, baseline and clear data regarding school meal adequacy in SFP as well as home food intake and nutrition status of the school age children is important.

This study will assess the school meal nutrient adequacy of the SFP and the nutritional status of the school children in the selected primary schools who are enrolled in Non-governmental SFP in order to provide good inputs for the developments of nutrition interventions on the study area.

1.2. Significance of the study

Childhood and adolescence are critical stages for providing the basic nutritional support which gives a good result in their overall development and also in later life.

For the planning of effective intervention regarding solving malnutrition problem in the school age children their nutritional status and the underlining cause of malnutrition need to be studied.

This study can generate evidence for different stakeholders such as health, education, agricultural and other sectors to design effective school meal menu and to formulate nutrition related standards, policy and rules. Assessing the adequacy of the nutrient intake is also important for the formulation of guideline for nutrient intakes.

Therefore assessment of growth is the typical measurement that best defines the nutritional and health status of children, and also gives additional information which indicates an indirect measurement of the quality of life of the entire population.
Moreover, assessing the nutritional status of a child can serve to identify children who need nutritional intervention and to stop future negative results in their nutritional status and improve their school performance. It is also helpful to identify the potential and critical nutrients deficiencies and to show the gaps to stakeholders in order to support the vulnerable children with the right intervention.

Therefore, the present studies aimed to determine the nutritional status and nutrient intake adequacy of school aged children (5 - 18 years) attending government schools in Addis Ababa Ethiopia.

1.4. Objective of the study

1.4.1. General objectives

- To assess the nutrient adequacy of school meal in SFP
- To assess the nutritional status of the school children

1.4.2. Specific objectives

- To provide data on nutritional status of the study subjects for improved nutritional intervention program

1.5. Research questions

- What is the nutrient adequacy the school meal in SFP and nutritional status of the study subjects in selected schools who are involved in private school feeding program?
- Are the study subjects mal nourished?
- Do the study subjects have adequate nutrient intake from the feeding program as well as their homes?

2. CHAPTER TWO: LITERATURE REVIEW

2.1. Introduction

Nutrition is a basic and key factor for overall children growth and development. It is crucial and essential during childhood to meet the need for healthy growth, proper organ formation and function, a strong immune system, and neurological and cognitive development (Thomson, I. S. I. 2017).

Globally, malnutrition is a serious public health concern for the school age child. Studies show that more than 200 million school age children are stunted and underweight (Abdelaziz &Youssef, 2015). As a result about one billion school children will be growing up by 2020with impaired physical and mental development (Abdelaziz &Youssef, 2015).

According to a report made by World Food Program (WFP) around 170 million children are affected by stunting due to lack of nutritious food and with added cause like infection and illness (Abdelaziz &Youssef, 2015).Under-nutrition by itself was a reason for the death for more than one-third of children globally, and has an impact for the occurrence of around 11 percent of the global burden of diseases (Ochola, S., & Masibo, P. K. 2014).

The health, physical growth, development and educational performance of schoolchildren depend largely on good nutrition (Hillier, S. L., &Nugent, R. P, 1995).Because of the positive relationships between malnutrition and disease, malnutrition has a major impact on children's survival mainly (Thomson, I. S. I. 2017). It is more prevalent in low and lower-middle income countries (Ochola, S., & Masibo, P. K. 2014).

Good nutrition during school age helps to develop a stronger immune system, mental and physical growth, prevent infections and illness, better academic scores, better health and thus a more productive community; therefore children must get a diet which is nutritionally adequate (Chen, R. S.& Bender, W. H. 1990).

Globally, regarding the size of population, school-age children hold a considerable portion, and more than three quarters of these children are living in developing counties. The childhood period is the foundation for good adult health as children go through physical, emotional and social changes and also a time to lay down good foundation for the future generation (Hillier, S. L., &Nugent, R. P, 1995).

The growth speed during school-age period is marked as rapid growth stage, which is the very noticeable first sign in the form of growth spurts. It is known as the first growth spurt or preadolescent or mid growth spurt which is seen around 6-8 years of age. Then next follows the adolescent growth spurt that occurs between 10-17 years of age (Chen, R. S.& Bender, W. H. 1990).

Both growth spurts of the preadolescent and the adolescent have extra demands on nutritional requirements. Therefore, proper food and good nutrition are essential for physical growth, sexual maturation, mental development, academic performance, good health, and well-being of adolescents (Chen, R. S.& Bender, W. H. 1990).

Children in the age group of 6-14 years are the future generation of any country and their nutrition needs are critical for the wellbeing of the society (Chen, R. S.& Bender, W. H. 1990). The school age period is nutritionally significant because this is a crucial time to lay the foundation for good health and sound mind and also build up body stores of nutrients in preparation for rapid physical growth and mental development (Best, C. & Neufingerl, N. 2010;Abdelaziz &Youssef, 2015;Ochola, S., & Masibo, P. K. 2014; and Chen, R. S.& Bender, W. H. 1990).

In developing countries it is indicated that poverty and ignorance are primary cause factors of malnutrition (Ochola, S., & Masibo, P. K. 2014). In Ethiopia, household food insecurity, hunger and under-nutrition remain critical issues; the poor nutritional status of children has been a consistent problem (You, D. and Hug, L2015).

In addition to poverty and ignorance, overpopulation which is seen in developing countries, has a negative impact on food insecurity as a result it can reduce food adequacy, leading to inadequate food intake or intake of foods of poor nutritional quality and quantity (Ochola, S., & Masibo, P. K. 2014).

The school is an opportune setting to provide health and nutrition services to disadvantaged children (Abdelaziz &Youssef, 2015). One of the health and nutrition intervention service which can be implemented in the school to avoid malnutrition and hunger is the school feeding program (Ochola, S., & Masibo, P. K. 2014).

It is an excellent opportunity to offer targeted and effective intervention for school age group and also it can meet directly the Millennium Development Goal 1 and 2: “Eradicate extreme poverty and hunger, and to achieve universal primary education”(Ochola, S., & Masibo, P. K. 2014).

Even-though, It is very important to know the nutritional status of school going children because they are the building blocks of state and country but they are not commonly included in health and nutrition surveys and an up-to-date overview of their nutritional status across the world is not available (Abdelaziz &Youssef, 2015).

2.2. Malnutrition and factors affecting nutritional status

2.2.1. Malnutrition in school age children

Malnutrition in school age is a serious issue now days especially in developing countries. As one study shows, if nutritional intervention will not take place on time, about one million school children will be growing up by 2020 with impaired physical and mental development (Rawe, K. 2012).

Under-nutrition is a major public health problem among children in Ethiopia. Chronic malnutrition constitutes 80% of all forms of malnutrition, and it continues to cause irreversible consequences on children’s physical and mental health. It is estimated that 38% of all Ethiopian children are stunted from the effects of chronic malnutrition (FAO/WHO No. 952, 2009). Such children are more likely to develop severe infections secondary to compromised immune responses, which is further compounded by the high prevalence of bacterial and parasitic diseases, thus aggravating malnutrition among children. In Ethiopia malnutrition contributes to over half of child deaths (FAO/WHO No. 952, 2009). Ethiopia has the second highest rate of malnutrition in Sub-Saharan Africa (SSA) (Herrador, Z, 2014; Asfaw, M., Wondaferash, M. 2015).

Malnutrition manifests in different forms, such as under-nutrition, over-nutrition and micro-nutrients deficiency in children. The malnutrition status which commonly occurs is under-nutrition in the form of wasting, stunting and underweight. United Nations Children’s Fund (UNICEF) reported that about 8 %, 26 % and 16 % of children worldwide suffer from wasting,

stunting and underweight, respectively, and it is higher in developing countries where wasting is 10%, stunting 38% and underweight 23% (Best, C. & Neufingerl, N. 2010)

Currently, the main form of malnutrition which is occurring in Ethiopia is acute and chronic malnutrition, Iron Deficiency Anemia (IDA), Vitamin A Deficiency, and Iodine Deficiency Disorder (IDD) which can be caused by different immediate causes such as poor diet and disease or underlying causes such as family food shortages, inadequate care of children and women, unhealthy environment and poor health services (Degarege, D& Animut, A. 2015).

Globally, it is reported that in 2010, the prevalence of malnutrition among school-age children (5-14 years old) is around 28% which is approximately 171 million children which specifically shows the prevalence of stunting, which is the indicator of chronic malnutrition in children (Hall & Kassa , 2008;Woodhead, & M., Dornan, P. 2013).

In the Eastern Africa, the prevalence rate is higher which around 45%.In Ethiopia study shows that the prevalence of stunting ranges from 9.8-48.1% and wasting 23.3-50% among school age children, which indicate that chronic and acute malnutrition still a serious public health concern (Hall & Kassa , 2008;Woodhead, & M., Dornan, P. 2013;UNICEF, 2014).

According to WFP, school age children are attending their class with empty stomach and hungry, which is estimated to reach around 66 million across the developing countries and out of them 23 million of these children live in Africa alone (Best, C. & Neufingerl, N. 2010).

In Ethiopia, school age children from poorer families and rural area are highly affected by stunting, when we see the effects of stunting ratio between the poor and good one is estimated that 38% to 16% and between the urban and rural estimated that 34% to 21%(UNICEF, 2014). It is also the same with the effect of stunting when we compare the level of wasting which is the sign of short term under-nutrition, children from rural area and poorest families are highly affected by wasting (Woodhead, & M., Dornan, P. 2013; UNICEF, 2014).

It is reported that in Ethiopia, currently more than 2 out of every 5 children are stunted. Around 81% of all cases of child under-nutrition and its related pathologies go untreated. In Ethiopia 28% of all child mortality is associated with under-nutrition.16% of all repetitions in primary school are associated with stunting. Child mortality associated with under-nutrition has reduced Ethiopia’s workforce by 8% (Mramba, L. & Ngari, M. 2017).

Table 1: Nutritional status of school age (10-13) children in Ethiopia

	Stunting (%)		Thinness (%)		Number of food groups eaten		Access to sanitation		Access to water	
	2006	2013	2006	2013	2006	2013	2002*	2013	2002*	2013
Gender										
Male	30.1	27.1	36.5	41.1	3.5	4.0	21.4	63.9	51.8	42.2
Female	30.5	30.9	35.8	41.0	3.7	4.0	22.6	61.8	55.1	48.8
Location										
Urban	20.4	21.4	31.0	34.2	3.8	4.1	35	52.4	84.3	63.0
Rural	36.9	34.1	39.7	45.8	3.4	3.9	15.1	70.2	37.0	33.1
Household wealth level (Young Lives wealth index)										
Bottom Tercile	41.4	37.5	42.4	44.6	3.3	3.9	1.5	67.7	13.4	37.9
Top Tercile	18.1	16.5	33.7	32.5	3.9	4.1	45.6	53.7	88.6	64.5
Caregiver's education										
No education	36.9	35.6	41.0	45.6	3.4	3.9	15.0	65.8	42.7	34.5
Lower primary (grades 1-4)	27.8	25.0	31.8	39.2	3.6	3.9	18.7	62.6	53.2	49.7
Upper primary (grades 5-8)	17.3	19.4	28.3	36.7	4.0	4.1	31.5	56.7	66.3	60.2
More than 8 grade	20.8	17.6	37.0	28.6	4.1	4.3	51.9	57.9	90.1	68.3
Region										
Addis Ababa	10.0	14.3	26.8	27.4	3.8	4.0	18.0	25.4	86.6	59.2
Amhara	43.2	38.1	58.0	59.5	3.3	3.5	13.7	66.8	61.6	49.1
Oromia	25.9	25.4	22.3	33.6	4.2	4.0	25.9	69.3	54.0	65.8
SNNPR	23.9	29.9	26.7	34.9	3.3	4.0	23.1	66.3	34.3	38.3
Tigray	44.2	32.7	46.7	47.9	3.6	4.2	27.7	75.4	44.9	19.8
Average of all children	**30.3**	**28.9**	**36.2**	**41.1**	**3.6**	**4.0**	**22**	**62.9**	**53.4**	**45.3**
Sample size (No. of children)	**967**	**1868**	**970**	**1863**	**903**	**1869**	**1873**	**1871**	**1868**	**1871**

Source: Round 4 Preliminary Findings Preliminary Findings from the 2013 Young Lives Survey

2.2.2. Factors affecting the nutritional status of school age children

Children nutrition status shows the macro- and micro- nutrient deficiencies, growth disturbance, and cognitive development. So it is good to find the factors which affect negatively the nutritional status in order to come to the solutions (Ma'alin, &Birhanu, 2016).

There are diverse, multidimensional and interrelated causes and factors which contribute to the occurrence of malnutrition including biology, economy, culture, environment and disease. Children are the most vulnerable to under-nutrition due to their low dietary intake, less access to food, inequitable distribution of food with in households, improper food storage and preparation, dietary taboos and infections with pathogens (Woodhead, & M., Dornan, P. 2013; Ruel, M. T. & Garrett, J. L.2010).

In one of the reviews of UNICEF, the causes of under-nutrition are categorized into (a) immediate causes: inadequate dietary intake and illness, (b) underlying causes: insufficient access to food in a household; inadequate health services and unhealthy environment; and inadequate care for children and women at the household level, and (c) basic causes: insufficient current and potential resources at societal level (Ruel, M. T. & Garrett, J. L.2010).

Generally, as different studies suggest that the following are the main causative agents which can negatively affect school age children nutritional status:

2.2.2.1. Food security

As defined by USAID, food security has three components - availability, access, and utilization. Household food access is defined as the ability to acquire sufficient quality and quantity of food to meet all household members' nutritional requirements for productive lives. Utilization, in the context of food security, refers to the individual's biological capacity to make use of food for a productive life (Ruel, M. T. & Garrett, J. L.2010).

Inadequate food intake is one of the causative agents of malnutrition especially in developing countries. It is most of the time related with access to land and other agricultural resources (Woodhead, & M., Dornan, P. 2013). WHO defines food security as "existing when all people, at all times, have access to sufficient, safe, nutritious food to maintain a healthy and active life". It

depends on food availability, access and food use (Katungwe, P.& Mwangwela, A.2015). Due to the family capacity and inadequate food provision to support their nutritional needs, children are the most vulnerable groups (Owoaje, E. &Onifade, O.,2014).

Globally, school age children and adolescents are exposed and vulnerable to food insecurity, conflict, and natural disasters. Endemic under-nutrition among school age children is also widespread in both rural and urban areas in non-crisis situations in low income countries (Awel & Hebo, 2016;Ruel, M. T. & Garrett, J. L.2010).

In Ethiopia, food insecurity fell slightly among the young lives households from 37% in 2009 to 33% in 2013, irrespective of wealth, caregiver education level, and rural/urban residence (Ruel, M. T. & Garrett, J. L.2010).Generally, due to the problem of the availability, accessibility and utilization of food in the community and household level, school age children are the ones highly affected and exposed for under-nutrition.

2.2.2.2. Socioeconomic factors

The nutritional status of school age children is mainly dependent on their parents' different status such as the state of the household food security, education level of the parents, food preference of the parents and food preparation constraints. All these factors affect food consumption patterns of children which affect their nutritional status positively or negatively (Olinto, P.& Beegle, K. 2013).

The risk factor for the family socioeconomic status are household monthly food income, maternal education of less than secondary level, sub-optimal breastfeeding practices, recent episodes of diarrhea, home with more than four children, and living in one room residence. These all affects the children nutritional status negatively (Ferdous, F.& Das, S. K.2013).

Waterlow reported that poor nutrition, high level of infection and problematic mother-infant interaction which are the etiology of growth retardation has direct relationship with the socio-economic status of the family [TUNJE, DR DORCAS SUPA and Chen, R. S.& Bender, W. H. 1990).A study in Sub-Saharan Africa indicated that, various indicators of social economic status

have been associated with children's nutritional status, such as maternal and paternal educational level, parental income, and family assets(Awel & Hebo, 2016; (Ruel, M. T. & Garrett, J. L.2010)

2.2.2.3. Poverty

Even-though the poverty level in high and middle income countries decline, in low income countries the level of poverty is still not declining. Reviews show that the highest poverty level in developing countries are found in the ages groups of 0-12 years and in low income countries half of all children are living in poverty(Chen, R. S.& Bender, W. H. 1990 and Abdu, J. & Kahsay, M., M 2015).

Due to the impact of poverty, children can't get food to sustain their life because it affects their family in order to generate income and provide food (Awel & Hebo, 2016;Abdu, J. & Kahsay, M., M 2015). Stunting and level of wasting is highest among children from poorer families and rural areas when it is compared to families in good socioeconomic status and living in urban areas (UNICEF, 2014).

2.2.2.4. Infections/Illness/Diarrhea

Infectious diseases affect the health and nutritional status of children specially children with chronic diseases are under risk of different nutritional problems because of poor intake of nutrients, increased caloric demands or impaired organ function for synthesis of nutrients (Asfaw, M., Wondaferash, M. 2015).

Diarrhea is the leading cause of malnutrition specially in children under five years and school age children (Awel & Hebo, 2016;Benítez-Bribiesca, L., & De la Rosa-Alvarez 1999). It has direct relationship with malnutrition due to its effect such as anorexia, reduced nutrient absorption, water and electrolyte loss, mucosal damage, and exhaustion of the body's nutrient supply (Abdu, J. & Kahsay, M., M 2015).

2.2.2.5. Water and sanitation

Good sanitation keeps germs and bacteria away but bad sanitation attracts them which can be a cause of infectious diseases especially diarrhea as a result it affects the nutrition status of an individual (Asfaw, M., Wondaferash, M. 2015) .Prior to nutrition intervention there should be water supply and sanitation interventions because by poor water and sanitation setting, nutrition intervention service cannot meet its purpose. At the community level, also the water and

sanitation service must be installed especially among mothers with no education to balance equity (Awel & Hebo, 2016; Sorhaindo, A., & Feinstein, L. 2006).

Commonly, causes of under-nutrition of children are: low dietary intake, inaccessibility to food, inequitable distribution of food within the household, improper food storage and preparation, dietary taboos and infectious diseases. Especially, micronutrient deficiencies result from inadequate intake or inefficient utilization of available micronutrients due to infections and parasitic infestations (Awel & Hebo, 2016;FAO/WHO No. 952, 2009).

2.3. Consequences of malnutrition in children

2.3.1. Impairment of physical and cognitive development

Adequate nutrition has positive effects for perfect cognitive function and school performance of school children so it is all about good nutrition which plays a vital role for a health, physical growth, development and educational performance at school (Hillier, S. L., &Nugent, R. P, 1995).

Good nutritional status is a strong factor of health and neurocognitive performance of school-age children. It is essential to minimize illnesses and enhance physical and cognitive development of school children; as a result it facilitate for the children in order to meet their energy and nutrient as per Recommended Dietary Allowance (RDA) (Olinto, P.& Beegle, K. 2013).

Studies shows that malnourished children exposed for physical and cognitive growth impairment specially the brain development is so affected like slowed rate of growth of the brain, lower brain weight, thinner cerebral cortex, decreased number of neurons, insufficient myelinization and change in the dendritic spines finally create cognitive delay (Hillier, S. L., &Nugent, R. P, 1995;Mramba, L. & Ngari, M. 2017;Alaimo, K., Olson & C. M., 2001).

The adverse effects of malnutrition causes delays in motor and cognitive development which results attention deficit disorder, impaired school performance, decrease IQ scores memory deficiency, reduced social skills, reduces language development, reduced problem solving abilities (Best, C. & Neufingerl, N. 2010).

Poor nutrition or malnutrition have short term negative impact on cognitive ability, concentration and activity levels in the class room(Sørlien, A. L. 2012) and also long term negative impact like poor academic performance and acquiring bad behavior (Hillier, S. L., &Nugent, R. P; 1995;Taras, H. 2005;Kleinman, R. E.&Hall, S.2002).

Poor health and nutrition in early childhood has adversely affects a child's cognitive and behavioral development with long term and may be by irreversible damage to the brain. It is also proved that malnutrition particularly stunting has direct association with poor school result and also most of them can't reach the final grade of primary school (FirehiwotMesfin, 2014).

2.3.2. Poor school performance

Good nutritional and health status have a positive outcome on children learning ability and school performance. Providing a nutritious mid-day meal is crucial in maintaining good nutritional status as well as the overall wellbeing and cognitive development of a school child. Hungry children may have difficulty in concentrating or performing academic activities effectively (Thomson, I. S. I. 2017).

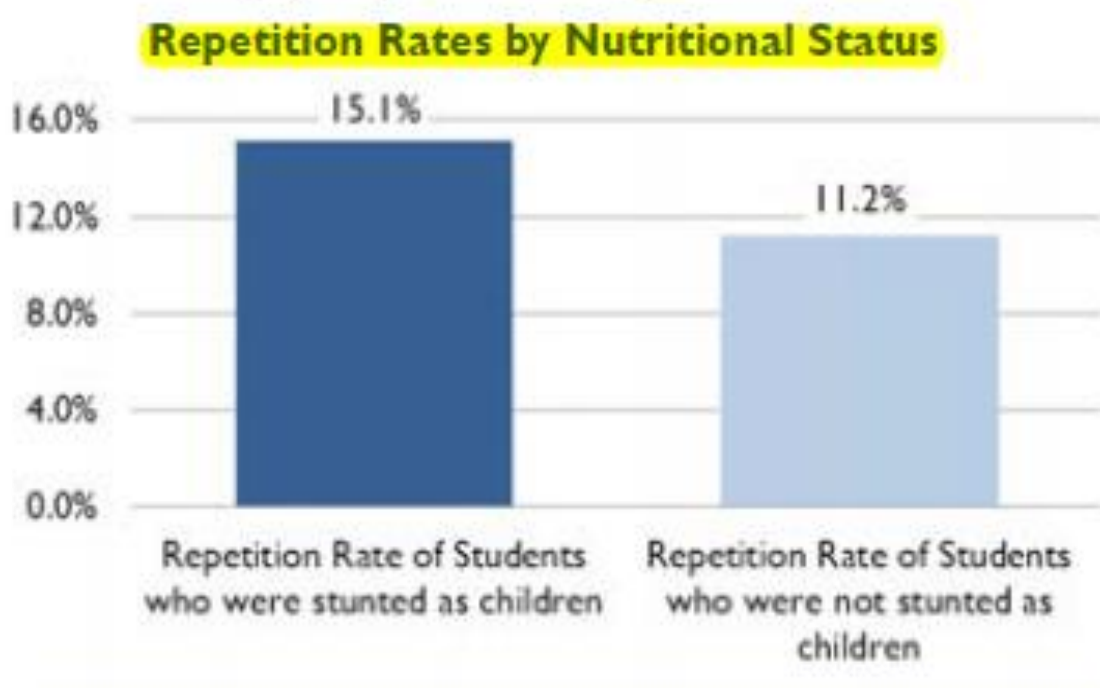
There is a strong relationship between malnutrition and academic performance of school age children. Both acute (wasting) and chronic malnutrition (stunting) impairs children's ability to execute effectively at school (Awel & Hebo, 2016).

Undernourished students have decreased attendance rate, attention, and academic performance beside these they experience more health problems when we compare with nourished students (Best, C. &Neufingerl, N., 2010). The negative impact of malnutrition on cognition, behavior, and academic performance of school-age children is also reported(Best, C. &Neufingerl, N., 2010; Hoddinott, J.& Maluccio, J. A2008; Gilligan, D. O., & Hoddinott, J. 2007).

Most of the time stunted children due to poor school performance they repeat grades in school, have high rate of school abscentism and dropout rate (Woodhead, & M., Dornan, P. 2013;Mramba, L. & Ngari, M. 2017). Nutritional deficiencies in a school age children can impact their health, cognition and as a result their educational achievement will be poor. As it is shown

in figure 1 due to this students may repeat their class and the dropout rate also increasing (Awel & Hebo, 2016;Acrivos, A. 1995).

Figure 1: Students repetitions rate by nutritional status



Source: Round 4 Preliminary Findings from the 2013 Young Lives Survey

Figure 2: Students repetitions rate associated with stunting

Source: Round 4 Preliminary Findings from the 2013 Young Lives Survey

2.3.3. Less economic productivity

Investing in childhood nutrition can have a return of long term economic growth for an individual, family and also a country. As study shows that nutrition intervention on economic growth increase 0.67 US dollar per hour in those who gain nutritious meal compared to those who gain less nutritious meal (Cogill, B. 2003).

Malnutrition has lifelong and intergenerational consequences for children specially growing up in a poor environment, with a life characterized by poor health and low schooling outcome then after reduced future income and high fertility (Best, C. & Neufingerl, N. 2010). Malnutrition for school age children can also create delayed maturation, deficiencies in muscular strength and work capacity, and reduced bone density later in life (Hall & Kassa , 2008).

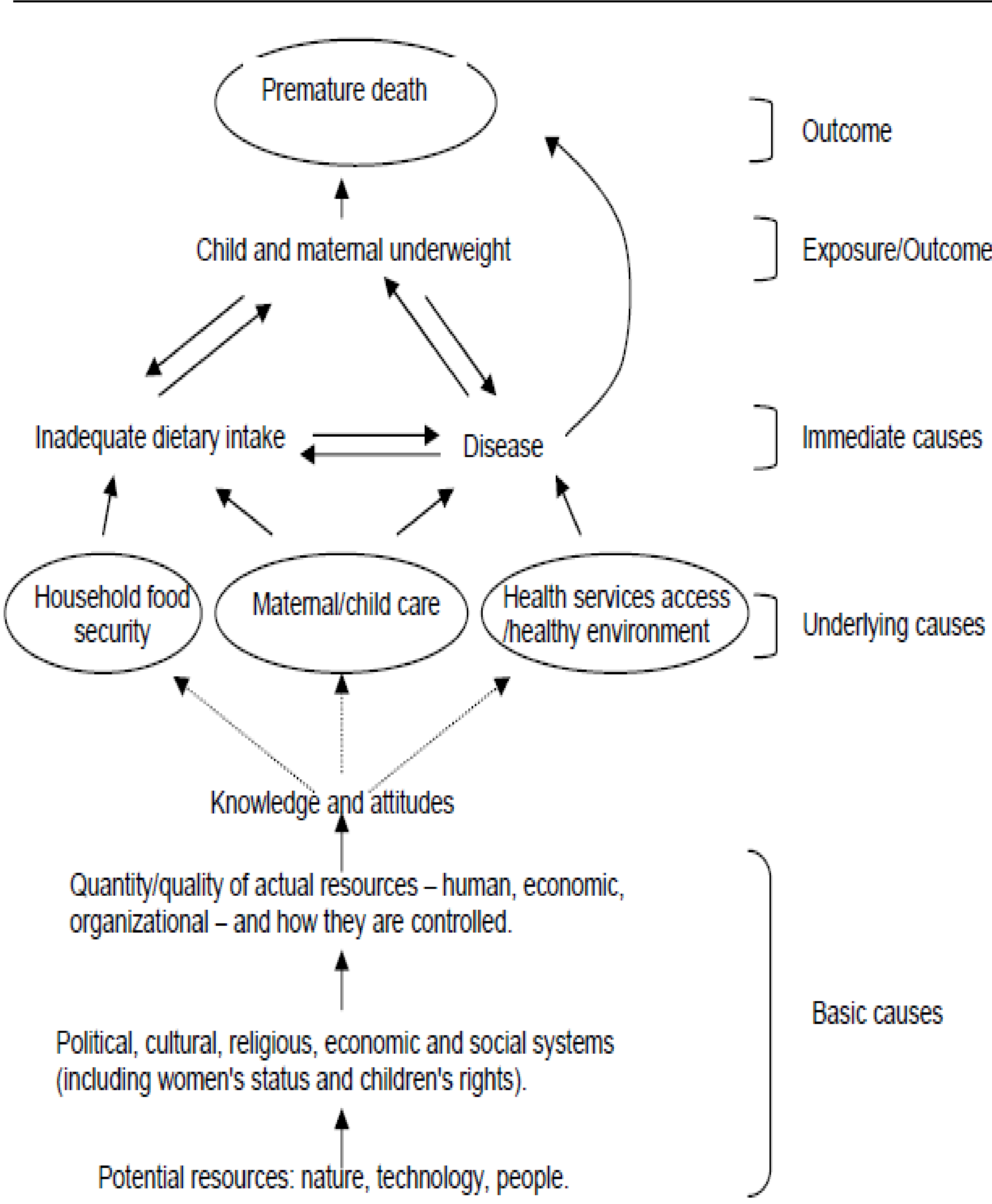
Stunted children has poor out come on their professional life when they reach a working age and the productivity of their work is less when we compare with non-stunted worker so they can't contribute for them self, for family and for the society economy (Berkman, D. S.2002,Kuklina, E. V 2006).As the magnitude and severity of stunting become higher, then the labour productivity becomes compromise and declines(Degarege, D& Animut, A. 2015).

Children who affected by mal nutrition achieve lower educational level than healthy children as a result it makes them less qualified for work, then it reducing their income earning potential for non-manual work. Stunted children have less body mass which results less productivity in manual intensive activities (Mramba, L. & Ngari, M. 2017).

When a child is undernourished, he or she will have an increased chance of experiencing specific health problems. For every additional case of child illness, both the health system and the families are faced with an additional economic cost (Mramba, L. & Ngari, M. 2017).

The consequences of malnutrition is a vicious circle of poverty and poor health as shown in figure 2: for example stunted girls most likely grow up to become stunted adolescents and adults and are likely to give birth to low weight infants who grow up to be malnourished or stunted. Therefore, to break this intergenerational cycle of poverty and adverse consequence of malnutrition, education and adequate nutrition service for a children is crucial in order to get its high pay back or return for individual, family and social (Pollitt, E., & Mathews, R. 1998).

Figure 3: Causal framework for child malnutrition



Source: Environmental Burden of Disease Series, No.

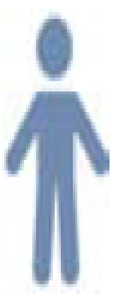
Figure 4: Social and Economic Impact of Child Under nutrition

0-5 years

Undernourished children are at higher risk of anaemia, diarrhoea, fever, and respiratory infections. These additional cases of illness are costly to the health system and families. Undernourished children are at higher risk of dying.

6-18 years

Stunted[1] children are at higher risk of repeating grades in school and at higher risk for dropping out of school. Additional instances of grade repetitions are costly to the education system and families.



15-64 years

If a child dropped out of school early and is working in non-manual labour, he/she may be less productive. If s/he is working in manual labour he/she has reduced physical capacity and may be less productive. People who are absent from the workforce due to undernutrition-related child mortalities represent lost economic productivity.

Source: The cost of hunger in Ethiopia, the Social and Economic Impact of Child Under nutrition in Ethiopia Summary Report (2011).

2.4. Importance of school meal

Now a day SFP is implemented in developing and developed countries in order to address the problem of malnutrition of school age children with little effort and cost (Wang, Y., & Chen, H. J. 2012). The importance of school feeding is wide and covers almost all the community. It has a lot of advantage in different ways for individual, families and country. In another way it increases the economic power of the family because the costs of their children meal decrease. SFP keeps well the health, academic and social life of the vulnerable school age children (Onis, M. D.& Onyango, A. W.2007;Wang, Y., & Chen, H. J. 2012).

Nutritious meal can improve the school age children short term and long term cognitive ability, the growth and development of the body and mind, creates health immune systems, gives health energy and makes them active in their class participation (Onis, M. D.& Onyango, A. W.2007;Wang, Y., & Chen, H. J. (2012).

In one report it is said that "When children go to school hungry or poorly nourished, their energy levels, memory, problem-solving skills, creativity, concentration and behaviour are all negatively impacted." (WHO, 2011).Therefore, provision of breakfast, lunch and snack for the school children can improve children concentration, school attendance, cognitive functioning, and academic performance and decrease the school drop-out rate, class absenteeism, class repetitions (Wang, Y., & Chen, H. J. 2012).

To implement targeted intervention via school feeding program, it needs well studied planning and designing menu which is based on the locally available and easily affordable food items (WHO, 2011).

In Ethiopian currently, SFP is implemented by government which was initiated by the first lady and other non-government organization. A lot of school children are enrolled under government school feeding and non-government school feeding program. School feeding program is implemented in different government schools by different ration such as on site feeding and home take ration. Most of the place on site feeding is implemented rather than home take ration.

2.5. Improvement area for nutrition status and nutrient adequacy of school age children

Providing targeted health and nutrition intervention service

Relevant nutritional information campaigns, broader access to maternal and child health care practices and availing affordable, diverse, and nutrient-rich food through public education and providing nutritional supplements and financial support to vulnerable families(Woodhead, & M., Dornan, P. 2013).Providing specialized nutritious food to prevent and treat acute and chronic malnutrition is helpful for school age children (NCHS, C. 2012).

To speed up accurately and effectively the ongoing intervention to eradicate malnutrition especially in Ethiopia the followings are the area which needs action:

2.5.1. **Initiate and promote the awareness of nutrition:** the entire population should get information regarding the importance of nutrition through various sectors and mechanisms including the educated groups. Promote the delivery of nutrition services integrated with other essential services for example in education sector providing fresh, hot and nutritious meal in every school day for vulnerable and need students can increase the dietary intake of the children as well it boosts their nutritional status(Mramba, L. & Ngari, M. 2017;Ruel, M. T. & Garrett, J. L.2010).

2.5.2. **Develop and activate food fortification programs:** large population of the Ethiopia people are located in rural area where the accessibility of food is not that much a problem but consumption of balanced diets and food diversity is limited so it is a good method to fortify the basic stables food items with micronutrients. Creating a means of bio fortification of common staple foods such as bean, maize, sweet potatoes in order to facilitate farmers to practicing it for improved food supplies from own production(Mramba, L. & Ngari, M. 2017).

2.5.3. **Strengthen the existing policies:** which is aimed to increase household income and improve the situation of women; improve women's literacy and girls' education, and access to basic social services (health, nutrition) (Sorhaindo, A., & Feinstein, L. 2006).

2.5.4. Creation of Public-Private partnerships: specially the private sectors which are engaged in the food production and processing industry in order to understand and incorporate the health and nutritional needs of the population in their products, promotions and distribution mechanisms(Mramba, L. & Ngari, M. 2017).

2.5.5. Water, Sanitation and hygiene (WASH) activities: must be considered before implementation of any nutritional intervention programs because it has a direct relationship between poor hygiene and malnutrition. Therefore, WASH program must include awareness creating component which helps in order to create behavioral change associated with WASH (Sorhaindo, A., & Feinstein, L. 2006).

2.5.6. Developing a guideline: to instruct how to use locally available food commodities that could be used, blended, processed to develop a nutritionally enriched food as a result it will solve the problem of malnutrition especially for the various vulnerable groups (Mramba, L. & Ngari, M. 2017).

2.6. Methods of assessing dietary adequacy and nutritional status of school age children

2.6.1. Dietary assessment

- Dietary assessment is a tool which helps to study the dietary behavior and habits of individual and families. The most common methods under dietary assessments tools are:
  - Food Frequency Questionnaire (FFQ) – used to determine the individual consumption of the amount of a specific food item in a specific period of time (Rockett, H. R., & Colditz, G. A. 1997;FAO/EC, FANTA 2007)
  - 24-hour recall – is a structured and unstructured recall method under 24-hour recall. A structure 24-hour recall is when a study subject is asked to fill the format which have meal list with specific types and amounts of food eaten in the 24-hours. An unstructured recall is when the subject is asked to write down the food consumed in 24-hour on blank paper (Rockett, H. R., & Colditz, G. A. 1997).
  - Estimated-diet records – used to determine an individual different type of food consumption using prepared food check list (Onis, M. D.& Onyango, A. W.2007)
  - Measuring diet diversity score(Onis, M. D.& Onyango, A. W.2007)
- After doing the dietary assessment of each school age children, the result will be compared with the RDA value in order to know if their diet is adequate or not

2.6.2. Measurement of nutritional status

- **Anthropometric indicators**

  Anthropometry is the measurement of an individual growth and body composition which is easy way, inexpensive and non-invasive measurement of the general nutritional status. To assess the nutritional status of a children using anthropometry we use three indices such as: weight for age; length for age or height for age; weight for length or weight for height (Wang, Y., & Chen, H. J. 2012).

  The assessment of body weight can be determined to the nearest 0.1 kg on an electronic digital scale and height can be measured to the nearest 0.1 cm. Overweight (> + 1 SD BMI-for-age z score), obesity (> + 2 SD BMI-for-age z score), thinness/wasting (< - 2 SD BMI-

for-age z score), underweight (< - 2 SD weight-for-age z score) and stunting (< -2 SD of height-for-age z score) which is defined according to the WHO and USCDC (WHO, 2011).

Weight for age is an indicator for monitoring child growth for pre-school children but it is not reliable for school age children so that BMI-for-age is recommended by the WHO and USCDC to measure wasting in school aged children (Martens, T. 2007).

- **Biochemical indicators**

  Nutritional deficiencies can be assessed using laboratory tests for example iron deficiency. The common bio-chemical indicators are Hemoglobin and red cell indicators to assess nutritional deficiencies of iron, folate or vitamin B12 and iodine, Pre-albumin and albumin which are also good indicators of protein and energy dietary intake (Wang, Y., & Chen, H. J. 2012).

- **Clinical indicators**

  Clinical assessment methods depend on the specific and nonspecific signs of an individual which have an association with malnutrition and deficiencies of micronutrients. It includes nutritional history, changes in hair, angles of mouth, gums, nails, bones, skin, eyes, tongue, muscles and thyroid (Wang, Y., & Chen, H. J. 2012).

3. CHAPTER THREE: STUDY METHODOLOGY

3.1. Study design and area

A school based cross sectional, descriptive survey which is non-experimental research was implemented among purposefully selected three government primary schools in woreda 1, 8, and 12, N/S/L/S/C, Addis Ababa, Ethiopia, from November 2017 up to May 2018.

Addis Ababa has ten sub-cities of which N/S/L/S/C is the third most populous with a population of 316,108 (148,984 Male, 167,299 Female - *CSA 2007*) occupying an area close to 70 km². The three selected schools are Hana Primary School (HPS), Agazian No.2 Primary School (APS), and Lafto Primary School (LPS) which are found in woreda 1, 8, and 12 respectively. All the selected schools are from the most impoverished school community in the sub-city specially HPS.

3.2. Study population

The study subjects were selected randomly from HPS, APS and LPS students ranging from 4-15 years old.

3.3. Inclusion criteria

- Study population were from HPS, APS and LPS students who were from Non-government feeding program
- The study subject were student from Kindergarten and from Grade 1-8
- Students who were willing and get permission from their parents to participate in the study.

3.4. Exclusion criteria

- Students who were not in the Non-government feeding program on the selected schools
- Students who were not willing to participate in the study

3.5. Sample size and sampling criteria

3.5.1. Sampling methods

The sample size determination was done by 95% confidence interval and 5% margin of error from 400 population size. 174sampleswere selected using random sampling method from the students in the feeding programs of the selected school population based on the following table.

Table 2: Sample size determination

	Confidence level = 95%			Confidence level = 99%		
	Margin of error			Margin of error		
Population size	5%	2,5%	1%	5%	2,5%	1%
100	80	94	99	87	96	99
500	217	377	475	285	421	485
1.000	278	606	906	399	727	943
10.000	370	1.332	4.899	622	2.098	6.239
100.000	383	1.513	8.762	659	2.585	14.227
500.000	384	1.532	9.423	663	2.640	16.055
1.000.000	384	1.534	9.512	663	2.647	16.317

Source: www.checkmarket.com/blog/how-to-estimate-your-population-and-survey- sample-size/

As per the above table, the sample size for 500 population with 95 % confidence interval and with 5 % marginal error = 217 sample size. The sample size for the population of 400 students as per the given base was 174 as calculated below

⇒ 500 population = 217 sample size

400 population = X sample size

⇒ X sample size = $\frac{400 \text{ ~~population~~ X } 217 \text{ sample size}}{500 \text{ ~~populations~~}}$

⇒ X sample size = 173.6 sample size ~174

3.6. Method of data collections

Before data collection, based on the sample size, it was divided proportionally in to the selected three schools. The required and different formats which was needed for the survey was developed. Then permission has requested and accepted from the concerned body such as from

school principal, study subjects and parents and also from the private feeding center. Then communication with Health Extension Workers (HEW) from each woreda was contacted in order to get their professional support during anthropometry measurement.

Based on the main objective of the study, in order to collect the data which is required to assess the nutritional status of the study subject, anthropometric measurements such as height, weight and MUAC of the study subject was measured using standard techniques. The parents of each participating child were interviewed for potential determinants of child nutrition status, including socio-economy, demography, and age of the child using a pre-tested structured. The questionnaire was first developed in English and then translated to Amharic language. Three HEWs, having previous experience in similar data collection, participated in the survey.

In order to collect the data to determine and assess the adequacy of the nutrient intake of the students' meal from school feeding and from their home, seven days24 hour recall was done. Students' breakfast and lunch meal consumption data from Monday to Friday was collected from the school feeding menu. Data collection for Saturday and Sunday, the whole days meal consumption and from Monday to Friday after school meal consumption has been collected from their home. Amount of foods were approximated using cups or plates or jug. All ingredients including their weight were recorded.

3.7. Data analysis

3.7.1. Nutritional status of the students

For those student who are under 5 years old, a software which is called WHO Anthro has been used in order to calculate the Z-score and percentiles, for those student who are above 5 years old, a software which is called WHO Anthro Plus has been identified the cut-off point of Z-score and percentiles the children grouped as normal nutritional status or malnourished such as normal, chronic malnutrition (stunted), acute or current malnutrition (wasted), underweight and overweight. The Z-scoresfor height-for-age (HAZ), weight-for-age (WAZ) and BMI-for-age (BMIAZ) and the prevalenceof stunting (height-for-age > -2SD) and underweight (weight-for-age > -2SD) were calculatedusing the NCHS/CDC reference population (CDC, 2000). The following figuresummarize the cut-off points of percentiles and Z-scores to define problematic growth status in children and adolescents when using anthropometric measures (Figure 4).

Figure 5: Cut-off points of percentile and Z-scores

Outcomes	Anthropometric measures and cut points	Indication of growth/nutrition problems
Infants and children (<10 years)		
Stunting	HAZ < −2 Z score, or <3rd percentile	Chronic malnutrition
Wasting/thinness	WHZ < −2 Z score, or <3rd percentile	Acute malnutrition, current malnutrition
Overweight	WHZ > 2 Z score	Overweight
Adolescents (> =10 years)		
Stunting	HAZ <−2, or <3rd percentile	Chronic malnutrition
Thinness	BMI-for-age < 5th percentile	Underweight
At risk of overweight	BMI-for-age > =85th percentile	Overweight
Obese	BMI-for-age > =85th percentile and triceps and subscapular skinfold thickness-for-age > =90th percentiles	Obesity

Source: Use of percentiles and Z-scores in Anthropometry by Youfa Wang and Hsin-Jen Chen based on WHO-growth reference

3.7.2. Adequacy of nutrient meal intake

Data were collected using 7 days 24 hour dietary recall which is the diet consumption from the school feeding center and from their home during the weekend time. The collected consumed food ingredient was converted in to calories using the Ethiopian Food Composition table and United State Department of Agriculture (USDA) food composition database then the calculated daily nutrient intake in terms of energy, protein, fat, ascorbic acid, iron, retinol, folic acid, calcium and zinc were then compared against the standard of RDA with their age (FCTEP4, 1968-1997; USDA,ndb.nal).

3.7.3. Dietary diversity Scores

The consumed foods were allocated to the following food groups, composed by the FAO/DHS: (1) Cereals and grain products; (2) Vitamin A rich vegetables and tubers; (3)White tubers and roots; (4) dark green leafy vegetables; (5) other vegetables; (6) vitamin A rich fruits; (7) other fruits; (8) organ meat (iron rich); (9) flesh meats; (10) eggs; (11) fish;(12) legumes, nuts and seeds; (13) milk and milk products; (14) oils and fats (Walker, S. P 20017;Abdelaziz &Youssef, 2015).

The dietary diversity scores (DDS) for the school lunch, the home consumption and the combination of the school and home consumption were calculated per child by summing the number of different consumed food groups.

Table 3: Food groups to assess the DDS of an individual as per FAO 2011

Question number	Food group	Examples	YES=1 NO=0
1	CEREALS	bread, noodles, biscuits, cookies or any other foods made from millet, sorghum, maize, rice, wheat + *insert local foods e.g. ugali, nshima, porridge or pastes or other locally available grains*	
2	VITAMIN A RICH VEGETABLES AND TUBERS	pumpkin, carrots, squash, or sweet potatoes that are orange inside + *other locally available vitamin-A rich vegetables(e.g. sweet pepper)*	
3	WHITE TUBERS AND ROOTS	white potatoes, white yams, cassava, or foods made from roots.	
4	DARK GREEN LEAFY VEGETABLES	dark green/leafy vegetables, including wild ones + *locally available vitamin-A rich leaves such as cassava leaves etc.*	
5	OTHER VEGETABLES	other vegetables (e.g. tomato, onion, eggplant) , including wild vegetables	
6	VITAMIN A RICH FRUITS	ripe mangoes, cantaloupe, dried apricots, dried peaches + *other locally available vitamin A-rich fruits*	
7	OTHER FRUITS	other fruits, including wild fruits	
8	ORGAN MEAT (IRON-RICH)	liver, kidney, heart or other organ meats or blood-based foods	
9	FLESH MEATS	beef, pork, lamb, goat, rabbit, wild game, chicken, duck, or other birds	
10	EGGS		
11	FISH	fresh or dried fish or shellfish	
12	LEGUMES, NUTS AND SEEDS	beans, peas, lentils, nuts, seeds or foods made from these	
13	MILK AND MILK PRODUCTS	milk, cheese, yogurt or other milk products	
14	OILS AND FATS	oil, fats or butter added to food or used for cooking	

Source: Guideline for measuring household and individual dietary diversity, version 3, August 2011, FAO nutrition and consumer protection division.

3.8. Ethical and human subject's issues

First permission was asked from the school management board to undertake the study on the school children. Then written consent form distributed to student's parents or guardians through the school.

4. CHAPTER FOUR: RESULTS AND DISCUSSIONS

4.1. Results

As mentioned earlier school feeding are implemented in Ethiopian by government and non-government organization in different government primary schools. This study focused in school children which are under Non-government feeding program. Three government primary schools were selected from N/S/L/S/C, Addis Ababa, Ethiopia. A total of 173 school going children who are beneficiaries of school feeding program at Non-government feeding program were included in the survey. The school children were selected randomly from Kindergarten and grade 1-8 with age group 5-15 years.

To assess the nutritional status and dietary intake; anthropometric measurements, 24 hour dietary recall, and diet diversity score were carried out. The overall study result is described below in step by step:

4.1.1. Socio-demographic description of the study subject and parents

The study subject age ranges from 5 to 15 years old. The youngest child was 5 years old boy and the oldest was 15 years old girl. Out of 176 participants 78 were girls and 99 were boys (Table 5).

The participating children in this study were living mainly with their mother (40%), father and mother (38%), and the remaining were living with their relatives. Head of the house, 40 % were mothers, 38 % were fathers and the remaining were their relatives. The highest family size was 9 and the smallest was 2.

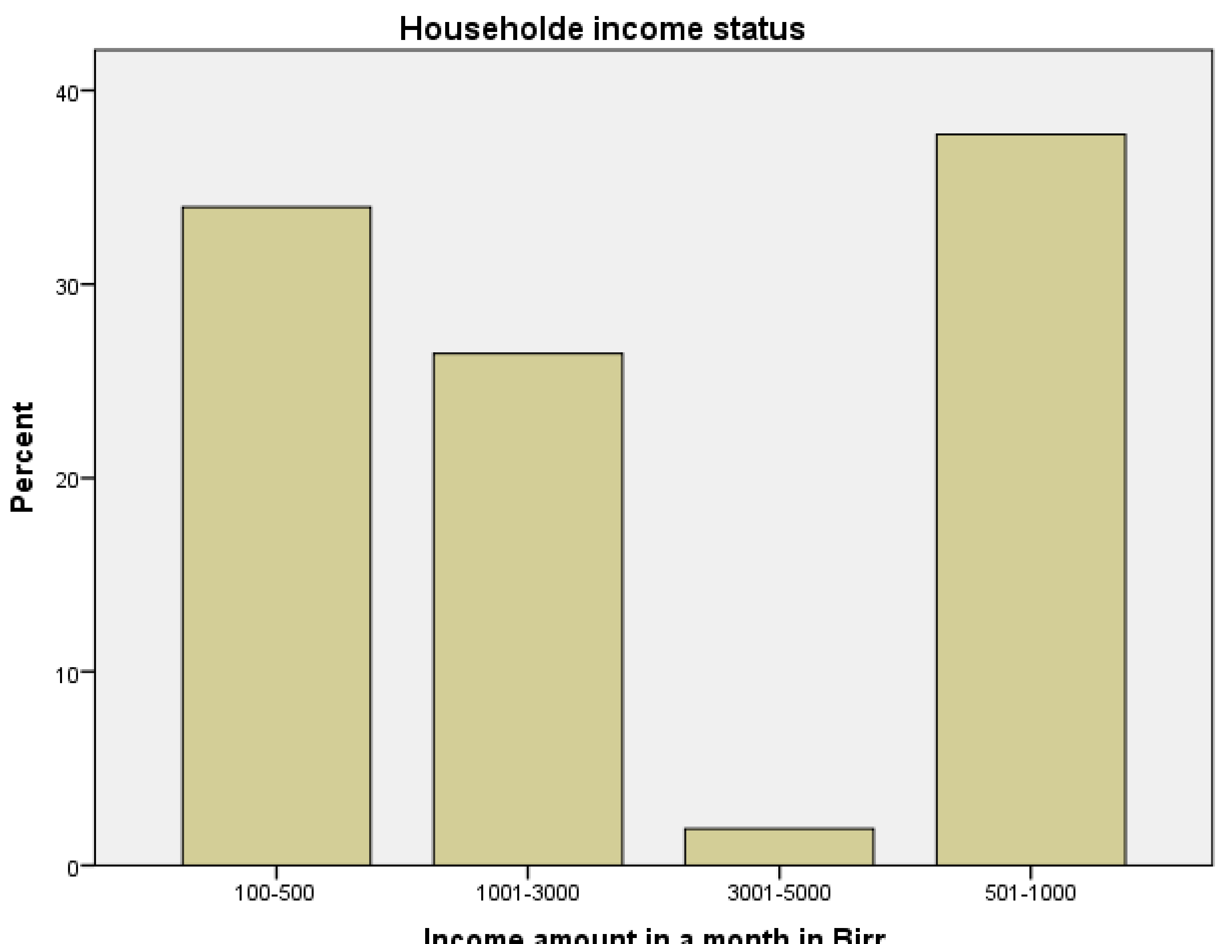
Concerning the educational background of the parents, 46% finished grade 8, 8% finished grade 10, 6% finished grade 12 and the remaining 40 % were illiterate (Table 4).

Table 4: Socio-demographic characteristics of the study subject and parents

Variables	**Category**	**Number**	**Percentage**
Study subject Sex	Female	78	44
	Male	99	56
Age category	4 – 6 Years	44	25
	7 – 12 Years	60	34
	13 – 15 Years	72	41
Grade	KG 1- KG3	49	27
	Grade 1-Grade 4	83	47
	Grade 5-Grade 8	44	26
Study subject head of the house	Father	65	36
	Mother	75	42
	Relative	36	22
Family size	Highest	9	4
	Lowest	2	8
House head education background	Completed grade 8	82	46
	Above grade 8	26	14
	Illiterate	68	39

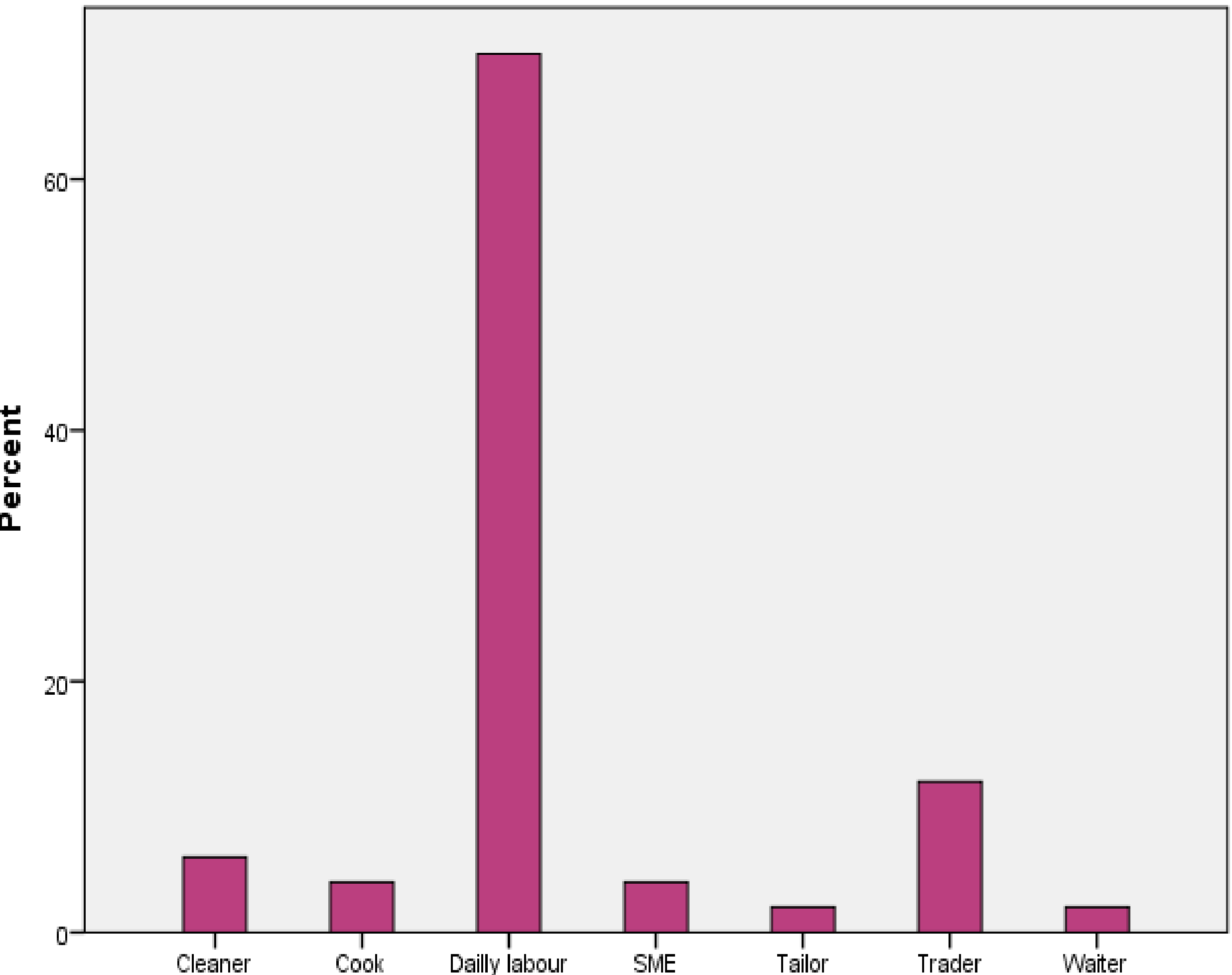
The highest income level was 5000.00 ETB per month and the lowest was 100.00 ETB, the mean income level was 973.00 ETB (Figure 6).

Figure 6:Income status of targeted households per month in ETB



Seventy percent of the parents were daily laborers, 4% were small and medium enterprise (SME) owner, 6% were cleaner, 4% were cook, 2% were tailors, 12% were business persons and the remaining didn't mention the type of their means of income (Figure 7).

Figure 7: Occupation of the study subject parents



4.1.2. Nutritional status of the study subjects

Anthropometric survey: Nutritional status of all the selected school children was assessed by measuring heights (cm), weights (kg) and the mid upper arm circumference (MUAC). Height and weight was compared with WHO growth reference height /weight for age percentiles and Z-scores standard, and MUAC compared with WHO 2007 growth reference MUAC for age.

The assessment of the study subject body weight was determined to the nearest 0.1 kg on an electronic digital scale under basal condition with minimum clothing and without shoes and height in the standing position to the nearest 0.1 cm using non-stretchable steel tape.

The shortest height was 96 cm and the longest height 180 cm. The smallest weight was 12 kg and the biggest weight was 75 kg, the smallest measurement of the MUAC was 13 and the largest was 28 (Table 5 - 7).

Table 5. Anthropometric measurement of the study subjects at LPS

No.	Student Code	Grade	Age Range	Ht. in cm Range	Wt. in kg Range	MUAC in cm Range
1	APS-KG-01-APS-KG-11	KG1-KG3	5-7	100-120	12-24	13-17
2	APS-G-01-APS-G-10	1-4	7-10	107-141	16-37	13-28
3	APS-G-11-APS-G-1	5-8	> 11	125-155	22-45	16-28

.

Table 6: Anthropometric measurement of study subjects at APS

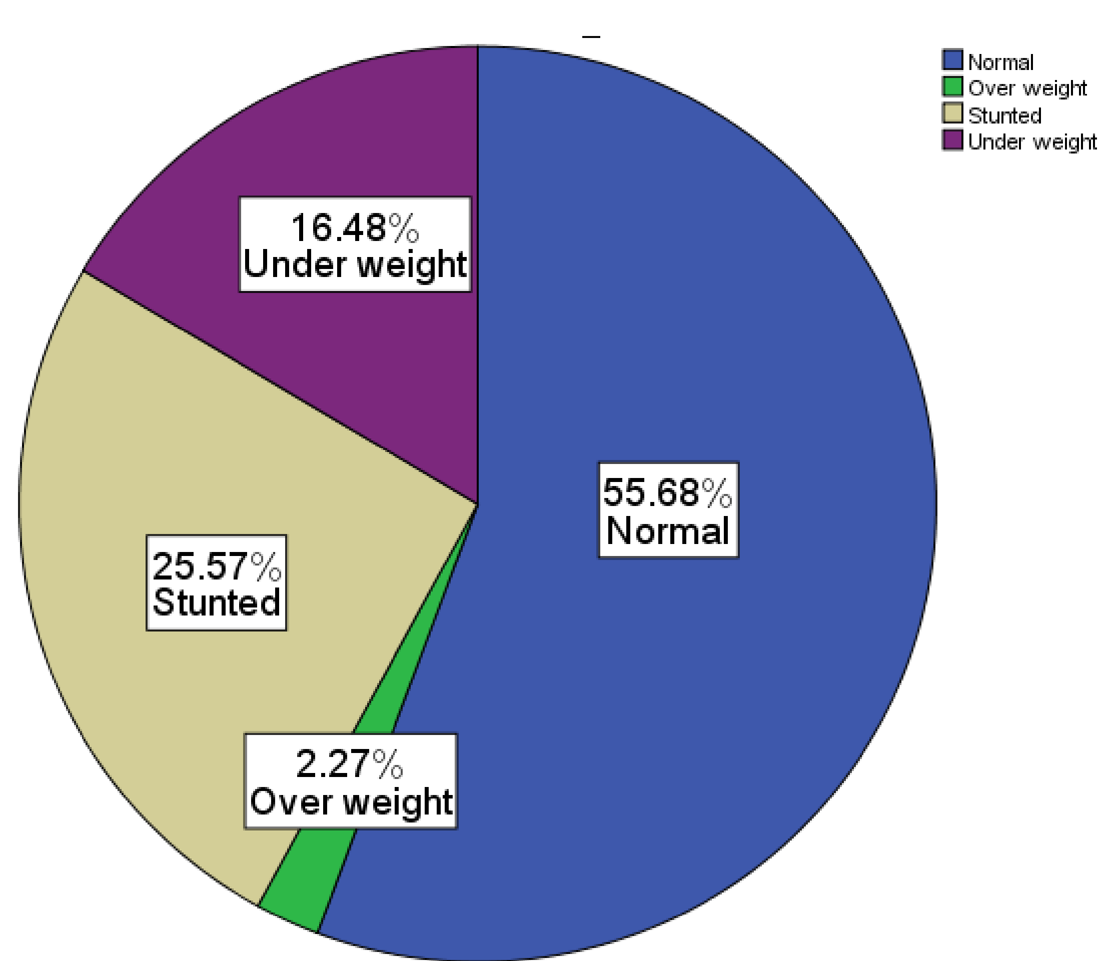
No.	Student Code	Grade	Age Range	Ht. in cm Range	Wt. in kg Range	MUAC in cm Range
1	APS-KG-01-APS-KG-17	KG1-KG3	5-7	100-122	12-24	13-19
2	APS-G-18-APS-G-15	1-4	7-10	107-166	18-37	15-28
3	APS-G-16-APS-G-22	5-8	>11	125-152	22-45	16-28

Table 7: Anthropometric measurement of the study subjects at HPS

No.	Student Code	Grade	Age Range	Ht. in cm Range	Wt. in kg Range	MUAC in cm Range
1	HPS-KG-01-HPS-KG-23	KG1-KG3	5-7	100-120	16-22	14-16
2	HPS-G-01-HPS-G-52	1-4	7-10	116-162	17-49	14-22
3	HPS-G-53-HPS-G-71	5-8	> 11	121-164	20-49	15-20

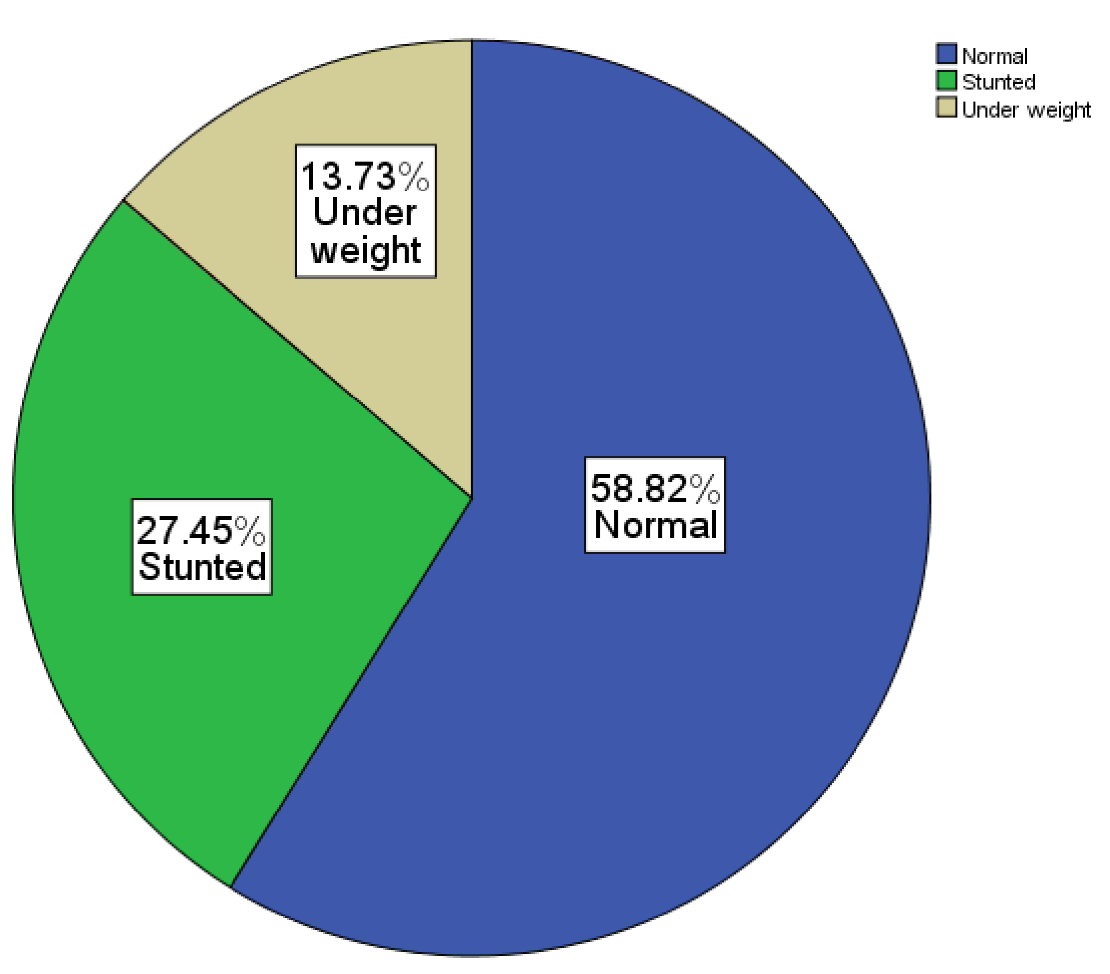
Figure 7 shows that the percentage of the calculated anthropometric results, Out of 176 study subjects, 45 participants were stunted, 29 participants wereunderweight, 4 participants were overweight and 98 participants were normalor have good nutritional status.

Figure 8: Analysis of nutritional status of the study subjects in all schools



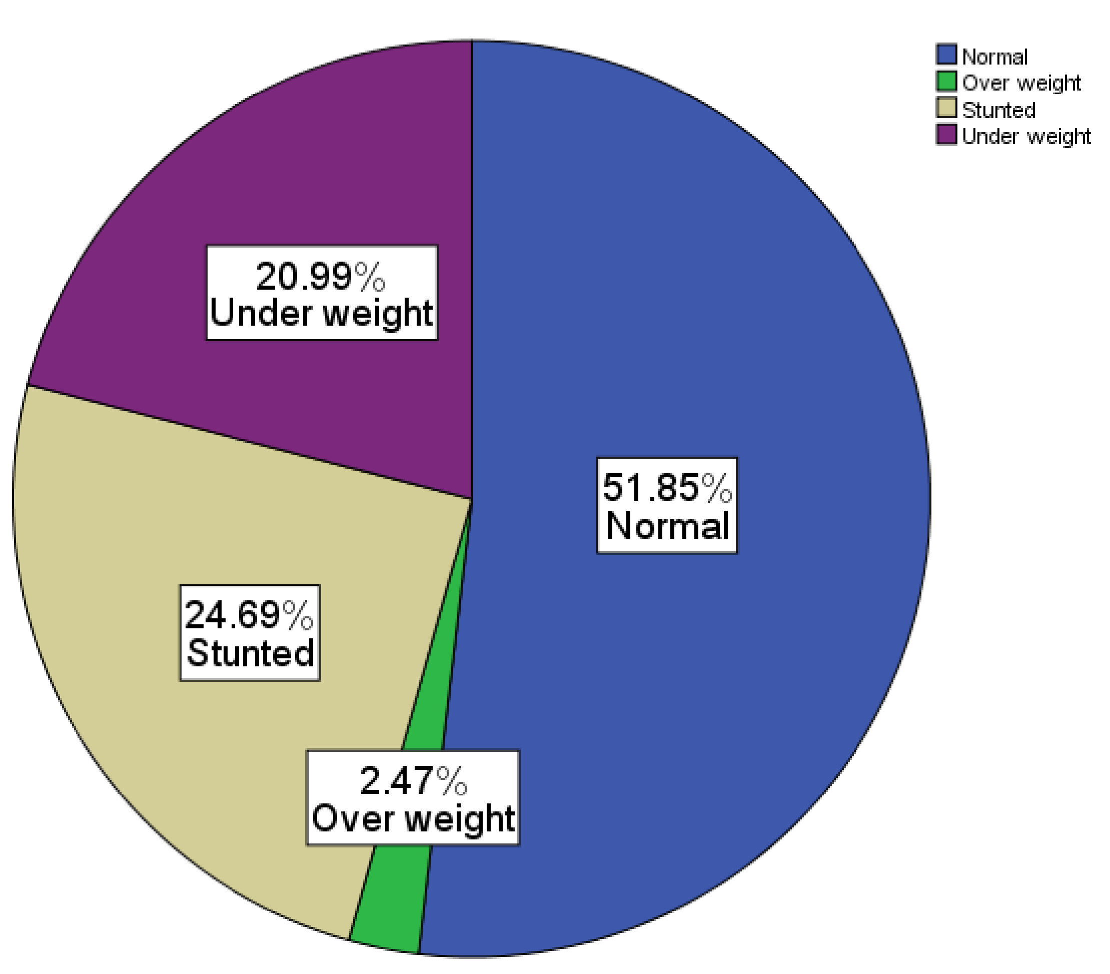
When we saw the study subjects nutritional status by categorizing according to different age groups, from the total of 51 participants of 4-6 years old children, 14 were in the range of moderate to severe stunting, 7 underweight and 30 in normal nutritional status. Figure 8 shows the percentage of each nutritional status of the age group.

Figure 9: Nutritional status of the study subject for age group 4-6 years old



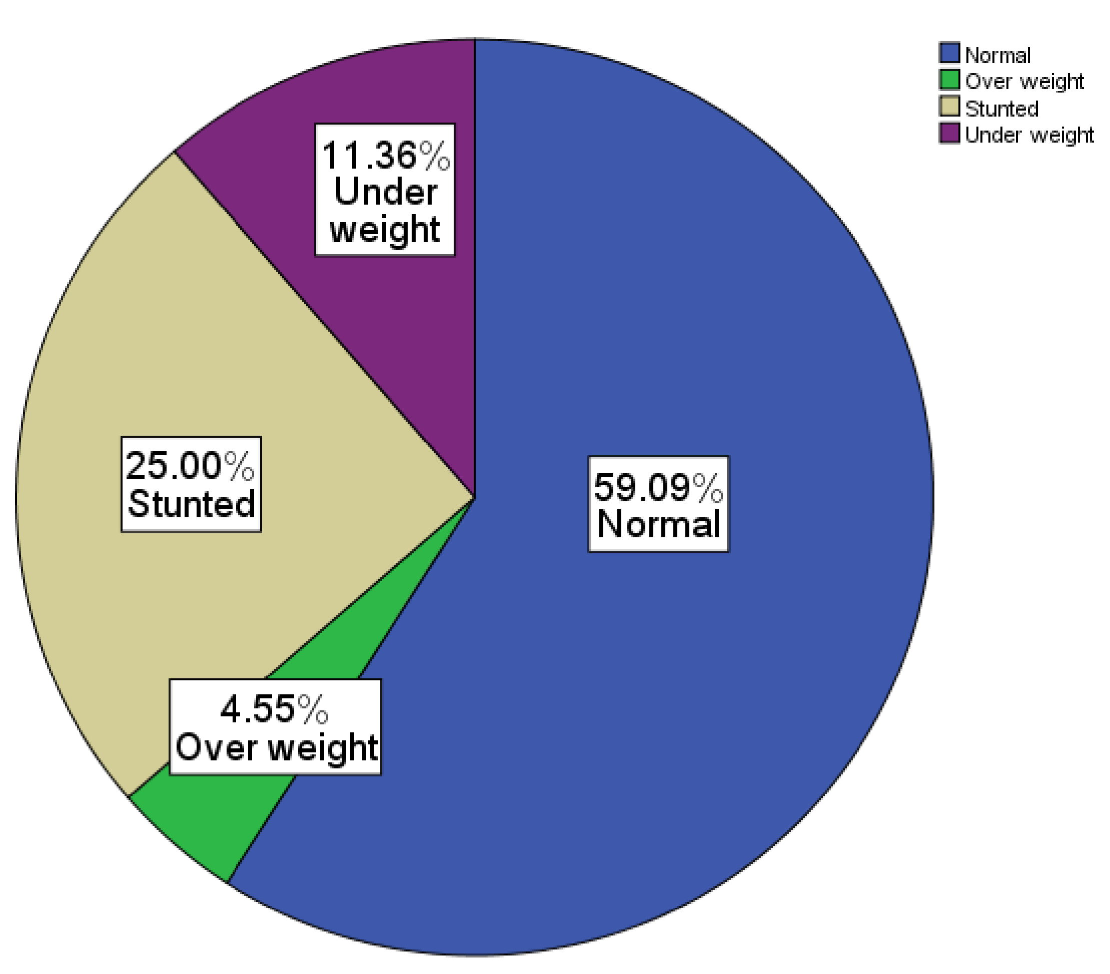
The second age group were 7-10 years old, from the total of 81 participants 20 were in the range of moderate to severe stunting, 17 underweight, 2 overweight and 42 in normal nutritional status. Figure 9 shows the percentage of each nutritional status of the age group.

Figure 10: Nutritional status of the study subject for age group 7-10 years old



The third age group were 11-14 years old, from the total of 44 participants 11 were in the range of moderate to severe stunting, 5 underweight, 2 overweight and 26 in normal nutritional status. Figure 10 shows the percentage of each nutritional status of the age group.

Figure 11: Nutritional status of the study subject for age group 11-14 years old



The study subject whose anthropometric analysis result for HAZ <-2 Z-score categorized as stunted, BMI-for-age< 5th percentiles categorized as underweight or thin and BMI-for-age >=85 percentiles categorizes as overweight. The study subject prevalence of stunting, underweight and over weight is summarize as follow (Table8).

Table 8: Prevalence of malnutrition of the study subjects

Nutritional status	All study subjects (N=176)		Age category					
			4-6 years old (N=51)		7-10 years old (N=81)		11-14 years old (N=44)	
	No.	%	No.	%	No.	%	No.	%
Stunted	45	26	14	27	20	25	11	25
Wasted	29	16	7	14	17	21	5	11
Over weight	4	2	0	0	2	2	2	6
Normal	98	56	30	59	42	52	26	60

4.1.3. Meal composition and dietary diversity scores

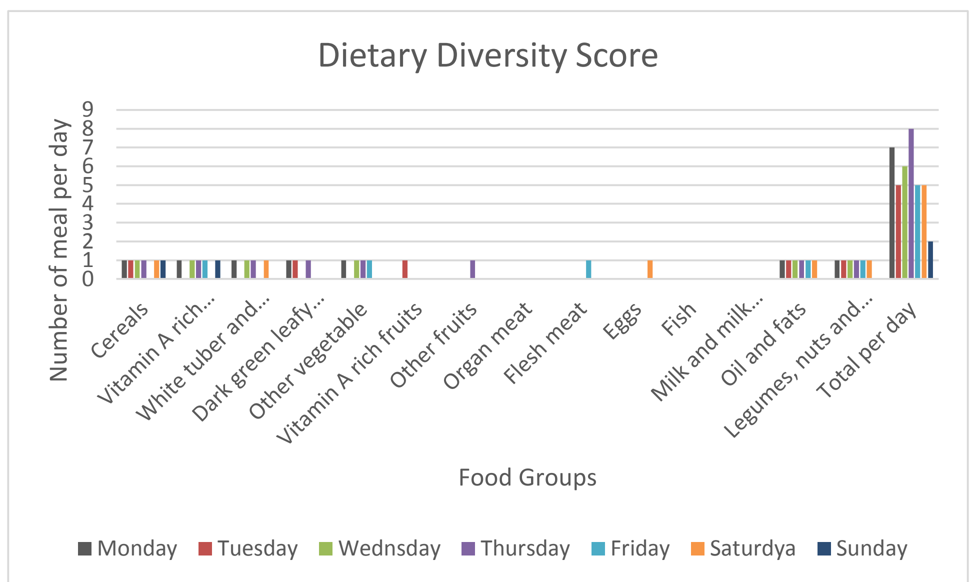
The weighted seven days 24 hour dietary recall and diet diversity score was determined and it was calculated using Ethiopia Food Composition Table and USDA food composition data base (FCTEP4, 1968-1997; USDA,ndb.nal). The calculated daily nutrient intake in terms of energy, protein, fat, ascorbic acid, iron, retinol, folic acid, calcium and zinc were then compared against recommended dietary allowance for school children.

Accordingly FAO the lowest dietary diversity is consumption of <3 food groups, the medium dietary diversity is consumption of 4 and 5 food groups and the highest dietary diversity is consumption of >6 food groups.

Based on the analysis, the study subject school meal DDS was 5 which is in the medium category but the school meal menu based on only plants source so that it lacks some of the food groups like meat, fish, egg and diary products.

The study subject home meal DDS was 3 which is in the lowest category. Even-though the DDS of the home meal in the lowest category, when we sum up the school meal on it the study subject DDS became under the medium category (Figure 12).

Figure 12: Food groups consumed in the past 7 days (7 day 24-hour recall)



4.1.4. Energy and dietary nutrient adequacy

The energy and dietary nutrient adequacy analysis done depending on the study subject's meal intake of from their home and school meal.

4.1.4.1. Home meal composition and nutrient value

Most of the home meal composed of cereals, legumes and roots. From Monday to Friday the study subject were getting their breakfast and lunch from school meal so that from Monday to Friday only the meal consumption after school and the whole day meal consumption for Saturday and Sunday were taken to do the analysis.

Most of the study subject meal consumption at home were grains, roots and tuber, legumes, vegetables, few of the respondents consume meat once in two week and some consume milk once in a week. Injera or dabo with shiro, dabo, potato and other vegetable were the usual type of food (Table 9 & 10).

Table 9: Breakfast consumption of the study subject on Saturday and Sunday at home

Foods	Number of respondents (176)	Percentage
Tea with bread, kita	80	46
Milk with bread	20	11
Injera firfir	40	23
Other like nifro, kita, genfo	15	9
No breakfast	21	12

Table 10: Meal consumption of the study subject at home during weekend

Foods	Number of respondents (176)	Percentage
Injera, bread, porridge, legumes and grain products	88	50
Potato, carrot, spinach and other vegetable with bread	50	28
Eggs	5	3
Meat	3	2
Others	30	17

The home meal nutrient intake value for macronutrients and micronutrients were as follows: Energy 187.87 kcal, Protein 5.85 g, Fat 4.64 g, Calcium 28.22 mg, Iron 25.82 mg, Iodine 25.82 mg, Vitamin A 78.03 micro gram, Vit.B1 0.09 mg, Vit.B2 0.06 mg, Vit.B3 2.13 mg and Vit.C 9.30 mg (Table 11).

Table 11: Home meal nutrient dietary intake of the study subjects (After school and dinner)

Nutrients	Nutrient Intake	Nutrients	Nutrient Intake
Energy_kcal	187.87	Vit.A _ µg RE	3.90
Protein_g	5.85	Vit.B1_mg	0.09
Fat_g	4.64	Vit.B2_mg	0.06
Calcium_mg	14.11	Vit.B3_mg	2.13
Iron_mg	2.36	Vit.C_mg	2.32
Iodine_mg	12.91		

4.1.4.2. School meal composition and nutrient value

The non-government school feeding program provides breakfast and lunch which is plant based hot, fresh and nutritious meal every school day. There were different menu for each day of the week (Table 12).

Table 12: Weekly Menu of the School Feeding Program

School Health and Nutrition Program - School Feeding Project- Weekly Menu					
MONDAY		**TUESDAY**		**WEDNSDAY**	
Menu	**Food Items**	**Menu**	**Food Items**	**Menu**	**Food Items**
Breakfast		**Breakfast**		**Breakfast**	
Bread with peanut butter and Tea	White bread	Bread with banana and Tea	White bread	Bread with peanut butter and Tea	White bread
	Peanut butter		Banana		Peanut butter
	Sugar		Sugar		Sugar
	Tea		Tea		Tea
Lunch		**Lunch**		**Lunch**	
Main Dish - Cracked Wheat with tomato sauce	Cracked wheat	Main dish : Rice with red beans sauce	Red beans	Main Dish : Macaroni with carrot sauce	Macaroni
	Avocado		Rice		Carrots
	Tomato		Carrots		Cabbage
	Onion		Collard Greens		Onion
	Niger oil		Onion		Tomato
Side Dish - Avocado and tomato salad	Garlic		Tomato		Niger oil
	Ginger	Side Dish : Carrot with Collared greens	Niger oil	Side Dish: Carrot with Cabbage	Garlic
	Iodized salt		Garlic		Ginger
	Turmeric		Ginger		Iodized salt
	Corriander		Iodized salt		Turmeric
	Sweet Basil (fresh)		Turmeric		Corriander (fresh)
	Rozemary		Corriander		Sweet basil (fresh)
	Cosorot		Sweet basil		Rozemary
	Lemon		Green chili pepper		Green chili pepper

School Health and Nutrition Program - School Feeding Project- Weekly Menu			
THURSDAY		**FRIDAY**	
Menu	**Food Items**	**Menu**	**Food Items**
Breakfast		**Breakfast**	
Bread with banana and Tea	White bread	Bread with peanut butter and Tea	White bread
	Banana		Peanut butter
	Sugar		Sugar
	Tea		Tea
Lunch		**Lunch**	
Main Dish : Azifa	Brown lentils	Main Dish : Injera with Sosi soya	Injera
	Carrots		Split lentils
	String bean		Potato
	Potato		Beetroot
Side Dish : Carrot and potato with string beans	Onion		Onion
	Tomato		Tomato
	Niger oil		Niger oil
	Garlic		Garlic
	Ginger		Ginger
	Iodized salt		Iodized Salt
	Turmeric		Turmeric
	Lemon		Corriander (fresh)
	Green chili pepper		Sweet Basil (fresh)
	Corriander (fresh)		Rozemary

The study subject school meal macronutrient and micronutrients contents calculated based on the reference of Ethiopia Food Composition table, USDA food composition database and other recognized websites (FCTEP4, 1968-1997; USDA,ndb.nal). Table 13 shows the amount of nutrients the study subject got in each school day from school meal breakfast and lunch.

Table 13: Nutritional value of the five days school meal

Description	Monday	Tuesday	Wednesday	Thursday	Friday
Energy_kcal	852.01	785.02	875.42	896.52	917.82
Protein_g	24.38	31.84	27.96	25.31	36.72
Fat_g	38.29	12.93	28.98	12.85	23.05
Calcium_mg	124.97	109.47	133.33	183.22	154.43
Iron_mg	6.87	4.24	5.07	3.40	39.42
Iodine_mg	126.96	130.28	129.51	130.23	128.55
Vit.A _ μg RE	209.32	753.82	493.44	473.98	20.26
Vit.B1_mg	0.47	0.28	0.41	0.27	0.71
Vit.B2_mg	0.43	0.26	0.24	0.31	0.37
Vit.B3_mg	11.49	4.14	21.66	5.00	10.97
Vit.C_mg	31.77	46.95	66.98	57.01	29.74

The adequacy of the nutrient intake of the school meal shows that macronutrients and micronutrients were above 50% of RDA for school meal except calcium which was 31.91 % RDA (Table 12).

The total RDA percentage what the school children got from school meal were : for energy 65.77%, protein 100.65 %, fat 107.04%, Calcium 31.91%, Iron 56.05%, Iodine 102.21%, Vit.A 78.03%, Vit.B1 75.30%, Vit.B2 56.65%, Vit.B3 140.55% and Vit.C 110.69% (Table 12).

The school meal RDA percentage is taken from FAO standard for school meal and WFP 2011 Proportion of Energy and Micronutrient Requirements.

Table 14: RDA % from the school meal dietary intake of the study subject

Nutrients	% RDA for school meal	Mean	% RDA
Energy_kcal	1,250.00	865.35±51.12	65.77
Protein_g	27.6	29.24±5.08	100.65
Fat_g	21.00	23.22±10.88	105.04
Calcium_mg	420.00	141.08±28.60	31.91
Iron_mg	20.00	11.80±15.49	56.05
Iodine_mg	120.00	129.10±1.38	102.21
Vit.A	475.00	390.16±282.60	78.03
Vit.B1	0.54	0.42±0.17	75.30
Vit.B2	0.54	0.32±0.07	56.65
Vit.B3	7.20	10.65±7.00	140.55
Vit.C	21.00	46.49±16.03	65.77

Table 15: RDA % from school meal

Age group	**Energy (Kcal)** (60-75% of RDA)	**Micronutrients %**
Pre-primary: 3 to <6 years	780-975 Kcal	At least 80% of RDA
Primary: 6 to <12 years	1,110-1,390 Kcal	At least 80% of RDA
Secondary: 12 - <16	2050 – 2140 Kcal	At least 80% of RDA

Source: WFP -2011 Proportion of Energy and Micronutrient Requirements.

The summation of the two nutrient intake of home and school meal of the study subject it covered, Energy 58.51%, Protein 127.14 %, Fat 131.69%, Calcium 36.95%, Iron 70.80%, Iodine 118.35 %, Vit.A 82.96 %, Vit.B1 95.11 %, Vit.B2 71.56 %, Vit.B3 177.53 % and Vit.C 232.45 % (Table 16).

Table 16: RDA % of the school meal and home meal

Nutrients	RDA for school children	Nutrient intake value	% RDA
Energy_kcal	1,800.00	1,053.23	58.51
Protein_g	27.60	35.09	127.14
Fat_g	21.00	27.86	132.69
Calcium_mg	420.00	155.19	36.95
Iron_mg	20.00	14.16	70.80
Iodine_mg	120.00	142.02	118.35
Vit.A	475.00	394.07	82.96
Vit.B1	0.54	0.51	95.11
Vit.B2	0.54	0.39	71.56
Vit.B3	7.20	12.78	177.53
Vit.C	21.00	48.81	232.45

4.2. Discussions

4.2.1. Nutrition status of the study subjects

Stunting

The prevalence of stunting for the study subjects were 26 % (Height-for-age Z-score less than -2). The result has similar prevalence rate with other studies which was done in Northern Ethiopia which ranges from 15 to 31 % (Awel & Hebo, 2016; Danquah, A. O. & Amoah, A. N. 2012; Steyn, N. P.& Nel, J. H., 2006) and in another different part of Ethiopia ranges 11% to 43 % (Degarege, D& Animut, A. 2015; 65].It is higher than another study which was done in Somalia and Addis Ababa,Ethiopia 12 % and 24 % respectively(Awel & Hebo, 2016; Danquah, A. O. & Amoah, A. N. 2012).

This prevalence of stunting is much lower than the study results which was observed in different parts of Ghana (46 %) (Owusu, J. S., KomeleyColecraft, E. 2017; Ene-Obong, H. N., &Ekweagwu, E. 2012) and in other it ranges 48 to 56 % (Awel & Hebo, 2016; Danquah, A. O. & Amoah, A. N. 2012; Musamali, B. 2007). The difference could be the dietary habit, the food consumption amount and food culture.

Underweight

The prevalence of underweight or thinness for the study subjects were 16 % as measured by BMI-for-age percentiles score is less than 5. It was in the range of the result with one study which was done in different part of Ethiopia, 7.2 % to 59.7 % (Degarege, D& Animut, A. 2015; AnuarZaini, M. Z. & Lim, C. T. 2005).

Contrary to this study result, there were lower prevalence of underweight reported in two different part of Ethiopia, Adama and Gondar (1.4% & 8.9%), in peri-urban Kenyan 4.5% (Steyn, N. P.& Nel, J. H., 2006; Olumakaiye, M. F. 2013), Ashanti region 3.4 % (Owusu, J. S., KomeleyColecraft, E. 2017), Eastern Uganda 10.1% (Awel & Hebo, 2016; Danquah, A. O. & Amoah, A. N. 2012) and Muktagangothri, Mysore, India 11.3 % (Steyn, N. P.& Nel, J. H., 2006; Olumakaiye, M. F. 2013).This prevalence was lower than the result observed in Ghana school age children 34.6 % (Ma'alin & Birhanu 2016)) and Northwest of Ethiopia 37.2 % (Mekonnen, H.& Tadesse, T. 2013; Owusu, J. S., KomeleyColecraft, E. 2017; Ene-Obong, H. N., &Ekweagwu, E. 2012).

Over weight

The prevalence of obesity for the study subjects were 3 % (BMI-for-age percentiles score greater or equal to 85).

It is lower when we compare with other school children which was done in Nigeria, their prevalence was 9.4 % and shows 1.9% obese (Steyn, N. P.& Nel, J. H., 2006; Olumakaiye, M. F. 2013), Malaysian 16.3 % (AnuarZaini, M. Z. & Lim, C. T. 2005), Nigerian SAC 4.7 % (Owusu, J. S., KomeleyColecraft, E. 2017; Ene-Obong, H. N., &Ekweagwu, E. 2012).

This prevalence is higher than what was reported in the study which was done in Ghana school age children 1 % (Owusu, J. S., KomeleyColecraft, E. 2017; Ene-Obong, H. N., &Ekweagwu, E. 2012).

The different prevalence rate among school age children in different country reveals that the different living condition, economical status, food culture, food choice habit.

4.2.2. Adequacy of nutrient intake and dietary diversity score

4.2.2.1. Study subject adequacy of nutrient intake

As per the nutrient intake analysis, the study subject were getting above 50 % of RDA for the most of the nutrients except calcium which contained 36.96 %. The study subject were consumed adequate intake of energy, protein, fat, selected vitamins and minerals.

In this present study, the energy provided by the SFP and home meal 58.51% was higher than what was reported in another studies 16.2% and 28 %. The mean energy content of the school meal of this study was 865.35±51.12 kcal which was higher than another Government school feeding program in Ashanti region 460.4±30.1 kcal and Ghana 295±94 kcal. It is reported that most GSFP meals didn't meet energy and nutrient requirement (Owusu, J. S., KomeleyColecraft, E. 2017; Danquah, A. O. & Amoah, A. N. 2012; Musamali, B. 2007).

The RDA % of the energy and protein content of the meal in this study 58.51 % and 127.14 % was lower than the study which was done in Malawi 69 to 73 % and 150 % but RDA % of Fat, Iron, calcium, Vitamins of the dietary intake of this study is higher than the same study in Malawi Kalira EPA (Owusu, J. S., KomeleyColecraft, E. 2017).

On the contrary of this study result, in Kenyan primary school children it was observed that there is higher intake of energy (2089±12.41 kcal vs.865.35±51.12 kcal) and protein (58±7.5 vs. 29.24±5.08) which is even above the % RDA for school meal (Musamali, B. 2007).

The RDA % of the energy is inadequate but protein and fat shows that above 100 % of the RDA % which can be a compensation mechanism for the low content of energy because the body uses protein and fat as a source of energy during the shortage of energy.

The RDA % of Iron of the current study subject was adequate, it is also similar with the study result in Uganda. Even-though the iron rich food source such as meat lacks for the school meal there was leafy vegetables with good iron content in the menu.

Regarding the low dietary intake of calcium similar trend was revealed that most of the African school age children consumption of calcium were in the range of 300-400 mg/day which is lower than the RDA. The mean calcium contents of the school and home meal consumed by the school children were 155.19 mg/day which was even below the usual African school age children and lower than what was reported about Ghana school children 384 mg/day (Owusu, J. S., KomeleyColecraft, E. 2017).

Similar study also mentioned that most of school age children, except energy and calcium, their nutrient intake of met the RDA (Iron, Vitamin A, Vitamin B1, B2, B3) and some of them (Protein, Fat and Vitamin C) met the RDA in excess way (Steyn, N. P.& Nel, J. H., 2006; Olumakaiye, M. F. 2013).

The school meal menu based on only plant source which lacks the animal products as a result the study subjects didn’t get meat, fish and dairy products which are rich source of protein and minerals, animal source foods is important for rapid growth and development of the children and it reduce the negative effect of ani-nutritional factors found in plant food source which inhibits absorption of nutrients such as iron and zinc (Owusu, J. S., KomeleyColecraft, E. 2017).

There is similar trend in another study conducted in Malawi and Uganda, the consumption of animal source foods is very low in different school feeding programs and even in children home meal (Owusu, J. S., KomeleyColecraft, E. 2017).

4.2.2. Dietary Diversity Score of the study subjects

Diets of the study subjects were in medium category of DDS which 5, it is the same as the study result observed in Ghana government school feeding program 5.46 (Owusu, J. S., KomeleyColecraft, E. 2017).But as explain earlier it did not include dairy products, meat and fish.

Similar report were observed in South Africa, Ghana, Uganda and India (Katungwe, P.& Mwangwela, A.2015). It is reported that high dietary diversity more focus on micro-nutrient adequacy than energy and macronutrient adequacy. DDS result also shows the household food security status as per the study which were done in 10 developing countries (Katungwe, P.& Mwangwela, A.2015).

The nutrient intake adequacy of the study subjects was good. When we saw separately the school meal and home meal. The home meal contained mostly cereals and grains on the other side the school meal contained different types of cereals, legumes, grains, vegetables and fruits. Similar result observed in South Western Nigeria school age children regarding the consumption of cereals, legumes, grain and less consumption of food groups like meat, fish and dairy products Olumakaiye, M. F. 2013).

5. Conclusions and Recommendations

5.1. Conclusions

The overall nutritional status of the study subjects shows that 56 % were normal and 44 % malnourished (stunted underweight and overweight). The nutrient content has good result. The school meal has more nutritional value in every day menu than home meal. It covered above 70% of their RDA as per the recommendation for the school meal by WFP.

Therefore, in order to prevent malnutrition in school age children it requires all-inclusive strategy such as awareness rising session for parents about nutrition and how the locally grown plants are useful to meet the RDA of their children and family. Increasing the coverage of school feeding program which can provide daily hot, fresh, nutritious meal and administration of de-worming and Vitamin A important.

Generally, there should be an enabling policy environment to facilitate planning and implementation of the health and nutrition intervention programs. It needs also strong political commitment and provision of adequate resource for its implementation. Coordination of multi-sectorial nutrition interventions for common objective of addressing under nutrition such as health, agriculture, water, education and other relevant sectors must work cooperatively in order to get good result (Mramba, L. & Ngari, M. 2017;Sorhaindo, A., & Feinstein, L. 2006).

To make sustainable, the health and nutrition intervention program strategy, there should be the collaboration of international organizations with national led investments. In addition, the monitoring and evaluation system to access the prevalence of child malnutrition must be improves and carried out at least in every 2 years until the required result happen (Mramba, L. & Ngari, M. 2017;Sorhaindo, A., & Feinstein, L. 2006).

5.2. Recommendations

The recommendations are as follows:

- Even through, the Non-government SFP nutrient value is good, it needs some adjustment on the menu planning such as increase the diet diversity score by adding meat, fish and milk groups instead of only using plant source.
- As a country there should have uniform school meal menu between government and non-government feeding program which can avoid division between the feeding program beneficiaries and keeps the nutritive value with minimum cost using our local produced food ingredients.
- It is important creating standard school meal menu which can be a model and as a user manual for all government and non-government organization who are involved on provision of school meal under school feeding program
- To improve the nutritional value of the feeding program menu there should be additional meals which have good nutrient value to be added in the menu like animal source food in order to increase the intake of nutrient and DDS of the school children.
- School health and nutrition program should be seriously taken and implementation of this program can help the school age children in order to meet their need in health and nutrition aspects.

- The intervention program such as provision of nutritious meal via school feeding, school de-worming, school WASH, health and nutrition education, and awareness raising for the parents in order to select and buy nutritious foods by affordable price and using of the available foods in proper way.
- To implement the above school health and nutrition interventions properly, different stakeholders from government office such as ministry of health, ministry of education, ministry of agriculture and non-government organization which are working on children should work in collaboration.

6. Limitation of the study and data weakness

- During data collection it was difficult to get right and full information such as date of birth for the study subject because some students are living with their extended family and some of them don't know their parents. So the analysis is done using approximate date.
- Getting nutrition value of some food
- It was difficult to get the information regarding their meal consumption at home

References

Abdelaziz, S. B., Youssef, M. R. L., Sedrak, A. S., &Labib, J. R. (2015). Nutritional Status and Dietary Habits of School Children in Beni-Suef Governorate, Egypt. Food and Nutrition Sciences, 6(01), 54.

Abdu, J., Kahsay, M., &Gebremedhin, M(2015). Household Food Insecurity, Underweight Status and Associated Characteristics among Women of Reproductive age Group in Asayita District, Afar Regional State, Ethiopia.

Acrivos, A. (1995). BINGHAM AWARD LECTURE—1994 Shear-induced particle diffusion in concentrated suspensions of noncolloidal particles. Journal of Rheology, 39(5), 813-826.

Alaimo, K., Olson, C. M., &Frongillo, E. A. (2001). Food insufficiency and American school-aged children's cognitive, academic, and psychosocial development. Pediatrics, 108(1), 44-53

AnuarZaini, M. Z., Lim, C. T., Low, W. Y., &Harun, F. (2005). Factors affecting nutritional status of Malaysian primary school children. *Asia Pacific Journal of Public Health*, *17*(2), 71-80.

Asfaw, M., Wondaferash, M., Taha, M., &Dube, L. (2015). Prevalence of undernutrition and associated factors among children aged between six to fifty nine months in BuleHora district, South Ethiopia. BMC Public health, 15(1), 41.

Awel, Lema&Hebo, (2016). Nutritional status and associated factors among primary school adolescents of pastoral and agro-pastoral communities, Mieso Woreda, Somali Region, Ethiopia: A comparative cross-sectional study. *Journal of Public Health and Epidemiology*, 8(11), 297-310.

Ara, R., Hoque, S. R., Adhikary, M., Uddin, M. N., Mahmood, A. R., &Ferdousi, S. K. (2011). Nutritional status among the primary school children in a selected rural community. Journal of Dhaka Medical College, 20(2), 97-101.

Benítez-Bribiesca, L., De la Rosa-Alvarez, I., &Mansilla-Olivares, A. (1999). Dendritic spine pathology in infants with severe protein-calorie malnutrition. Pediatrics, 104(2), e21-e21.

Berkman, D. S., Lescano, A. G., Gilman, R. H., Lopez, S. L., & Black, M. M. (2002). Effects of stunting, diarrhoeal disease, and parasitic infection during infancy on cognition in late childhood: a follow-up study. The Lancet, 359(9306), 564-571.

Best, C., Neufingerl, N., Van Geel, L., van den Briel, T., & Osendarp, S. (2010). The nutritional status of school-aged children: why should we care? Food and nutrition bulletin, 31(3), 400-417.

Bronner, E. A. (2015). Nutritional Assessment of Preschool Children in an Urban Ecuadorian Community.

Butler-Jones, D. (2008). *The Chief Public Health Officer's Report on the State of Public Health in Canada: 2008*. Ottawa, ON: Public Health Agency of Canada.

Chen, R. S., Bender, W. H., Kates, R. W., Messer, E., &Millman, S. R. (1990). The hunger report: 1990.

Cogill, B. (2003). Anthropometric indicators measurement guide.

Danquah, A. O., Amoah, A. N., Steiner-Asiedu, M., &Opare-Obisaw, C. (2012). Nutritional status of participating and non-participating pupils in the Ghana School Feeding Programme. *Journal of Food Research*, *1*(3), 263.

Degarege, D., Degarege, A., &Animut, A. (2015). Undernutrition and associated risk factors among school age children in Addis Ababa, Ethiopia. BMC Public health, 15(1), 375.

Endris, Asefa, &Dube(2017). Prevalence of Malnutrition and Associated Factors among Children in Rural Ethiopia. BioMed Research International, 2017.

Ene-Obong, H. N., &Ekweagwu, E. (2012). Dietary habits and nutritional status of rural school age children in Ebonyi state, Nigeria. *Nigerian journal of Nutritional sciences*, *33*(1), 23-30.

FCTEP4, 1968-1997, Food Composition Table for use in Ethiopia Part III, Ethiopia Health and Nutrition Institute (EHNRI), 1968-1997

Ferdous, F., Das, S. K., Ahmed, S., Farzana, F. D., Latham, J. R., Chisti, M. J., ...&Faruque, A. S. (2013). Severity of diarrhea and malnutrition among under five-year-old children in rural

Bangladesh. *The American journal of tropical medicine and hygiene*, 89(2), 223-228.

FirehiwotMesfin, (2014), The nutritional status of primary school children in Kersadistrict, Eastern Ethiopia NNP related research finding dissemination workshop Oct. 23-25, 2014 Adama, Ethiopia Haramaya University)

Guidelines for Measuring Household And individual Dietary Diversity version 3 August 2007

Griggs, D., Stafford-Smith, M., Gaffney, O., Rockström, J., Öhman, M. C., Shyamsundar, P., & Noble, I. (2013). Policy: Sustainable development goals for people and planet. Nature, 495(7441), 305-307.

Gilligan, D. O., &Hoddinott, J. (2007). Is there persistence in the impact of emergency food aid? Evidence on consumption, food security, and assets in rural Ethiopia. *American journal of agricultural economics*, *89*(2), 225-242.

Hall, A., Kassa, T., Demissie, T., Degefie, T., & Lee, S. (2008). National survey of the health and nutrition of schoolchildren in Ethiopia. Tropical Medicine & International Health, 13(12), 1518-1526.

Handa, R., Ahamad, F., Kesari, K. K., & Prasad, R. (2008). Assessment of nutritional status of 7-10 years school going children of Allahabad district*: A review. Middle-East Journal of Scientific Research*, 3(3), 109-115.

Hart, K. H., Bishop, J. A., &Truby, H. (2002). An investigation into school children's knowledge and awareness of food and nutrition. *Journal of Human Nutrition and Dietetics*, 15(2), 129-140.

Herrador, Z., Sordo, L., Gadisa, E., Moreno, J., Nieto, J., Benito, A., &Custodio, E. (2014). Cross-sectional study of malnutrition and associated factors among school aged children in rural and urban settings of Fogera and LiboKemkem districts, Ethiopia. PLoS One, 9(9), e105880.

Hillier, S. L., Nugent, R. P., Eschenbach, D. A., Krohn, M. A., Gibbs, R. S., Martin, D. H., ... &McNellis, D. (1995). Association between bacterial vaginosis and preterm delivery of a low-birth-weight infant. New England Journal of Medicine, 333(26), 1737-1742.

Hoddinott, J., Maluccio, J. A., Behrman, J. R., Flores, R., &Martorell, R. (2008). Effect of a nutrition intervention during early childhood on economic productivity in Guatemalan adults. The lancet, 371(9610), 411-416.

Katungwe, P., Mwangwela, A., &Geresomo, N. (2015). Dietary adequacy of rural school children among bambara groundnut growing farmers in Ntchisi district of Malawi. *African Journal of Food, Agriculture, Nutrition and Development,* 15(1), 9620-9634.

Kleinman, R. E., Hall, S., Green, H., Korzec-Ramirez, D., Patton, K., Pagano, M. E., & Murphy, J. M. (2002). Diet, breakfast, and academic performance in children. Annals of Nutrition and Metabolism, 46(Suppl. 1), 24-30.

Kuklina, E. V., Ramakrishnan, U., Stein, A. D., Barnhart, H. H., &Martorell, R. (2006). Early childhood growth and development in rural Guatemala. Early human development, 82(7), 425-43

Ma'alin, Birhanu, Melaku, S, Tolossa, D., Mohammed, Y., &Gebremicheal, K. (2016). Magnitude and factors associated with malnutrition in children 6–59 months of age in Shinille Woreda, Ethiopian Somali Regional State: a cross-sectional study. BMC Nutrition, 2(1), 44.

Martens, T. (2007). Impact of the Ghana school feeding programme in 4 districts in central region, Ghana. *Wageningen University: Division of Human Nutrition (Thesis)*

Mekasha, A., &Zerfu, M. (2009). Prevalence of anemia among school children in Addis Ababa. *Ethiopian medical journal*, 47(2), 129-133.

Mekonnen, H., Tadesse, T., & Kisi, T. (2013). Malnutrition and its correlates among rural primary school children of Fogera district, northwest Ethiopia. *Journal of Nutritional Disorders and Therapy S*, 12, 2161-0509.

Mikkelsen, B. E. (2014). School-a multitude of opportunities for promoting healthier eating. Public health nutrition, 17(6), 1191.

Mramba, L., Ngari, M., Mwangome, M., Muchai, L., Bauni, E., Walker, A. S., ...& Berkley, J. A. (2017). A growth reference for mid upper arm circumference for age among school age children and adolescents, and validation for mortality: growth curve construction and longitudinal cohort study. *bmj*, *358*, j3423.

Musamali, B. (2007). Impact of school lunch programmes on nutritional status of children in Vihiga district, western Kenya. *African Journal of Food, Agriculture, Nutrition and Development*, *7*(6).

NCHS, C. (2012). Growth charts. US Department of Health and Human Services, Centers for Disease Control and Prevention. National Center for Health Statistics.

Nicklas, T. A., Stone, E., Montgomery, D., Snyder, P., Zive, M., Ebzery, M. K., & Dwyer, J. (1994). Meeting the dietary goals for school meals by the year 2000: The CATCH Eat Smart school nutrition program. *Journal of Health Education*, *25*(5), 299-307.

Owoaje, E., Onifade, O., &Desmennu, A. (2014). Family and socioeconomic risk factors for undernutrition among children aged 6 to 23 Months in Ibadan, Nigeria. *The Pan African medical journal,* 17.

Ochola, S., &Masibo, P. K. (2014). Dietary intake of schoolchildren and adolescents in developing countries. Annals of Nutrition and Metabolism, 64(Suppl. 2), 24-40.

Olinto, P., Beegle, K., Sobrado, C., &Uematsu, H. (2013). The state of the poor: Where are the poor, where is extreme poverty harder to end, and what is the current profile of the world's poor?. Economic Premise, 125(2).

Olumakaiye, M. F. (2013). Dietary diversity as a correlate of undernutrition among school-age children in southwestern Nigeria. *Annals of Nutrition and Metabolism*, *63*, 569-569.

Onis, M. D., Onyango, A. W., Borghi, E., Siyam, A., Nishida, C., &Siekmann, J. (2007). Development of a WHO growth reference for school-aged children and adolescents. Bulletin of the World health Organization, 85(9), 660-667

Owusu, J. S., KomeleyColecraft, E., Aryeetey, R., Vaccaro, J. A., & Huffman, F. (2017). Nutrition intakes and nutritional status of school age children in Ghana.

Pollitt, E., & Mathews, R. (1998). Breakfast and cognition: an integrative summary. *The American journal of clinical nutrition*, 67(4), 804S-813S.

Rawe, K. (2012). A life free from hunger: tackling child malnutrition. Save the Children.

Reji, P., Belay, G., Erko, B., Legesse, M., & Belay, M. (2011). Intestinal parasitic infections and malnutrition amongst first-cycle primary schoolchildren in Adama, Ethiopia. *African Journal of Primary Health Care and Family Medicine*, 3(1), 1-5.

Rockett, H. R., &Colditz, G. A. (1997). Assessing diets of children and adolescents. *The American journal of clinical nutrition*, *65*(4), 1116S-1122S.

Ruel, M. T., Garrett, J. L., Hawkes, C., & Cohen, M. J. (2010). The food, fuel, and financial crises affect the urban and rural poor disproportionately: a review of the evidence. *the Journal of Nutrition,* 140(1), 170S-176S.

Srivastava, A., Mahmood, S. E., Srivastava, P. M., Shrotriya, V. P., & Kumar, B. (2012). Nutritional status of school-age children-A scenario of urban slums in India. Archives of Public Health, 70(1), 8.

Sorhaindo, A., & Feinstein, L. (2006). What is the relationship between child nutrition and school outcomes?[Wider Benefits of Learning Research Report No. 18].

Sørlien, A. L. (2012). To school or not to school: the impact of child nutrition on school participation in Northern Ethiopia(Master's thesis, Norwegian University of Life Sciences,

Steyn, N. P., Nel, J. H., Nantel, G., Kennedy, G., &Labadarios, D. (2006). Food variety and dietary diversity scores in children: are they good indicators of dietary adequacy?. *Public health nutrition*, *9*(5), 644-650.

Taras, H. (2005). Nutrition and student performance at school. *Journal of school health*, 75(6), 199-213.

Theron, M., Amissah, A., Kleynhans, I. C., Albertse, E., &MacIntyre, U. E. (2007). Inadequate dietary intake is not the cause of stunting amongst young children living in an informal settlement in Gauteng and rural Limpopo Province in South Africa: the NutriGro study. Public health nutrition, 10(4), 379-389.

Tunje, d. D. S. Prevalence and determinants of malnutrition among primary school children in Kilifi District, Kenya.

Thomson, I. S. I. (2017). VN Ibeanu, FO Okechukwu and EP Eme-Okafor. *Pakistan Journal of Nutrition*, 16(3), 125-130.

Uauy, R., Kain, J., Mericq, V., Rojas, J., &Corvalán, C. (2008). Nutrition, child growth, and chronic disease prevention. Annals of medicine, 40(1), 11-20.

UNICEF, (2014). The cost of hunger in Ethiopia. The social and economic impact of child undernourishment in Ethiopia summary report.

USDA,ndb.nal, United States Department of Agriculture, Agricultural Research Service, USDA Food Composition Database - https://ndb.nal.usda.gov/ndb/search/list

Use of Percentiles and Z -Scores in Anthropometry Youfa Wang and Hsin-Jen Chen; Department of International Health , Johns Hopkins Bloomberg School of Public Health, Center for Human Nutrition.

Walker, S. P., Chang, S. M., Powell, C. A., Simonoff, E., & Grantham-McGregor, S. M. (2007). Early childhood stunting is associated with poor psychological functioning in late adolescence and effects are reduced by psychosocial stimulation. *The Journal of nutrition,* 137(11), 2464-2469.

World Health Organization. (2009). Evaluation of certain food additives: sixty-ninth report of the Joint FAO/WHO Expert Committee on Food Additives (No. 952). World Health Organization.

World Health Organization Growth Standards BC Training Module Appendices, BRITISH COLUMBIA, JUNE 2, 2011

Woodhead, M., Dornan, P., & Murray, H. (2013). What inequality means for children: Evidence from young lives.

You, D., Hug, L., Ejdemyr, S., &Beise, J. (2015). Levels and trends in child mortality. Estimates developed by the UN Inter-agency Group for Child Mortality Estimation (IGME). Report 2015.

APPENDIX

APPENDIX 1) Parent consent form in English and Amharic

The purpose of this study is to assess the nutritional status of your child

The assessment will consist of:

- Measuring of heights, weights and Mid Upper Arm Circumferences
- Estimated intake of meal for one week

Benefits

Knowing your child nutritional and overall growth status helps to make timely action in order to improve its status and also it will be a good baseline data for the donor in order to give the child the right and needed nutritional intervention.

Sticker or other motivation things will be given to your child to thank them for participating with this study.

Confidentiality

Your child data will be kept confidentially until the study finished, after completion of the study the records will be destroyed.

Right to quite from being part of the study

You have the right to withdraw from this study at any time.

Please check one of the following:

o I confirm that I have read and understood the study titled, Nutritional Assessment of students enrolled in school feeding program". I hereby give my informed consent for my child to participate in this nutritional assessment activity and have their picture taken or be videotaped for printed educational and research presentations.

Parent/Guardian Signature _________________/Date

Child's name_________________

o I do not give consent for my child to participate in this study.

Parent/Guardian Signature /Date________

Child's name __ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

If you are willing please participate in order to answer the attached 24 hour dietary recall questionnaires

Thank you for your time!

የልጆቻቸውን የተመጣጠነ እድገት እና የተመጣጠን ምግብ አወሳሰድ ምዘና ለማድረግ የወላጅ ፍቃደኛነትን የመጠየቂያ ቅጽ

የዚህጥናትዋናአላማየልጆችንየተመጣጠነእድገትእናየተመጣጠነምግብአወሳሰድለመመዘንሲሆንይህንንምጥናትለማካሄድየሚደረገውሁለት ነገርሲሆን፡-

፩- የልጆችቁመት፣ክብደትእናየክንድስፋትይለካል

፪- የአንድሳምንትከሰኞእስከአርብከትምህርትቤትመልስልጆትየተመገበው / የጠጣውንማንኛውንምምግብ / መጠጥእንዲሁምቅዳሜእናእሁድጥዋትከእንቅልፉተነስቶማታእስከሚተኛድርስየተመገበው / የጠጣውንማንኛውንምምግብ / መጠጥመጠንይለካል

ከዚህጥናትየሚገኘውጥቅም

የልጆትንየተመጣጠነምግብአወሳሰድእናየተመጣጠነእድገትማወቅጊዜውንየጠበቀተገቢውሳኔለመውሰድይጠቅማልእንዲሁምልጆትንበተለ ያየመልኩየጤናድጋፍማድረግለሚፈልግየእርዳታድርጅትየመነሻመረጃመስጫይሆናል።

የልጆትመረጃምስጥራዊነትአጠባበቅ

የልጆትመረጃይህጥናትእስከሚያልድረስበጥሩእናበጥንቃቄይቀመጥናጥናቱካለቅበሃላይቃጠላልስለዚህየልጆችማንኛውምመረጃበሚስጥርየ ተጠበቀይሆናልማለትነው።

ከጥናቱውጭየመሆንሙብትንበተመለከተ

ልጆችበማንኛውምጊዜከዚህጥናትማቆምቢፈልግእርሶምቢፈልጉየማቆምሙብቶትየተጠበቀነው

እባክዎትንከዚህበታችካሉትምርጫከሁለትአንዱንምረጡ

O

የልጆችየተመጣጠነእድገትእናየተመጣጠነምግብአወሳሰድምዘናበሚልርዕስየሚደረገውንጥናትአንብቤእናተረድቼልጄበጥናቱላይእንዲካተት እንዲሁምፎቶውምቢወሰድየማልቃወምመሆኑንእናፍቃደኛመሆኔንበፊርማዬአረጋግጣለሁ።

የወላጅስምእናፊርማ:________________________________ቀን:____________________

የተማሪው/የተማሪዋስም:______________________________

o ልጄበጥናቱላይእንዲሳተፍፍቃደኛአይደለሁም

የወላጅስምእናፊርማ:________________________________ቀን:____________________

የተማሪው/የተማሪዋስም:______________________________

እባክዎፍቃደኛከሆኑከዚህቅጽጋርየተያያዘውንመጠይቅበመመለስተባበሩን

ውድጊዜዎትንሰውተውስለተባበሩንበቅድሚያእናመሰግናለን።

APPENDIX 2) 24-dieatry recall form in English and Amharic

Seven day food intake questionnaires using 24-dietary recall

Student ID: | APS | KG |__ |__ | Student date of birth: ___/____/_______

Date of Interview: ________________________

General Introduction

Hello! I am__________ and I am an interviewer which is a 3rd year student from Addis Abeba University 4 Kilo Campus. Today I would like to ask about your child food consumption for the last one week on daily basis. It will take about 15-25 minutes. If you are agree let me start my interview?

All that you have eaten including drinks, snacks and others will need to be recalled. Please tell me everything you ate or drank all the seven days and don't forget to tell me all you ate and drank at home and away—even snacks.

Food/liquid serving size can be explained by large spoon, number of bread/Injera, cup, glass or whatever it is convenient to explain and convert to gram or litre

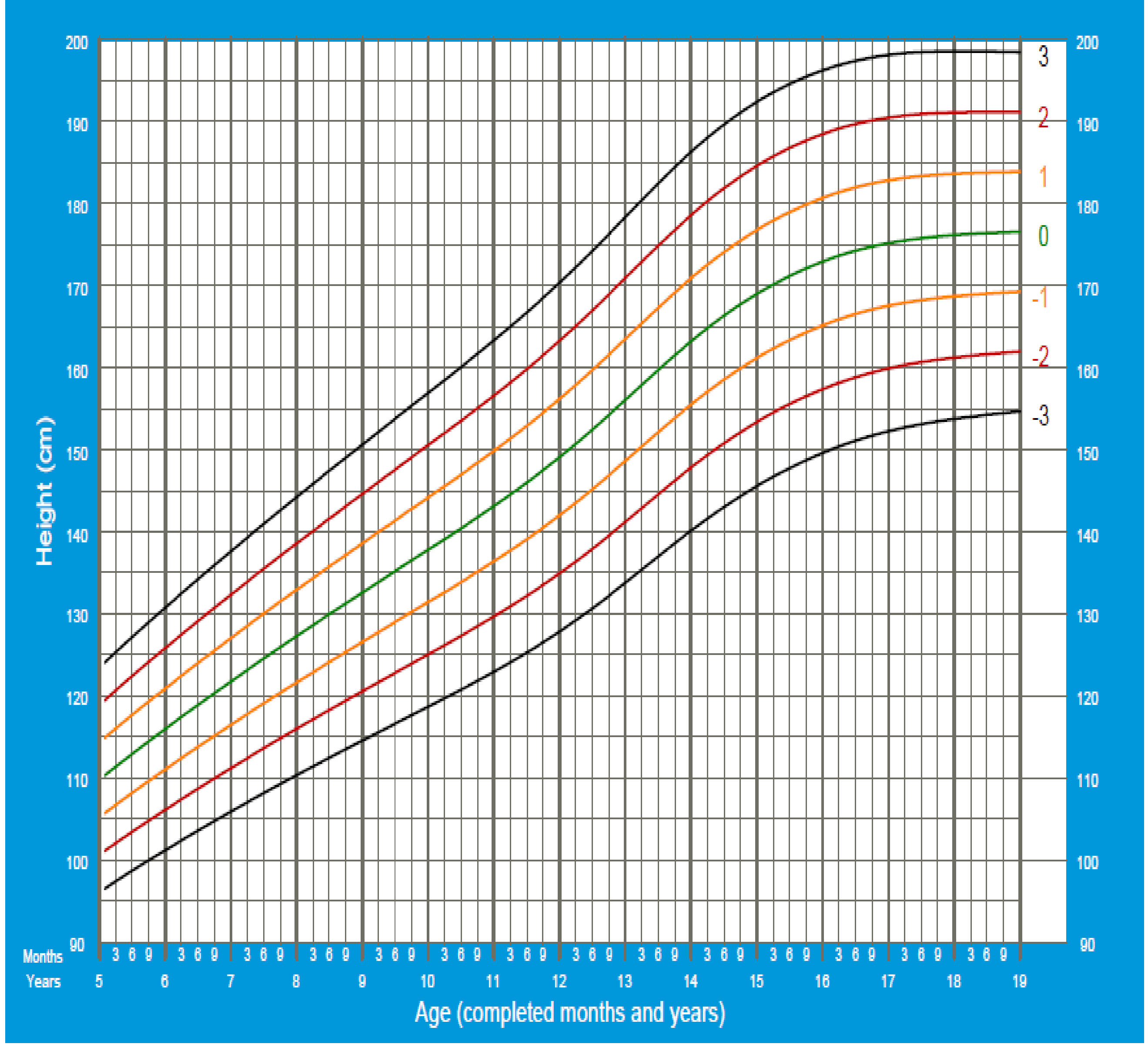
Lists of food items with codes	Day (Monday and Sunday	Time (Morning, Afternoon, Night)	Occasion (Breakfast, Lunch, Dinner and Snack)	Food/Drink and additions	Description of food/drink and ingredient	How much of food did you eat/drink	Food code	Amount in gram / litre
	Monday	After school						
		Dinner						
	Tuesday	After school						
		Dinner						
	Wednesday	After school						
		Dinner						
	Thursday	After school						
		Dinner						
	Friday	After school						

		Dinner						
	Saturday	Breakfast						
		Lunch						
		Dinner						
	Sunday	Breakfast						
		Lunch						
		Dinner						

Parent signature: ___________________________Parent contact address: _____________________________

Thank you for your participation!

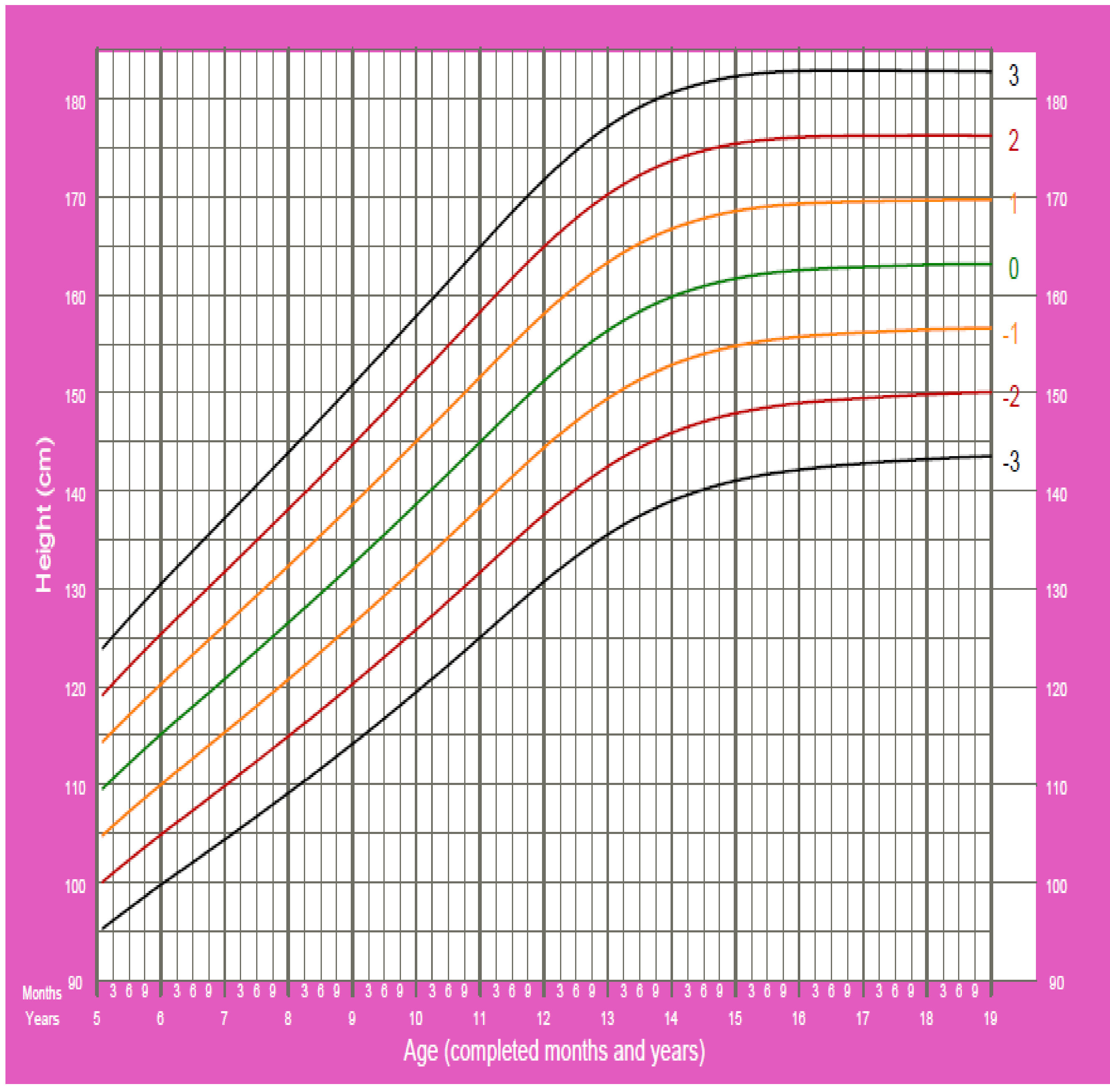
APPENDIX 3) WHO Growth charts– Height-for-age & BMI-for-age



Height-for-age GIRLS

5 to 19 years (z-scores)

World Health Organization



2007 WHO Reference

BMI-for-age GIRLS

5 to 19 years (percentiles)

					Percentiles (BMI in kg/m^2)										
Year: Month	Month	L	M	S	1st	3rd	5th	15th	25th	50th	75th	85th	95th	97th	99th
7: 3	**87**	-1.2941	15.4593	0.10883	12.4	12.9	13.2	13.9	14.4	15.5	16.7	17.5	19.0	19.6	21.0
7: 4	**88**	-1.3060	15.4798	0.10929	12.4	12.9	13.2	13.9	14.4	15.5	16.7	17.5	19.0	19.7	21.1
7: 5	**89**	-1.3175	15.5014	0.10974	12.4	12.9	13.2	13.9	14.4	15.5	16.8	17.5	19.1	19.7	21.2
7: 6	**90**	-1.3287	15.5240	0.11020	12.5	12.9	13.2	14.0	14.5	15.5	16.8	17.6	19.1	19.8	21.2
7: 7	**91**	-1.3395	15.5476	0.11065	12.5	12.9	13.2	14.0	14.5	15.5	16.8	17.6	19.2	19.8	21.3
7: 8	**92**	-1.3499	15.5723	0.11110	12.5	13.0	13.2	14.0	14.5	15.6	16.9	17.6	19.2	19.9	21.4
7: 9	**93**	-1.3600	15.5979	0.11156	12.5	13.0	13.2	14.0	14.5	15.6	16.9	17.7	19.3	20.0	21.5
7:10	**94**	-1.3697	15.6246	0.11201	12.5	13.0	13.3	14.0	14.5	15.6	16.9	17.7	19.3	20.0	21.6
7:11	**95**	-1.3790	15.6523	0.11246	12.5	13.0	13.3	14.0	14.6	15.7	17.0	17.8	19.4	20.1	21.7
8: 0	**96**	-1.3880	15.6810	0.11291	12.5	13.0	13.3	14.1	14.6	15.7	17.0	17.8	19.4	20.2	21.7
8: 1	**97**	-1.3966	15.7107	0.11335	12.6	13.0	13.3	14.1	14.6	15.7	17.0	17.9	19.5	20.2	21.8
8: 2	**98**	-1.4047	15.7415	0.11380	12.6	13.1	13.3	14.1	14.6	15.7	17.1	17.9	19.6	20.3	21.9
8: 3	**99**	-1.4125	15.7732	0.11424	12.6	13.1	13.4	14.1	14.7	15.8	17.1	18.0	19.6	20.4	22.0
8: 4	**100**	-1.4199	15.8058	0.11469	12.6	13.1	13.4	14.2	14.7	15.8	17.2	18.0	19.7	20.4	22.1
8: 5	**101**	-1.4270	15.8394	0.11513	12.6	13.1	13.4	14.2	14.7	15.8	17.2	18.1	19.8	20.5	22.2
8: 6	**102**	-1.4336	15.8738	0.11557	12.6	13.1	13.4	14.2	14.7	15.9	17.2	18.1	19.8	20.6	22.3
8: 7	**103**	-1.4398	15.9090	0.11601	12.7	13.2	13.4	14.2	14.8	15.9	17.3	18.2	19.9	20.7	22.4
8: 8	**104**	-1.4456	15.9451	0.11644	12.7	13.2	13.5	14.3	14.8	15.9	17.3	18.2	20.0	20.7	22.5
8: 9	**105**	-1.4511	15.9818	0.11688	12.7	13.2	13.5	14.3	14.8	16.0	17.4	18.3	20.0	20.8	22.6
8:10	**106**	-1.4561	16.0194	0.11731	12.7	13.2	13.5	14.3	14.9	16.0	17.4	18.3	20.1	20.9	22.7
8:11	**107**	-1.4607	16.0575	0.11774	12.8	13.3	13.5	14.4	14.9	16.1	17.5	18.4	20.2	21.0	22.8
9: 0	**108**	-1.4650	16.0964	0.11816	12.8	13.3	13.6	14.4	14.9	16.1	17.5	18.4	20.2	21.1	22.9
9: 1	**109**	-1.4688	16.1358	0.11859	12.8	13.3	13.6	14.4	15.0	16.1	17.6	18.5	20.3	21.1	23.0
9: 2	**110**	-1.4723	16.1759	0.11901	12.8	13.3	13.6	14.4	15.0	16.2	17.6	18.5	20.4	21.2	23.1
9: 3	**111**	-1.4753	16.2166	0.11943	12.8	13.4	13.6	14.5	15.0	16.2	17.7	18.6	20.5	21.3	23.2

2007 WHO Reference

BMI-for-age BOYS

5 to 19 years (percentiles)

Year: Month	Month	L	M	S	Percentiles (BMI in kg/m²)										
					1st	3rd	5th	15th	25th	50th	75th	85th	95th	97th	99th
7: 3	87	-1.3040	15.5407	0.09176	12.9	13.3	13.5	14.2	14.6	15.5	16.6	17.2	18.4	18.9	20.0
7: 4	88	-1.3228	15.5608	0.09213	12.9	13.3	13.6	14.2	14.7	15.6	16.6	17.2	18.4	18.9	20.0
7: 5	89	-1.3414	15.5814	0.09251	12.9	13.3	13.6	14.2	14.7	15.6	16.6	17.3	18.5	19.0	20.1
7: 6	90	-1.3596	15.6023	0.09289	12.9	13.3	13.6	14.3	14.7	15.6	16.7	17.3	18.5	19.0	20.2
7: 7	91	-1.3776	15.6237	0.09327	12.9	13.4	13.6	14.3	14.7	15.6	16.7	17.3	18.6	19.1	20.2
7: 8	92	-1.3953	15.6455	0.09366	12.9	13.4	13.6	14.3	14.7	15.6	16.7	17.4	18.6	19.2	20.3
7: 9	93	-1.4126	15.6677	0.09406	12.9	13.4	13.6	14.3	14.7	15.7	16.7	17.4	18.7	19.2	20.4
7:10	94	-1.4297	15.6903	0.09445	13.0	13.4	13.6	14.3	14.8	15.7	16.8	17.4	18.7	19.3	20.4
7:11	95	-1.4464	15.7133	0.09486	13.0	13.4	13.7	14.3	14.8	15.7	16.8	17.5	18.8	19.3	20.5
8: 0	96	-1.4629	15.7368	0.09526	13.0	13.4	13.7	14.4	14.8	15.7	16.8	17.5	18.8	19.4	20.6
8: 1	97	-1.4790	15.7606	0.09567	13.0	13.4	13.7	14.4	14.8	15.8	16.9	17.5	18.9	19.4	20.6
8: 2	98	-1.4947	15.7848	0.09609	13.0	13.5	13.7	14.4	14.8	15.8	16.9	17.6	18.9	19.5	20.7
8: 3	99	-1.5101	15.8094	0.09651	13.0	13.5	13.7	14.4	14.9	15.8	16.9	17.6	19.0	19.5	20.8
8: 4	100	-1.5252	15.8344	0.09693	13.0	13.5	13.7	14.4	14.9	15.8	17.0	17.7	19.0	19.6	20.9
8: 5	101	-1.5399	15.8597	0.09735	13.1	13.5	13.7	14.4	14.9	15.9	17.0	17.7	19.1	19.7	21.0
8: 6	102	-1.5542	15.8855	0.09778	13.1	13.5	13.8	14.5	14.9	15.9	17.0	17.7	19.1	19.7	21.0
8: 7	103	-1.5681	15.9116	0.09821	13.1	13.5	13.8	14.5	14.9	15.9	17.1	17.8	19.2	19.8	21.1
8: 8	104	-1.5817	15.9381	0.09864	13.1	13.5	13.8	14.5	15.0	15.9	17.1	17.8	19.2	19.9	21.2
8: 9	105	-1.5948	15.9651	0.09907	13.1	13.6	13.8	14.5	15.0	16.0	17.1	17.9	19.3	19.9	21.3
8:10	106	-1.6076	15.9925	0.09951	13.1	13.6	13.8	14.5	15.0	16.0	17.2	17.9	19.3	20.0	21.4
8:11	107	-1.6199	16.0205	0.09994	13.2	13.6	13.8	14.6	15.0	16.0	17.2	17.9	19.4	20.0	21.4
9: 0	108	-1.6318	16.0490	0.10038	13.2	13.6	13.9	14.6	15.1	16.0	17.2	18.0	19.5	20.1	21.5
9: 1	109	-1.6433	16.0781	0.10082	13.2	13.6	13.9	14.6	15.1	16.1	17.3	18.0	19.5	20.2	21.6
9: 2	110	-1.6544	16.1078	0.10126	13.2	13.7	13.9	14.6	15.1	16.1	17.3	18.1	19.6	20.2	21.7
9: 3	111	-1.6651	16.1381	0.10170	13.2	13.7	13.9	14.6	15.1	16.1	17.4	18.1	19.6	20.3	21.8

2007 WHO Reference