



ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCES

SCHOOL OF PUBLIC HEALTH

ASSESSMENT OF THE MAGNITUDE OF DOUBLE BURDEN OF MALNUTRITION AND ITS ASSOCIATED FACTORS AMONG SELECTED IN-SCHOOL ADOLESCENTS IN ARBA MINCH TOWN, SOUTHERN ETHIOPIA: SCHOOL BASED CROSS SECTIONAL STUDY.

BY: DESSALEGN AJEMA (BSc)

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ADDIS ABABA, ETHIOPIA



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BY: DESSALEGN AJEMA (BSc)

ADVISOR: DR.JEMAL HAIDAR

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ABBREVIATIONS/ACRONYM

BMI	Body Mass Index
BAZ	Body Mass Index for Age Z-score
CVD	Cardiovascular Disease
DBM	Double Burden of Malnutrition
EDHS	Ethiopian Demographic Health Survey
FANTA	Food and Nutrition Technical Assistance
FAO	Food and Agriculture Organization
HAZ	Height for Age Z-score
HFIAS	Household Food Insecurity Access Scale
LMICs	Low and Middle Income Countries
NCD	Non Communicable Disease
PA	Proportionate allocation
REC	Research Ethical Committee
SNNPR	Southern Nation Nationalities and People Region
WC	Waist Circumference
WHO	World Health Organization
WHR	Waist- to- Hip Ratio

ABSTRACT

Background: The Double Burden of Malnutrition is a recent emerging nutritional problem of the coexistence of both under nutrition and over nutrition. Although several studies have been conducted on under 5 children malnutrition in Ethiopia, there is a research gap on double burden of malnutrition among adolescents.

Objective: To assess the magnitude of double burden of malnutrition and its associated factors among in-school adolescents in Arba Minch town, Southern Ethiopia.

Methods: School based, Cross-sectional study design was conducted among 634 high school students aged 10 to 19 years old in Arba Minch town from March, 2015 to April, 2015.

Multi-stage sampling method was used. To select the study participant, the schools were first stratified by ownership as governmental and private. Two schools from each category was randomly selected and the number of sample size required for each school was allocated proportional to the number of students in each school and grade level, Finally 406 students from government and 228 from private were included. A structured questionnaire was used to collect socio-demographic, food insecurity and physical activity data. Anthropometric measurements [weight, height, waist circumference and hip circumference] were performed by using calibrated equipments and standardized techniques. Finally bivariate and multivariate analysis was done using multinomial regression model using SPSS, version21 and WHO Anthro-Plus software, version 1.0.4 for classifying nutritional status of adolescents.

Results: The magnitude of underweight, normal and overweight and/or obesity were 19.7% (95%CI: 16.5%, 23.2%), 69.2% (95%CI: 66.2%, 72.2%) and 11.2% (95%CI: 8.7%, 13.7%), respectively. Respondents whose family size of five or less were 80% times less likely to be underweight [AOR=0.2; 95% CI= 0.12 to 0.4] compared to those whose family size of more than 5, whereas, the odds of being overweight and/or obesity was 79% times lower in participants who spent 9 hours and less in sitting than those who spent in sitting above 9 hours per day [AOR=0.21; 95% CI=0.1 to 0.4].

Conclusion and recommendation: This study revealed the coexistence of double burden of malnutrition among in-school adolescents. Parents' education, family size and wealth index were some significantly associated factors. Intersectoral collaboration among health sectors and education sectors to intervene nutrition problem and nutrition related education is recommended.

1. INTRODUCTION

1.1. Background

The Double Burden of Malnutrition (DBM) is a recent emerging nutritional problem of the coexistence of both under weight, and overweight and/or obesity. Most countries are subjected to both excesses and deficiencies of nutrients and need programmes addressing both issues. The DBM also recognizes that under nutrition early in the life course contributes to an increased tendency for over nutrition in adulthood. The DBM affects all countries, rich and poor. At the individual level the most common form of DBM seems to be energy over nutrition and iron deficiency. At the population level women are most affected by DBM, with most countries having more overweight than underweight women (1).

Adolescence is a time of dramatic change. The process of physically developing from a child to an adult is called puberty, but the chronological age provides only a rough marker of the stage of puberty. Before puberty, children in developed countries grow approximately 50–70 mm a year and gain around 2.5 kg a year. Adolescence is the only time in life besides the critical window of the first 1,000 days (from conception until two years of age) when the velocity of growth actually increases. Nearly 45% of maximum skeletal mass and 15% of adult height are gained during adolescence (2, 3).

Children in the developing world also undergo the same changes, although many enter adolescence thin and stunted through malnutrition and infections during infancy and childhood, which may delay or extend the period of pubertal changes, thus enabling more time for growth to catch up (4). A focus on adolescence is central to the success of many public health agendas, including the Millennium Development Goals aiming to reduce child and maternal mortality and non-communicable diseases (5). This study assessed the magnitude of DBM and its associated factors among in-school adolescents in Arba Minch town, Southern Ethiopia.

1.2. Statement of the problem

The magnitude of overweight and obesity in children is increasing worldwide, and currently 1 child in 10 is overweight or obese (6). Results of longitudinal study in United State suggest that obese adolescents are likely to stay obese into adulthood, and among individuals who were obese as adolescents, incident of severe obesity was 37.1% in men and 51.3% in women (7).

In lower- to middle-income countries, over nutrition co-exists with under nutrition where most overweight and obese children being concentrated in urban areas and presents serious social and psychological impacts (8).

In 2010, overweight and obesity were estimated to cause 3.4 million deaths, 3.9% of years of life lost, and 3.8% of disability-adjusted life-years (DALYs) worldwide (9).

Africa is experiencing a shift from underweight to overweight along with rapid socioeconomic and nutritional transition particularly in their urban population. This transformation comes with increased access to energy-dense foods and less strenuous jobs resulting into many people having a positive energy balance and hence becoming overweight or obese (10, 11).

The dual burden of malnutrition presents a challenge for programme and policy-makers in transitional countries. Prioritizing one extreme of malnutrition over the other is difficult on a limited budget, but under nutrition, especially in children under 5 years of age continues to be the main focus of research and health care spending. Overweight and obesity particularly in adolescents receives very little attention, and is difficult to quantify accurately in this age group due to rapid changes in growth and development, and a lack of consensus over which definition to use. As a result, there is limited understanding of the problem of dual burden and how best to manage it. Examination of the two extremes of malnutrition in adolescents may provide insight into the nature of dual burden and how to direct prevention strategies, both for the immediate problem of adolescent underweight, and the rapidly increasing problem of adolescent overweight. Although several studies have been conducted on under 5 children malnutrition in Ethiopia, there is a research gap on the coexistence of the double burden of malnutrition among adolescents.

1.3. Significance of the Study

Overweight and/or obesity during adolescence increases the risk for the development of non-communicable diseases and predisposes the individual to the development of overweight, obesity, cardiovascular disease, and metabolic and other disorders in adulthood. Therefore data on magnitude and determinants of obesity in developing countries are needed for primary prevention. Studies on the prevalence of overweight/obesity in different parts of the country and identifying high risk groups in the communities are important to design appropriate intervention strategies.

Therefore, this study will avail baseline information and reference data on the magnitude and its associated factors of underweight, overweight and obesity among in-school adolescents. Secondly, it will provide evidences to further research and concerned bodies to plan prevention strategies for both under and over nutrition simultaneously.

2. LITERATURE REVIEW

There are different factors that affect nutritional status of adolescents ranging from individual, household and basic factors. Socioeconomic status, age, sex, and mothers' educational level are among the important determinants of nutritional status of adolescents (12).

2.1. Magnitude of the Double Burden of Malnutrition

According to Trends of obesity and underweight in older children and adolescents in the United States, Brazil, China, and Russia: the prevalence of overweight increased during the study periods in Brazil (from 4.1%-13.9%), China (from 6.4%-7.7%), and the United States (from 15.4%- 25.6%); underweight decreased in Brazil (from 14.8%- 8.6%), China (from 14.5%- 13.1%), and the United States (from 5.1%- 3.3%). In Russia, overweight decreased (from 15.6%- 9.0%) and underweight increased (from 6.9%- 8.1%). The annual rates of increase in the prevalence of overweight were 0.5%, 0.2%, 1.1%, and 0.6% in Brazil, China, Russia and United States, respectively (13).

A study conducted in all Iranian children entering public and private elementary schools indicated that, 6.5 % of children had short stature, 19.1 % were underweight, 12.8 % were overweight and 3.4 % were obese in average. There was no significant difference in terms of gender, but considerably larger differences were documented among various provinces (14).

In Africa, despite the high prevalence of under nutrition, the prevalence of overweight is increasing at an alarming rate. It is estimated that 25% to 60% of urban women are overweight (15). Prevalence study of overweight, obesity, and thinness among urban school-aged children and adolescents in southern Nigeria were 11.4%, 2.8%, and 13.0%, respectively. More females (3.7%) than males (1.8%) were obese. The prevalence of overweight was higher among adolescents aged 10 to 18 years (13%) than among children from 5 to 9 years old (9.4%) and was highest (23.1%) at age 15 years. Thinness was significantly more prevalent among children (19.0%) than adolescents (8.3%) and was highest (28.6%) at age 7 years. Age- and sex-related increases and decreases were observed in the prevalence of overweight, obesity, and thinness. The rates of overweight, obesity, and thinness were affected by location and income levels (16).

In Ethiopia, a study conducted in Addis Ababa in 2007 reported that the prevalences of overweight and obesity on elementary school students were 7.6% and 0.9%, respectively (17). Another studies done in the same city among High School adolescents in Addis Ababa, the prevalence of overweight and/or obesity was found to be 9.4% and 7.2%, respectively (18, 19). High School Adolescents in Urban Communities of Hawassa, Southern Ethiopia showed that the prevalence of overweight was 12.9% and the prevalence of obesity was 2.7% (20). In the Northern part of Ethiopia, the overall prevalence of wasting (thinness), overweight and obesity were 37.8%, 2%, and 0.4%, respectively (21).

The study conducted on changes in the prevalence of underweight and overweight/obesity in non-pregnant women of reproductive age (ages 15-49), and their main socio-demographic correlates in Addis Ababa using data from 2000, 2005 and 2011 Ethiopian Demographic and Health Surveys, revealed the prevalence of overweight/obesity rose significantly from 16.1% to 20.6%; while underweight decreased from 17.9% to 14.1% between 2000 and 2011. Overall, one-third (34.7%) of these women in this African political capital were malnourished. The women aged 30-49 are more likely to be overweight/obese as those 15-19, and women with secondary education are twice as likely as their uneducated counterparts. At the current rate of decline in underweight and increase in overweight/obesity, after ten years, nearly 40% of the women will be under this malnutrition trap, with serious health consequences that require new and comprehensive policies (22).

Study done in Gondar revealed that the overall prevalence of overweight and obesity was 5.4% and 0.5%, respectively. The prevalence of overweight among in-school adolescents from private schools was 10.1% and was higher than government schools (4%). Overweight was higher among girls from private school. Consuming sweet food item was significantly associated with overweight. However, moderate or vigorous sport activity for at least 10 minutes continuously was only marginally significant (23).

2.2. Health Impact of Overweight and Obesity

According to WHO/FAO (2003), 60% of children who are overweight have at least one additional risk factor for CVD, such as hypertension, cardiovascular disease or hyperinsulinaemia. Obese children are at increased risk of Type 2 diabetes, previously considered an adult disease. Stunting in children is associated with an increased risk for obesity due to impaired fat metabolism and other metabolic shifts. The health problems associated with obesity in adults are well known and include: diabetes, hypertension, stroke, CVD and some form of cancers. The higher the weight the greater the risk of developing any of these conditions (24).

2.3. Factors Associated with Under-nutrition/Over-nutrition

The variables associated with the nutrition transition and obesity epidemic can be grouped into four crosscutting themes: the Health/Biological Environment, the Economic/Food Environment, the Physical/Built Environment and The Socio/Cultural Environment (25).

Among Adolescents in Ankara, Turkey, Computer use and TV viewing as well as physical activity and income level of family are significant risk factors for obesity in Turkish adolescents (26).

A cross sectional study on double burden of malnutrition in Palestinian school children revealed that being male sex, mother being unemployed and households not having enough food to eat were factors associated with underweight. On the other hand, Factors associated with obesity were age, with children in the ninth grade and time spent watching television and no association with birth order, birth weight, size of the household, maternal education, and the child's nutritional status (27).

According to the national survey done on Dual burden of body weight among Iranian children and adolescents in 2003 and 2010, the double burden issue has increased among Iranian children and adolescents, especially in rural areas. This change may be related to epidemiologic transition, notably in terms of nutrition transition and attributed to lifestyle changes (28).

A systemic review on determinants of stunting and overweight among young children and adolescents in sub-Saharan Africa revealed that socioeconomic, demographic and environmental

factors were the significant determinants of stunting and overweight. Stunting in childhood is a risk factor that may result in overweight and obesity later in adolescence and adulthood (29).

Another study done among adolescents in Addis Ababa, Having small family size, learning in private school and living in male headed household were positively and significantly associated with overweight and/or obesity (18).

The issue as to whether malnutrition in childhood predisposes to later obesity may be difficult to recognize owing to the lack of prospective cohorts in developing countries. Such links have been claimed by studies showing that short adult stature is a risk factor for obesity even after adjusting for contemporary differences in socioeconomic status (30). In some studies, physical activity was inversely correlated with being overweight or obese for those engaged in more than 30 minutes of physical activity versus those engaged in less than 30 minutes' activity. The same study highlighted the challenge faced by Pakistani school-aged children which reported a rapid rise in the number of overweight and obesity despite a persistently high burden of under nutrition (31).

Household food insecurity contributes to poor nutritional health, with negative consequences on growth and development during childhood. A study done among adolescents from Kilosa District, Tanzania, indicated that the Household food security is inversely associated with under-nutrition (32).

2.4. Conceptual Frame Work

The etiology of both extremes of malnutrition is complex and multi-factorial. Socio-demographic, dietary and behavioral factors are involved, and may serve as useful indicators of specific groups at risk of becoming malnourished. While each of these themes influences the double burden of malnutrition, they are not necessarily dependent on each other (Figure 1).

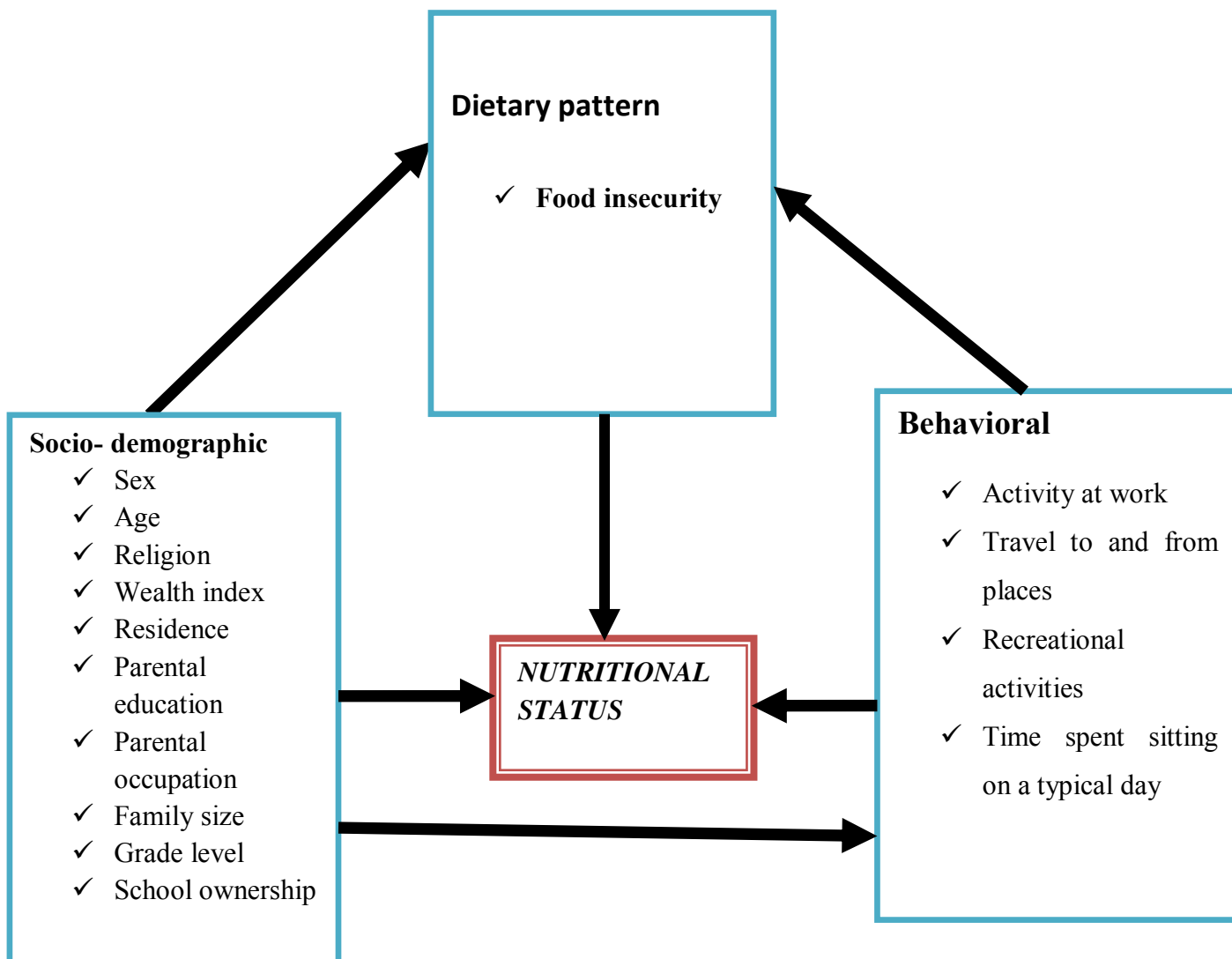


Figure 1: Conceptual frame work developed for factors associated with nutritional status from literatures, 2015.

3. GENERAL OBJECTIVE

The general objective of this study was to assess the magnitude of double burden of malnutrition and its associated factors among selected in-school adolescents in Arba Minch town, Southern Ethiopia.

3.1. Specific Objective

- ✚ To determine the magnitude of overweight/obesity.
- ✚ To assess the magnitude of underweight.
- ✚ To identify the associated factors of overweight/obesity and underweight.

4. MATERIALS AND METHODS

4.1. Study Area and Period

The study was conducted in Arba Minch town which is the capital city of Gamo Gofa zone and Arba Minch Zuria wereda., Southern Nation, Nationality and Peoples Region, (SNNPR).

Arba Minch is about 430 kms South of Addis Ababa, at an elevation of 1285 meters above sea level and has a total area of 12, 581.4 square kms (Figure 2). The highland and lowland areas of the zone are characterized by an average annual rain fall of 1166 mm and 900 mm, respectively. According to the 2007 Census, the town has a total population of 74,879(33). In Arba Minch town there were nine high schools (5governmental and 4private) with a total number of 6303 students at the time of the study. The study was conducted from March, 2015 to April, 2015.

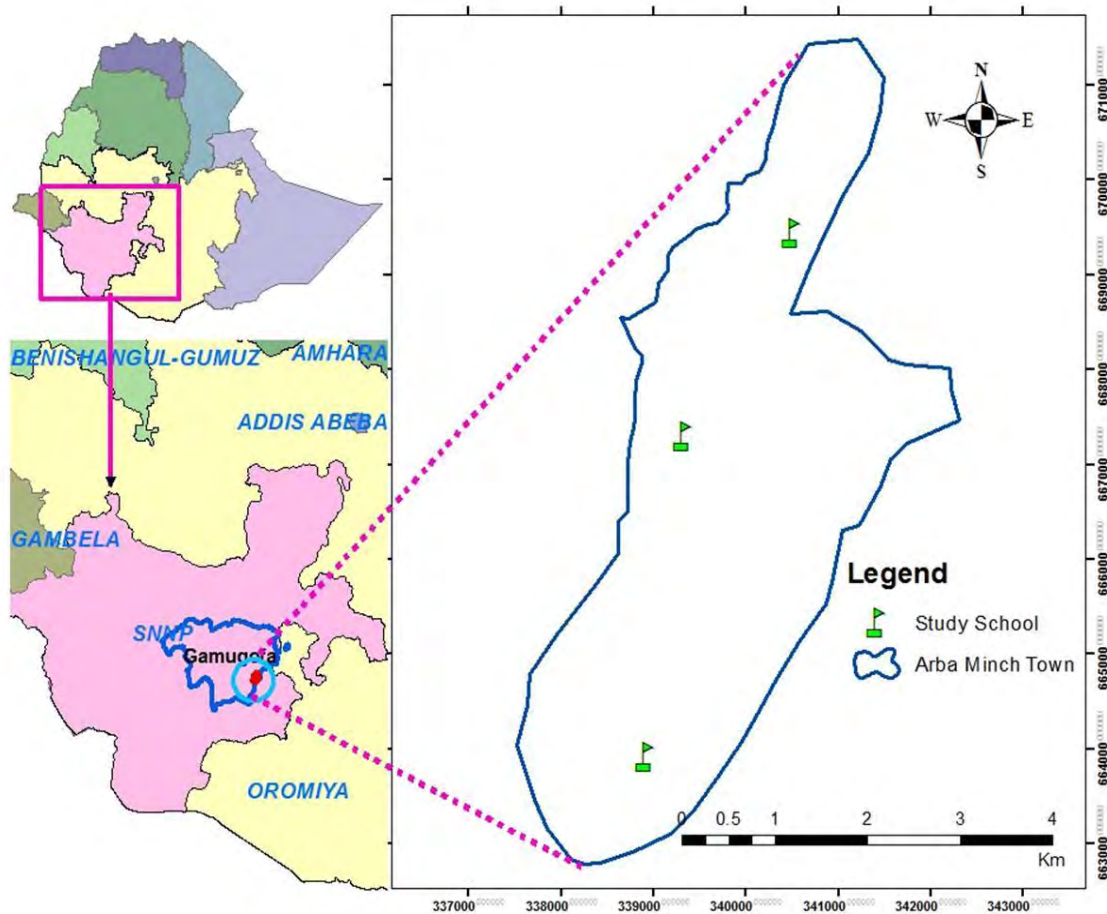


Figure 2: Map of the selected high schools in Arba Minch town, March, 2015.

4.2. Study Design

A School based cross-sectional study design.

4.3. Source Population

All adolescents in the high schools of Arba Minch town

4.4. Study Population

School adolescents of selected high schools

4.5. Inclusion and Exclusion Criteria

4.5.1. Inclusion Criteria

Regular students (grade 9 and 10) with permanent residency and who were present on the day of survey

4.5.2. Exclusion Criteria

Students with obvious physical disability were exclude.

4.6. Sample Size Determination and Sampling Technique

4.6.1. Sample size determination

Sample size was calculated for each specific objective by Epi Info software version 7

For objective one and two: to determine the magnitude of overweight/obesity and underweight

The single proportion formula, $n = \frac{Z^2 p (1-p)}{d^2}$ was used considering the following parameters (Table1).

$$d^2$$

Z= 1.96 at 95% confidence interval

d= margin of error

P =Proportion of underweight

n=total sample size before adding before 10% non response rate

Table 1: Sample size calculation for the first and second specific objectives.

Specific objective	Assumption					
	P	Z	d	n	n _{total} *	reference
Objective 1	0.15	1.96	0.04	306	337	(20)
Objective 2	0.201	1.96	0.04	385	423	(32)

*total sample size after adding 10% non response rate.

For specific objective three: Sample size for proportion of two populations was used

Sample size for the last specific objective (to identify associated factors with malnutrition among adolescents in Arba Minch town) was calculated by using different parameters by considering proportion of explanatory variables of malnutrition. On the basis of Hawassa city sedentary behavior and wealth index study, two explanatory variables of mal nutrition (20) were considered and the respective sample size for each explanatory variable was calculated using the formula for comparisons of proportions shown below,

$$n_1 = \frac{\{Z_{\alpha/2}\sqrt{(1+1/r)p(1-p)} - Z\beta\sqrt{P_1(1-P_1)+[P_2(1-P_2)]/r}\}^2}{P_1-P_2}$$

Where, $z_{\alpha/2}$ = the Z score at 95 % confidence interval (1.96)

p_1 = the proportion of over nutrition among non-exposed

p_2 = the proportion of over nutrition among exposed

r = the ratio between exposed and non-exposed

n_1 = sample size before addition of non-response rate

Table 2: Sample Size Determination Using Relevant Determinant Factors with Malnutrition among School Adolescents from Similar Study.

Relevant factors	$Z_{\alpha/2}$ of 1- B(power)	$Z_{\alpha/2}$ of 95% certainty	P_1	P_2	Ratio	OR	n_1	n_{total}
Sedentary behavior	0.84	1.96	8.9	19	1:1	2.4	408	449
Socioeconomic index	0.84	1.96	9.6	20.3	1:1	2.4	382	420

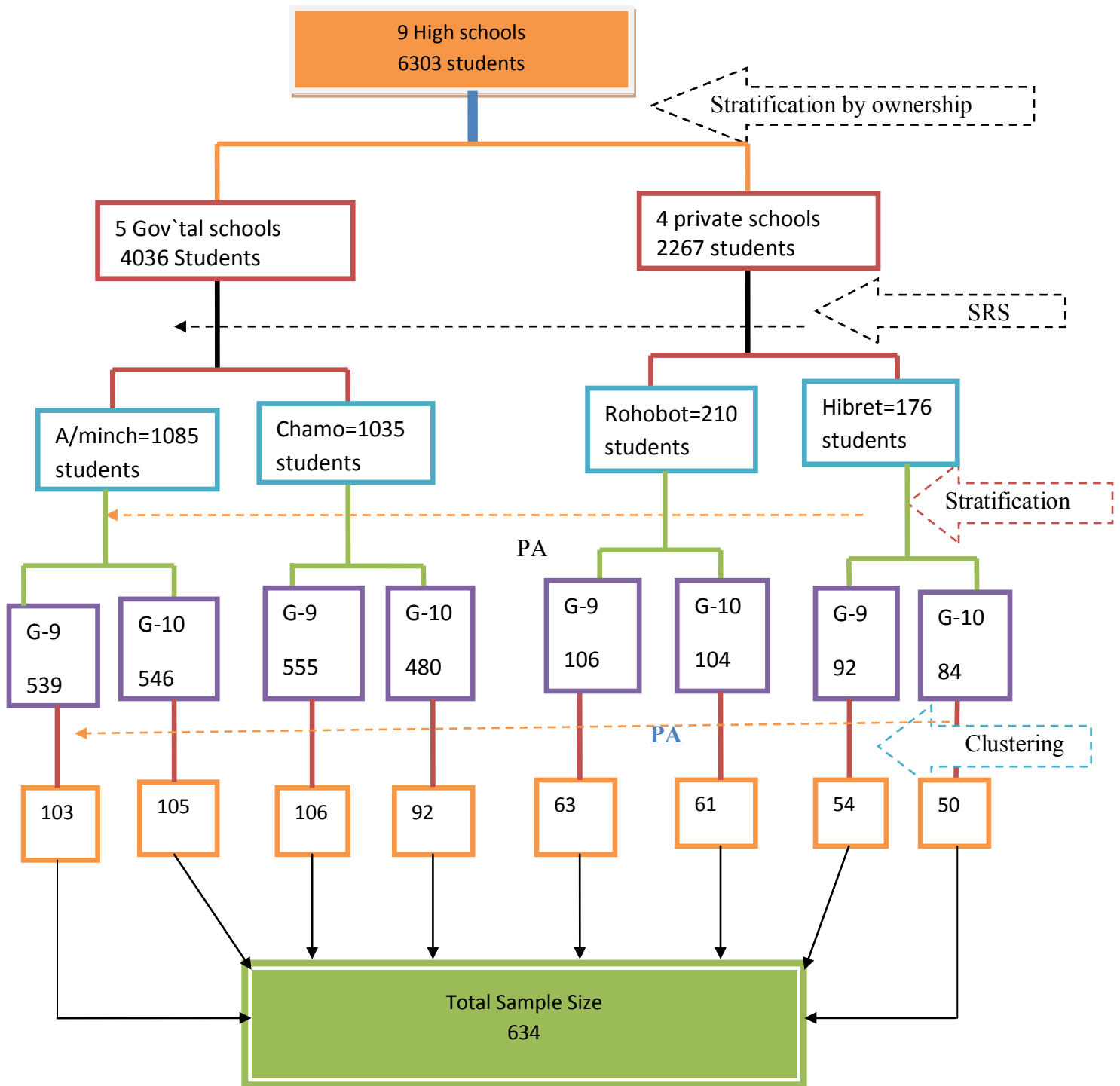
Where, n_{total} =total sample size after adding 10% non-response rate

Considering design effect, sample size of the second objective was multiplied with 1.5, giving a final sample size of $n=634$.

Since 634 accommodate all the assumptions, it was taken as the final working sample size to meet all the objectives.

4.6.2. Sampling Technique/ Procedure

Multi-stage sampling method was used. There are five governmental and four private high schools found in the town. To select the study participant, the schools were first stratified by ownership as governmental and private schools (Grade 9 and Grade 10). Two schools from each category were randomly selected and the number of sample size required for each school was allocated proportional to the number of students in each school and grade level. Finally, the study participant was selected using cluster sampling by using section from each grade level. The total of twelve sections (clusters), eight sections from two governmental and the remaining four sections from two private schools were randomly used to select the final working sample size of 634 (Figure 3).



PA=proportionate allocation

Figure 3: Schematic presentation of the sampling procedures and techniques in Arba Minch high school students, March, 2015.

4.7. Data Collection Procedures

4.7.1. Questionnaires

Structured questionnaires were used to collect the data. The questionnaires were adapted from the Global Physical Activity Questionnaire (GPAQ) Analysis Guide (34) and WHO steps instrument for chronic disease risk surveillance (35). The questionnaires were developed in English and then translated in to Amharic and review made for consistency of translation of the language. Pretest and demonstration of instrument was performed on 5% of the sample from nearby Arba Minch town of Merab Abaya high school. In addition, daily checkup and follow up was done by the supervisors. The questionnaire was used to obtain background information on the adolescents and their parents' socio-demographic, the participants' food insecurity and physical activity patterns.

In this study, the household food insecurity was assessed using household food insecurity access scale (HFIAS) developed by Food and nutrition technical assistance (36).

4.7.2. Anthropometric measurements

Weight was measured by a digital scale to the nearest 0.1 kg, without shoes and minimum clothes.

Height was measured with portable stadiometer to the nearest 0.1 cm. The study participants stood upright on bare feet, with heels together, and buttocks and back touching the meter rule. Single measurements were taken in each case.

Waist circumference was measured to the nearest 0.1cm with a non-elastic standard measurement tape. The measurement was taken parallel to the floor at the umbilical level, with study participants wearing no or only light clothing around the waist area after expiration.

Hip circumference was measured as standing inter-trochanteric girth according to the WHO guidelines. Hip circumference (cm) was measured at the widest point around the greater trochanter.

Waist-to-hip ratio (WHR) was calculated by dividing the waist size by the hip size.

Body mass index (BMI) for age was calculated using Anthroplus software version 1.0.4.

The measurement was conducted in a private place by an interviewer of the same sex. Three trained females and three males with BSc in public health, and 2 supervisors qualified with masters of public health were recruited to collect data and supervise the data collection process.

4.8. Study Variables

4.8.1. Dependent variable: Nutritional status measured by BMI for age

4.8.2. Independent variables:

Socio-Demographic variables

- ✓ Sex
- ✓ Age
- ✓ Grade level
- ✓ Religion
- ✓ Wealth index
- ✓ Residence
- ✓ Parental education
- ✓ Family size
- ✓ occupation of parents
- ✓ school ownership

Food insecurity

- ✓ access

Physical Activity and Sedentary Behavior

- ✓ Activity at work
- ✓ Travel to and from places
- ✓ Recreational activities
- ✓ Time Spent sitting on a typical day

4.9. Operational Definitions (WHO growth reference 2007)

1. Under-weight: $BAZ < -2SD$
2. Normal weight: BAZ between $-2SD$ and $+1SD$
3. Over- weight: BAZ between $+1SD$ and $+2SD$
4. Obesity: $BAZ > +2SD$
5. A waist-to-hip ratio of 0.85 or greater for females and 0.90 or greater for male is the increased risks for heart disease and other ailments connected with being overweight.
6. For men, a waist-to-hip ratio of less than 0.90 and for women, less than 0.85 is considered as low risk.
7. Food insecurity was assessed by HFIAS score as secure (0-1), mildly food insecure (2-8), moderately food insecure (9-15) and severely food insecure (16-27).

4.10. Data Analysis Procedures

For the first and second objectives frequency, magnitude of malnutrition was based on the BMI for age and cut off points using WHO growth reference 2007, Mean and standard deviation (SD) were calculated to describe the sample population in relation to relevant variables. For the third objective, Bivariate analysis was performed to explore the association between independent and outcome variables using crude odds ratio with 95% C.I. Finally, multinomial logistic regression analysis was done to determine the factors associated with malnutrition since the outcome variable has more than two categorical variables. Accordingly, adjusted odds ratios (AORs) with 95% CIs were estimated. All variables in the bivariate analysis were taken to the multinomial logistic regression model. The WHO 2007 growth reference was used as a standard reference for classifying nutritional status of adolescents using WHO Anthroplus software version 1.0.4. All statistical analyses were done using the SPSS version 21. Statistical significance was considered as $p\text{-value} < 0.05$. Principal component analysis was done to determine the wealth index in five categories.

4.11. Data Quality Management

To maintain the quality of the data, two days training was given to data collectors on the objective of the study, measurement procedures and ethical issues prior to the pre-test and an additional one day of training was given with the final version of the questionnaire before the start of the actual data collection. The collected data was checked for completeness and consistencies by the supervisors and the investigator. To test for accuracy, the scales were checked by placing items of known weight on them after every 10 measurements. The scales were regularly checked and adjusted to zero after each measurement. Meanwhile, the collected data was entered into Epi Info version 7 prepared templates by the investigator. 10% of the data set was double entered, and missing values and outliers were checked using SPSS to check the accuracy of the entered data.

4.12. Ethical Consideration

An ethical clearance and official letter was obtained from the Research and Ethics Committee of School of Public Health AAU to Arba Minch Education office, and permission was secured from Arba Minch education office. After getting permission from school to participate in the study, Assent was obtained from children's family through school director for those participants less than 18 years old and verbal consent was obtained for willingness of adolescents aged 18 years and above. The students' privacy during the interview and anthropometric measurement was maintained by conducting in a private place with interviewer of the same sex. They were informed that there was no incentives and harm for their participation in this study. Finally the data obtained from them were kept confidential by not writing participant's name in the questionnaire and during interview.

4.13. Dissemination of Results

The final result of this research will be presented to the community of SPH AAU and disseminated to the school library and respective high schools of Arba Minch town. Finally, it will be published in reputable journals.

5. RESULTS

A total of 600 study participants out of 634 were enrolled from government 372 (62%) and 228 (38%) from private with a response rate of 94.6%.

5.1. Socio-Demographic Characteristics

Of the total respondents, 276(46%) were males and 324(54%) females. The mean (\pm SD) age of the respondents was 16.32(\pm 1.45) years ranging from 14 to 19 years.

Majority of the study participants 465 (77.5%) reside in urban, 262 (43.7%) were Protestant by religion and 372 (62%) were from government by school ownership. Of the 600 enrolled participants, 327 (54.5%) were from grade nine and 273(45.5%) were grade 10 students. Educational status of parents' of the study participants revealed that 151(25.2%) mothers and 108(18%) fathers had no formal education.

Over half (55.2%) were living in the family size of more than five. The major occupation of the fathers was government based 216 (36%) and 185 (30.8%) of mothers were housewives. As for wealth index quintile, 132(22%) and 129(21.5%) of study participants were from second and middle socio economic index category, respectively (Table 3).

Table 3 : Socio-Demographic Characteristics of Respondents in Arba Minch town, Southern Ethiopia, March, 2015. n=600

variables		frequency	percent
Residence	Urban	465	77.5
	Rural	135	22.5
School type	Government	372	62
	Private	228	38
grade	9	327	54.5
	10	273	45.5
Religion	Orthodox	246	41
	Protestant	262	43.7
	Muslim	58	9.7
	Others	34	5.7
Family size	<=5	269	44.8
	>5	331	55.2
Mothers' Educational status	No formal education	151	25.2
	Primary	164	27.3
	Secondary	134	22.3
	More than secondary	151	25.2
Fathers' Educational status	No formal education	108	18
	Primary	150	25
	Secondary	156	26
	More than secondary	186	31
Mothers' occupational status	Housewife	185	30.8
	Merchant	176	29.3
	Government employee	170	28.3
	Daily labourer	14	2.3
	Private work	42	7
	Others	13	2.2
Fathers' occupational status	Farmer	138	23
	Merchant	108	18
	Government employee	216	36
	Private work	138	23
Wealth index	Lowest	94	15.7
	Second	132	22
	Middle	129	21.5
	Fourth	126	21
	Highest	119	19.8

5.2. Magnitude of Malnutrition

The overall magnitudes of normal weight was 69.2% (95%CI: 66.2%, 72.2%), underweight 19.7% (95%CI: 16.5%, 23.2 %) and overweight and/or obesity 11.2% (95%CI: 8.7%, 13.7%) (Figure 4).

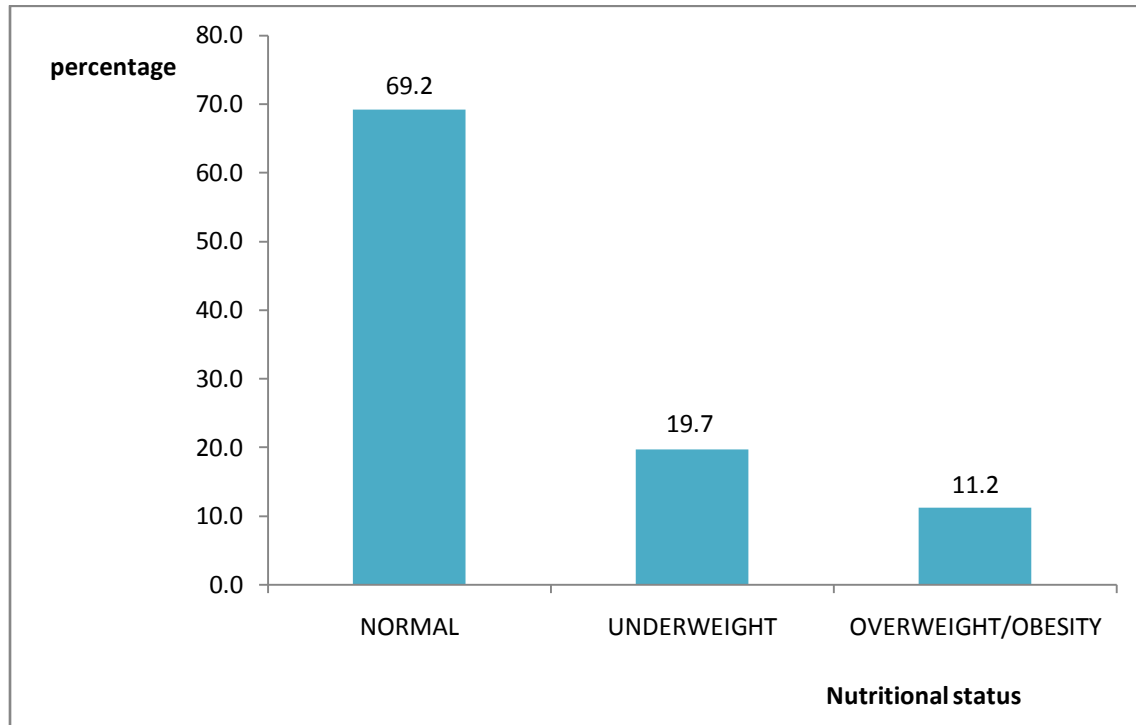


Figure 4: Magnitude of Malnutrition of the Respondents in Arba Minch town, Southern Ethiopia, March, 2015.

The WHR of 34(5.6%) respondents were in the range of increased risks for heart disease and other ailments connected with being overweight. The mean HAZ and BAZ of the respondents were $-0.67(\pm 1.4)$ and $-0.18(\pm 1)$, respectively. The magnitude of stunting according to WHO 2007 reference HAZ cut off value was 18% (95%CI: 15%, 21%). The mean difference of weight and height was not significant in government and private schools (P-value=0.08); but mean difference of BAZ, HAZ and WC among government and private school showed significance (Table 4).

Table 4: Mean (\pm SD) of anthropometric parameters by school ownership of respondents in Arba Minch town, Southern Ethiopia, March, 2015

parameter	Mean(\pm SD)			p-value
	Government school(n=372)	Private school(n=228)	TOTAL	
Weight	55.8kg(± 0.4)	52.2kg(± 0.5)	54.4(± 8.5)	0.08
Height	1.62m(± 0.004)	1.59m(± 0.005)	1.61(± 0.08)	0.49
BAZ	1.38(± 0.03)	1.48(± 0.05)	-0.18(± 1)	>0.0001
HAZ	-0.82(± 0.07)	-0.43(± 0.09)	-0.67(± 1.4)	>0.0001
HAZ<-2	81(13.5%)	27(4.5%)	108(18%)	*
HAZ>-2	291(48.5%)	201(33.5%)	492(82%)	*
WC	67.8cm(± 0.4)	63cm(± 0.6)	65(± 2.5)	>.000
HC	80.4cm(± 2)	82.1cm(± 0.5)	81(± 3.1)	>.001
WHR	0.78(± 0.27)	0.80(± 0.35)	0.79(± 0.6)	0.48

m=meter, cm=centimeter, kg=kilo gram, HC=hip circumference, WC=waist circumference

WHR=waist to hip ratio, BAZ=body mass index for age Z-score, HAZ=height for age Z-score

* indicates magnitude and percent not mean

5.3. Food Insecurity

The proportions of participants that experienced each of the specific conditions that were used to assess food insecurity in this study are given in Table 5. More than one fourth(25.9%) which comprise rarely(15.8%),sometimes(7.8%) and often(2.3%) of the respondents experienced worry or anxiety about food supply, and 24% of respondents reported that household member had to eat a smaller meal than they felt needed because there was not enough food in the past four weeks (table 5).

Table 5: Food Insecurity Related Conditions in One Month Preceding the Survey of Respondents in Arba Minch town, Southern Ethiopia, March, 2015. n=600

HFIAS Question	Frequency			
	Never(0)	Rarely(1)	Sometimes(2)	Often(3)
Worry over household food supply	444(74)	95(15.8)	47(7.8)	14(2.3)
Not able to eat the kinds of foods they preferred	472(78.7)	70(11.7)	36(6.0)	22(3.7)
Limited variety of foods due to a lack of resources	460 (76.7)	81 (13.5)	33 (5.5)	26 (4.3)
Have to eat some foods that they really did not want to eat	446 (74.3)	91 (15.2)	42 (7.0)	21 (3.5)
Have to eat a smaller meal than they felt they needed	447 (74.5)	81 (13.5)	52 (8.7)	20 (3.3)
Have to eat fewer meals in a day	456 (76.0)	74 (12.3)	42 (7.0)	28 (4.7)
There ever no food to eat of any kind	474 (79.0)	64 (10.7)	43 (7.2)	19 (3.2)
Go to sleep at night hungry because there was not enough food?	468 (78.0)	75 (12.5)	30 (5.0)	27 (4.5)
Go a whole day and night without eating anything	488 (81.3)	72 (12.0)	31 (5.2)	9 (1.5)

*Numbers in parenthesis indicates percentage

HFIAS=house hold food insecurity access scale

The mean HFIAS of the participants based on HFIAS score was 3.29(\pm 5.344). A total of 326 (54.3%) respondents had a score of 0, indicating they never experienced any form of food insecurity. According to the HFIAS scores categories, majority 382 (63.7%) of participants were food secure and more than one-thirds (36.3%) of respondents experienced some degree of food insecurity in the one month preceding the survey (Table 6).

Table 6: Magnitude of Household Food Insecurity Access Scale Scores of the Respondents in Arba Minch town, Southern Ethiopia, March, 2015

HFIAS Scores Category	Frequency	Percentage
Food secure(0-1)	382	63.7
Mildly food insecure(2-8)	107	17.8
Moderately food insecure(9-15)	78	13
Severely food insecure(16-27)	33	5.5

HFIAS=household food insecurity access scale

5.4. Physical Activity and Sedentary Behavior

Job related physical activity, sport related activity and sedentary behavior of study participants are indicated in Table 6. As indicated in the Table, 195(32.5%) had moderate intensity activity work and 98(16.3%) were performing vigorous intensity activity work at least once per week continuously at least for 20 minutes.

Physical activity of participants related to movement from place to place showed that 77(12.8%) of them were used to walk or riding a bicycle less than 20 minutes continuously in any of a day in a week and 181(30.2%) participants were used to walk or ride bicycle 5-7 days per week continuously without interruption for 20 minutes or more.

The result of physical exercise related to sport showed that 120(20%) of participants were not doing moderate intensity or vigorous intensity activity throughout the week whereas 291(48.5%) and 189(31.5%) used to exercise moderate and vigorous intensity activity sport, respectively without interruption for 10 minutes or more at least one day per week.

Duration of sedentary activity performed or time spent in sitting on a typical day was 9 hours or less among 448(74.7%) respondents and greater than 9 hours among 152(25.3%) of participants.

Table 7: Physical Activity level and Sedentary Behavior of respondents in Arba Minch town, Southern Ethiopia, March, 2015. n=600

Variables		Frequency	Percent (%)
Physical activity related to job			
(Working besides Learning)	No work	307	51.2
	Moderate intensity activity work for at least 20 minutes	195	32.5
	Vigorous intensity activity work for at least 20 minutes	98	16.3
Physical activity related to moving from place to place			
(Number of Walking or bicycling days per week at least for 20 minutes continuously)	No walk	77	12.8
	1-2	185	30.8
	3-4	157	26.2
	5-7	181	30.2
Physical activity related to sport or recreation			
(Vigorous or moderate intensity activity sport at least for 10 minutes)	No	120	20.0
	Moderate	291	48.5
	Vigorous	189	31.5
Sedentary behavior			
(Time spent in sitting per Day)	<=9hrs	448	74.7
	>9hrs	152	25.3

Hrs=hours

5.5. Factors Associated with Malnutrition

5.5.1. Socio-Demographic Factors

The associations between adolescents' socio demographic factors and underweight are indicated in Table 8 and annex 5a. As shown, being male was 1.7 times more likely to be underweight than girls [COR=1.7; 95%CI=1.2 to 2.6]. Respondents from family size of 5 or less were 74% times less likely to be underweight than of family size more than 5 [COR=0.26; 95%CI= 0.16 to 0.43]. Parental educational status, father occupational status and wealth index were also significantly associated with underweight.

The odds of being underweight was more among respondents whose father educational status had no formal education [COR=13; 95% CI=5.8 to 29], primary [COR=7.9; 95% CI= 3.5to 17] and secondary [COR= 4.3; 95% CI= 1.8 to 9.9] compared to above secondary. Maternal education was also significantly associated with underweight. Participants whose mother had no formal education were about 5times [COR=5.7; 95% CI= 2.9to11.2] and primary 2 times [COR =2.4; 95% CI= 1.2to4.8] more likely to be underweight compared to mother education above secondary. In addition, being in the wealth index quintile of lowest was 4times [COR=3.9; 95% CI= 1.9 to 8] and second was 3.5times [COR=3.5; 95% CI= 1.7 to 7] more likely to be underweight. Father occupation of merchant [COR=0.2; 95% CI=0.1 to 0.5] and government employee [COR=0.5; 95% CI= 0.3 to 0.9] were negatively and significantly associated with underweight.

After controlling the effect of other variables, only father educational and occupation status, family size and wealth index remained significant. The odds of being underweight among participants whose fathers' had no formal education was 12 times [AOR=12; 95% CI=4 to 34], primary 6.8 times [AOR=6.8; 95% CI= 2.5 to 18] and secondary education 4times [AOR=4; 95% CI= 1.4 to 10.6] higher compared to those whose education level above secondary. Respondents whose family size of five or less were 80% times less likely to be underweight [AOR=0.2; 95% CI= 0.12 to 0.4 compared to those whose family size of more than 5. Participants whose fathers' occupation was merchant were 75% times less likely to be underweight than private work [AOR=0.25; 95%CI=0.09 to 0.6]. Wealth index quintile of lowest [AOR=9.4; 95% CI=3 to 29] and second [AOR= 5; 95%CI= 1.8 to14.9] were positively associated with underweight compared to their counterparts of highest wealth quintile.

Table 8: Association of Socio-Demographic Factors Associated with Underweight among Respondents in Arba Minch town, Southern Ethiopia, March, 2015. n=533

Socio demographic Variables	Nutritional Status		ODDS RATIO	
	Underweight	Normal	COR(95%CI)	AOR(95%CI)
Sex				
Male	66	174	1.7(1.2,2.6)*	1.59(0.9,2.7)
Female	52	241	1	1
Family size				
≤5	24	203	0.26(0.16,0.43)*	0.2(0.1, 0.4)*
>5	94	212	1	1
Mothers' educational status				
No formal education	53	82	5.7(2.9,11.2)*	1.8(0.7,4.6)
Primary	32	118	2.4(1.2,4.8)*	1.1(0.4,2.6)
Secondary	20	99	1.8(0.8,3.8)	1.3(0.5,3.1)
More than secondary	13	116	1	1
Fathers' educational status				
No formal education	44	62	13(5.8,29)*	12(4, 34)*
Primary	41	96	7.9(3.5,17)*	6.8(2.5, 18)*
Secondary	25	108	4.3(1.8,9.9)*	4(1.5, 10.9)*
More than secondary	8	149	1	1
Fathers' occupational status				
Farmer	30	96	0.6(0.3,1.2)	1.1(0.3,3.7)
Merchant	9	82	0.2(0.1,0.5)*	0.25(0.1,0.6)*
Government employee	41	154	0.5(0.3,0.9)*	0.67(0.3,1.3)
Private work	38	83	1	1
Wealth index				
Lowest	32	57	3.9(1.9, 8)*	9.7(3, 30)*
Second	41	81	3.5(1.7, 7)*	5.5(1.9,15.7)*
Middle	14	99	0.9(0.4,2.2)	1.9(0.6, 6.4)
Fourth	18	87	1.4(0.6, 3)	2.7(0.9, 7.8)
Highest	13	91	1	1

The reference category is: normal weight, *=significant at P-value<0.05, COR=Crude odds ratio, AOR=Adjusted odds ratio, CI=Confidence interval

The associations between respondent's socio demographic factors and overweight and/or obesity are indicated in Table 9 and annex 5b. Family size, school type and grade level were significantly associated with overweight and /or obesity.

Government school respondents were 60% times less likely to be overweight/obesity than private schools [COR=0.4; 95%CI=0.2 to 0.7]. The odds of being overweight/obesity is twice more among grade 9 students than grade 10[COR=2; 95% CI=1.1, 3.6)]. Participants from family size of 5 or less were 1.7 times more likely to be overweight than of family size more than 5[COR=1.7; 95%CI=1.03 to 2.9].

After controlling for other confounding factors, family size, wealth index quintile of lowest, second and middle, fathers' education level of no formal education, mother occupation of housewife and being grade 9 students remained significantly associated with overweight and/or obesity (Table 9).

Respondents whose family size of five or less were 2.6 times more likely to be overweight and/or obesity compared to those whose family size of more than 5 [AOR=2.6;95%CI=1.3 to 5.5].

The odds of being overweight and/or obesity among participants whose fathers' had no formal education was 80% times lower [AOR=0.2; 95% CI=0.03 to 0.9] compared to those whose education level above secondary; and the odds of being overweight and/or obesity among participants whose mothers' were housewives was 90% times lower [AOR=0.1; 95% CI=0.01 to 0.8] compared to those whose occupation was NGO. Wealth index quintile of lowest [AOR=0.2; 95% CI=0.03 to 0.7], second [AOR= 0.23; 95%CI= 0.1 to 0.8] and middle [AOR= 0.21; 95%CI=0.1 to 0.7] were negatively associated with overweight and/or obesity compared to their counterparts of highest wealth quintile.

Table 9: Association of Socio-Demographic Factors with Overweight/ Obesity of Respondents in Arba Minch town, Southern Ethiopia, March, 2015. n=482

Socio- demographic variables	Nutritional Status		ODDS RATIO	
	Overweight&/obesity	Normal	COR(95%CI)	AOR(95%CI)
School type				
Government	29	259	0.4(0.2,0.7)*	0.5(0.2,1.2)
Private	38	156	1	1
Grade				
9	47	221	2(1.1,3.6)*	2(1.01,4.1)*
10	20	194	1	1
Family size				
≤5	42	203	1.7(1.03,2.9)*	2.6(1.3,5.5)*
>5	25	212	1	1
Fathers' educational status				
No formal education	2	62	0.16(0.03,0.7)	0.2(0.03,0.9)*
Primary	13	96	0.6(0.3,1.4)	0.6(0.2,1.6)
Secondary	23	108	1.1(0.6,2)	1.06(0.4,2.4)
More than secondary	29	149	1	1
Mothers' occupational status				
Housewife	11	131	0.3(0.07,1.9)	0.1(0.01,0.8)*
Merchant	27	117	1.03(0.2,5)	0.2(0.02,2.1)
Government employee	15	124	0.5(0.1,2.7)	0.17(0.01,1.5)
Daily labourer	2	8	1.12(0.12,9.9)	0.3(0.01,5.7)
Private work	10	26	1.7(0.3,9.4)	0.3(0.02, 3)
NGO	2	9	1	1
Wealth index quintile				
Lowest	5	57	0.5(0.18,1.5)	0.2(0.03,0.7)*
Second	10	81	0.7(0.3,1.7)	0.23(0.1,0.8)*
Middle	16	99	0.9(0.4, 2)	0.21(0.1, 0.7)*
Fourth	21	87	1.4(0.7, 3)	0.5(0.18, 1.8)
Highest	15	91	1	1

The reference category is: normal weight, *=significant at P-value<0.05, COR=Crude odds ratio, AOR=Adjusted odds ratio, NGO=nongovernmental organization

5.5.2. Food Insecurity

Study participants who were from food secured households in the past four weeks were 65% times less likely to be underweight than those from severely food insecure [COR=0.35;95%CI=0.16 to 0.79] as shown in Table 10. Household food insecurity of being food secured remained negatively associated with underweight [AOR=0.3; 95%CI=0.1 to 0.9] after all other variables were controlled by multinomial logistic regression.

Table 10: Association of Food Insecurity Access Scale Scores with Underweight and Overweight of Respondents in Arba Minch town, Southern Ethiopia, March, 2015. n=533

HFIAS		Nutritional Status		ODDS RATIO	
		underweight	normal	COR(95%CI)	AOR(95%CI)
(Household food insecurity access scale)	Food secure	59	270	0.35(0.16,0.79)*	0.3(0.1, 0.9)*
	Mildly food insecure	30	70	0.7(0.29,1.6)	0.6(0.2, 2)
	Moderately food insecure	18	57	0.51(0.2,1.2)	0.9(0.3, 3)
	Severely food insecure	11	18	1	1
HFIAS		Overweight/obesity	normal	COR(95%CI)	AOR(95%CI)
(Household food insecurity access scale)	Food secure	53	270	0.8(0.2,2.7)	2(0.3,12)
	Mildly food insecure	7	70	0.4(0.1,1.7)	0.8(0.12,5.7)
	Moderately food insecure	3	57	0.2(0.04,1.1)	0.5(0.05,4.7)
	Severely food insecure	4	18	1	1

The reference category is: normal weight, *=significant at P-value<0.05

COR=Crude odds ratio, AOR=Adjusted odds ratio, HFIAS=household food insecurity access scale

5.5.3. Physical Activity and Sedentary Behavior

Number of walking or bicycling days per week at least for 20 minutes continuously was significantly associated with underweight (Table 12). After adjusting for other variables, no vigorous or moderate intensity activity sport at least for 10 minutes became significant [AOR=0.4; 95%CI= 0.2 to 0.97].

Table 11: Association of Physical Activity level and Sedentary Behavior with Underweight among Respondents in Arba Minch town, Southern Ethiopia, March, 2015. n=533

Physical activity and sedentary behaviors		Nutritional Status		ODDS RATIO	
		underweight	Normal	COR(95%CI)	AOR(95%CI)
(Working besides Learning)	No work	57	214	1.1(0.6,2)	1.2(0.5, 2.8)
	moderate	44	132	1.3(0.7,2.5)	1.9(0.4, 2.4)
	vigorous	17	69	1	1
(Number of Walking or bicycling days per week at least for 20 minutes continuously)	No walk	11	39	3.4(1.7,7)*	1.1(0.3,2.9)
	1-2	36	135	2.1(1.1,3.8)*	1.11(0.5,2.1)
	3-4	37	105	2(1.1,3.5)*	1.5(0.8, 3)
	5-7	34	136	1	1
(Vigorous or moderate intensity activity sport at least for 10 minutes)	No	16	88	0.5(0.2,1.02)	0.4(0.2, 0.97)*
	Moderate	60	202	0.8(0.5,1.3)	0.6(0.3,1.08)
	Vigorous	42	125	1	1
(Time spent in sitting per day)	≤9hr	96	322	1.2(0.7,2.1)	1.4(0.7, 2.6)
	>9hr	22	93	1	1

The reference category is: normal weight, *=significant at P-value<0.05, COR=Crude odds ratio, AOR=Adjusted odds ratio

Number of walking or bicycling days per week at least for 20 minutes continuously and sedentary behavior were significantly associated with overweight.

Respondents who spent in sitting for 9 hours and less were 80% times less likely to be overweight and /or obesity [COR=0.2; 95%CI=0.1 to 0.4] compared to more than 9 hours per day.

All variables were taken to a multinomial logistic regression model to appreciate the effects of independent variables after the bivariate multinomial logistic regression was done for each variable. Sedentary activity showed statistically significant association with respondents overweight and/or obesity. Hence, the odds of being overweight and/or obesity was 79% times lower in participants who spent 9 hours and less in sitting than those who spent in sitting above 9 hours per day [AOR=0.21;95% CI=0.1 to 0.4)]. Respondents who had no history of walking per week at least for 20 minutes continuously were 7 times more likely to be overweight and/or obese than those who walk 5-7 days per week [AOR=7.4; 95% CI=2.6 to 20] (Table 13).

Table 12: Association of Physical Activity level and Sedentary Behavior with Overweight/obesity among Respondents in Arba Minch town, Southern Ethiopia, March, 2015
n=482

Physical activity and sedentary behaviors		Nutritional status		ODDS RATIO	
		Overweight &/obesity	Normal	COR(95%CI)	AOR(95%CI)
(Working besides Learning)	No work	36	214	0.9(0.4,1.9)	0.6(0.2,1.7)
	moderate	19	132	0.8(0.3,1.8)	0.8(0.3,2.3)
	vigorous	12	69	1	1
(Number of Walking or bicycling days per week at least for 20 minutes continuously)	No walk	27	39	8.5(3.8,18)*	7.4(2.6, 20)*
	1-2	14	135	1.2(0.5,2.9)	1.1(0.4, 2.8)
	3-4	15	105	1.7(0.7,4)	1.8(0.7, 4.6)
	5-7	11	136	1	1
(Vigorous or moderate intensity activity sport at least for 10 minutes)	No	16	88	1(0.5, 2)	0.7(0.3, 1.8)
	Moderate	29	202	0.8(0.4,1.4)	0.5(0.2, 1.2)
	Vigorous	22	125	1	1
(Time spent in sitting per day)	≤9hr	30	322	0.2(0.1,0.4)*	0.21(0.1, 0.4)*
	>9hr	37	93	1	1

The reference category is: normal weight, *=significant at P-value<0.05, COR=Crude odd ratio, AOR=Adjusted odds ratio

6. DISCUSSION

The overall magnitude of underweight and overweight/obesity co-existing together in-selected high school students of Arba Minch town was 19.7% and 11.2%, respectively. This finding is more or less consistent with a study conducted in different countries that included Iranian study which showed 19.1 % underweight, 12.8 % overweight and 3.4 % obese on average; Nigerian study documenting overweight, obesity, and thinness among urban school-aged children and adolescents of 11.4%, 2.8%, and 13.0%, respectively (14, 16). Likewise, the study done among high School adolescents in Addis Ababa, the magnitude of overweight and/or obesity was found to be 9.4%; and in Hawassa, Southern Ethiopia, the magnitude of overweight and obesity were 12.9% and 2.7% (18, 20). On the other hand, a study in Gondar reported overweight and/or obesity of 5.9% (23) which is lower than the present finding. This discrepancy might be due to socio-economic difference, different cut-off points criteria for malnutrition used in the present study and time of study (seasonality).

The odds of being underweight among adolescents whose fathers' had no formal education attended, primary and secondary education were higher than those education level was above secondary, respectively; and concurs with previous study finding from northern part of Ethiopia (21). Nevertheless, when compared with Hawassa and Addis Ababa the finding is different (17, 20). This difference observed in this study might be explained by the fact that fathers had better education with better job opportunity that lead to higher income resulting a better opportunity of food availability and household resources. In addition to this, educated fathers had better nutritional awareness as well as better caring of children.

In this study, respondents whose family size of five or less were observed to be less likely to be underweight at the same time (double burden) more likely to be overweight and/or obesity than those whose family size was greater than five. This finding is comparable to the study done in Addis Ababa and among Adolescents in Osun State, Nigeria (18, 37) .Where both documented the coexistence of both underweight and overweight/ obesity.

Students whose fathers' occupation was merchant showed to be less likely to be underweight than private work; which is consistent with the study in Palestinian school children and among adolescents from Kilosa, Tanzania (27, 32). This might be attributed to a better socioeconomic status of merchants. Wealth index quintile of lowest and second were positively associated with underweight while respondents who were food secure were negatively associated with underweight in the present study which concurs with the previous studies of Palestine and Tanzania (27, 32).

Sedentary activity showed statistically significant association with adolescents overweight and/or obesity. The odds of being overweight and/or obesity was higher in students who spent more than 9 hours in sitting than those spent in sitting 9 hours and less per day. There was supporting findings from Hawassa , Addis Ababa and Ankara, Turkey (18-20, 26). Respondents who had no history of walking per week at least for 20 minutes continuously were more likely to be overweight and/or obesity than those who walk 5-7 days per week.

In this study, wealth index quintile of lowest, second and middle, fathers' education level of no formal education and mother occupation of housewife were negatively and significantly associated with overweight and/or obesity. This finding is in line with a study done in South Africa (38), when the parent's occupations were compared with the children's

overweight/obesity, the least overweight/obese children's parents were employed as domestic/housewife workers, while more overweight/obese children's parents had professional/business occupations (higher incomes) or were self-employed in the informal sector. But the finding was not in agreement with a study done in Korea (39), where high economic status was a protective factor for overweight. This discrepancy observed in this study might be attributed to participants who came from higher economic status family were exposed for fat dense foods and weight gaining might be considered as a sign of healthiness. On the contrary, developed countries considered overweight as a disease and those families in low socioeconomic status might be accessible for fat dense foods.

Being grade 9 student was positively and significantly associated with overweight and/or obesity compared to grade 10. Nevertheless, studies from Hawassa (20) and Addis Ababa (18) showed no significant difference among grade level. The difference observed in the present study might be associated to more awareness of physical exercise of grade 10 students than grade 9; and another probable reason might also attributed to the adolescent growth spurt sometimes occurs at an earlier age, leading to increased adiposity.

Respondents who had no vigorous or moderate intensity activity sport at least for 10 minutes were 60% lower to be underweight [AOR=0.4; 95%CI= 0.2 to 0.97]; and respondents who had no history of walking per week at least for 20 minutes continuously were 7 times more likely to be overweight and/or obese than those who walk 5-7 days per week [AOR=7.4; 95% CI=2.6 to 20], alike with study from Hawassa (20). This finding might be explained by the decreased energy expenditure among this group.

7. STRENGTHS AND LIMITATIONS

7.1. STRENGTHS

- ✓ In addition to weight and height, waist circumference and hip circumference was measured to address the central adiposity by WHR.
- ✓ Multinomial logistic regression model was used to reduce the effect of error.

7.2. LIMITATIONS

There are limitations like; variables which can affect malnutrition such as parental weight status, nutritional knowledge, dietary intake and disease status of the participants which were not addressed in this study. Since the study depends on self report, there might be social desirability and recall bias from respondents. The study was not out of the limitations of cross sectional study like identifying the temporal relationship. In addition, measurement errors, and Seasonal variation for food insecurity could be acknowledged as another limitation of the study.

8. CONCLUSION AND RECOMMENDATION

8.1. CONCLUSION

This study revealed the coexistence of underweight (19.7%) and overweight and/or obesity (11.2%) among in- school adolescents.

Parental education and occupational status, family size, wealth index, household food insecurity , number of walking or bicycling days per week at least for 20 minutes continuously and sedentary behaviors were significantly associated factors.

8.2. RECOMMENDATION

- ✓ Based on the finding; there must be intersectoral collaboration among health sectors and education sectors to address adolescent nutrition problems, intervening nutrition related education and family planning in school and community.
- ✓ Physical activity behaviors of adolescents addressing double burden of malnutrition should be encouraged by schools and youth centers.
- ✓ There is a need to establish income generating mechanisms in the community.
- ✓ Further studies and analysis investigating food consumption patterns are required to confirm nutrition transition trends.

10. REFERENCES

1. James WPT, Norum KR, Mitasiri S, Swaminathan MS, Tagwireyi J, Uauy R, et al. Ending Malnutrition by 2020: An Agenda for Change in the Millennium. Geneva: UN SCN, 2000.
2. Spear B. Adolescent growth and development. *J Am Diet Assoc.* 2002;102:23S–9S.
3. Thurnham D. Nutrition of Adolescent Girls in Low- and Middle-Income Countries. *sight and life.* 2013:26.
4. Rogol A, Clark P, Roemmich J. Growth and pubertal development in children and adolescents: effects of diet and physical activity. *Am J Clin Nutr* 2003 (72):521S–8S.
5. WHO. Global health risks: mortality and burden of disease attributable to selected major risks. Geneva: World Health Organization. 2009.
6. Hazbun O, Azcona C, Martínez J, Martí A. Management of overweight and obesity in adolescents: an integral lifestyle approach. *Actividad Dietética.* 2009;13:153-60.
7. THE N, Suchindran C, North K, Popkin B, Gordon-Larsen P. Association of adolescent obesity with risk of severe obesity in adulthood *JAMA.* 2010;304:2042-7.
8. Kelishadi R. Childhood overweight, obesity, and the metabolic syndrome in developing countries. *Epidemiol Rev* 2007;29: 62-76.
9. Marie N, Tom F, Margaret R, Blake T, Nicholas G, Christopher M, et al. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic analysis for the Global Burden of Disease *Lancet.* 2014;384:766–81.
10. Garenne M. Urbanisation and child health in resource poor settings with special reference to under-five mortality in Africa. *Arch Dis Child.* 2010;95:464-8.
11. Ziraba A, Fotso J, Ochako R. Overweight and obesity in urban Africa: A problem of the rich or the poor? . *BMC Public Health.* 2009; 9:465.
12. Doustmohammadian A, Dorostymotlagh AR, Keshavarz A, Sadrzadehyeganeh H, Mohammadpour-Ahrangani B. Socio-demographic factors associated with body mass index of female adolescent students in Semnan city, Iran. *Malaysian Journal of Nutrition.* 2009;15(1):27–35.
13. Wang Y, Monteiro C, Popkin BM. Trends of obesity and underweight in older children and adolescents in the United States, Brazil, China, and Russia. *Am J Clin Nutr.* 2002;75:971–7.

14. Motlagh ME, Kelishadi R, Amirkhani MA, Ziaoddini H, Dashti M, Aminae T, et al. Double burden of nutritional disorders in young Iranian children: findings of a nationwide screening survey. *Public Health Nutrition*. 2010;14(4):605–10.
15. Caleyachetty R, Rudnicka AR, Echouffo-Tcheugui JB, Siegel KR, Richards N, al. e. Prevalence of overweight, obesity and thinness in 9–10 year old children in Mauritius. *Global Health* . 2012; (8):28.
16. Ene-Obong H, Ibeanu V, Onuoha N, Ejekwu A. Prevalence of overweight, obesity, and thinness among urban school-aged children and adolescents in southern Nigeria. *food and nutrition bulletin*. 2012;33(4).
17. Alebachew Z. Prevalence of childhood and adolescent overweight and obesity among elementary school students in Addis Ababa: Double burden of malnutrition in Ethiopia. Addis Ababa University digital library.(<http://hdl.handle.net/123456789/2063>). 2009.
18. Alemu E, Atnafu A, Yitayal M, Yimam K. Prevalence of Overweight and/or Obesity and Associated Factors among High School Adolescents in Arada Sub city, Addis Ababa, Ethiopia. *Nutrition & Food Sciences*. 2013;4(2).
19. Gebreyohannes Y, Shiferaw S, Demtsu B, Bugssa G. Nutritional status of adolescents in selected government and private secondary schools of Addis Ababa, Ethiopia *ijnfs*. 2014;3(6):504-14.
20. Teshome T, Pragya S, Moges D. Prevalence and Associated Factors of Overweight and Obesity Among High School Adolescents in Urban Communities of Hawassa, Southern Ethiopia. *Current Research in Nutrition and Food Science*. 2013;1(1):23-36.
21. Gebremariam H, Seid O, Assefa H. Assessment of nutritional status and associated factors among school going adolescents of Mekelle City, Northern Ethiopia *International Journal of Nutrition and Food Sciences*. 2015;4(1):118-24.
22. Yibeltal T, Charles T, Uriyoan C. The Rising Overweight-obesity and Its Socio-Demographic Correlates in Addis Ababa, Ethiopia, 2000-2011.
23. Berhe G, Endris M, Kisi T. Overweight and Obesity, and Associated Factors among High School Students in Gondar Town, North West Ethiopia. *J Obes Wt Loss Ther*. 2013;3(2).
24. Thiam I, Samba K, Lwanga D. Diet-related Chronic Diseases and the Double Burden of Malnutrition in West Africa. *East Afr Med J*. 2006.

25. Shrimpton R, Rokx C. The Double Burden of Malnutrition :A Review of Global Evidence. 2012.
26. Ercan S, Dallar Y, Serdar Önen S, Engiz O. Prevalence of Obesity and Associated Risk Factors Among Adolescents in Ankara, Turkey. *J Clin Res Pediatr Endocrinol* 2012;4(4):204-7.
27. Massad S, Holleran S, Gebre-Medhin M, Dary O, Obeidi M, Bordelois P, et al. Double burden of undernutrition and obesity in Palestinian Schoolchildren: a cross-sectional study. *the lancet*. 2012.
28. Rahmanian M, Kelishadi R, Qorbani M, Motlagh M, Gita Shafiee G, Aminae T, et al. Dual burden of body weight among Iranian children and adolescents in 2003 and 2010:. *Arch Med Sci*. 2014;10(1).
29. Keino S, Plasqui G, Ettyang G, Van den Borne B. Determinants of stunting and overweight among young children and adolescents in sub-Saharan Africa *International journal of preventive medicine*. 2014;35(2).
30. Sichieri R, Siqueira K, Moura A. Obesity and abdominal fatness associated with undernutrition early in life in a survey in Rio deJaneiro. *Int J Obes*. 2000 (24):614–18.
31. Jafar TH, Qadri Z, Islam M, Hatcher J, Bhutta ZA, Chaturvedi N. Rise in childhood obesity with persistently high rates of undernutrition among urban school-aged IndoAsian children. *BMJ*. 2008;93:373–8.
32. Cordeiro L, Wilde P, Semu H, James Levinson F. Household Food Security Is Inversely Associated with Undernutrition among Adolescents from Kilosa, Tanzania. *J Nutr*. 2012;142:1741-7.
33. Federal Democratic Republic of Ethiopia. Population census commision and housing census Results of Ethiopia. Addis Ababa. Ethiopia: 2008.
34. WHO. Global physical activity questionnaire (GPAQ) analysis guide. 2011.
35. WHO. WHO Steps instrument for chronic disease risk surveillance. 2012.
36. Coates J, Swindale A, Bilinsky P. Household Food Insecurity Access Scale (HFIAS) for Measurement of Food Access: Indicator Guide. Washington: USAID, 2007.
37. Motunrayo Funke O. Prevalence of Underweight: A Matter of Concern among Adolescents in Osun State, Nigeria. *Pakistan Journal of Nutrition* 2008;7(3):503-8.

38. Kruger R, Kruger H, MacIntyre U. The determinants of overweight and obesity among 10- to 15-year-old schoolchildren in the North West Province, South Africa. *Public Health Nutrition*. 2006;9(3):351-8.
39. Jin-Won Noh J, Kim Y, Park J, Oh I, Dae Kwon Y. Impact of Parental Socioeconomic Status on Childhood and Adolescent Overweight and Underweight in Korea. *J Epidemiol* 2014;24(3):221-9.

11. ANNEXES

Annex 1: English Version of Participant’s Consent and Information Sheet

Addis Ababa University, College of Health Sciences, School of Public Health

Questionnaire to assess the prevalence and its associated factors of double burden of malnutrition among in- school adolescents in Arba Minch town, southern Ethiopia

Hello. My name is _____ and I am here on behalf of Dessalegn Ajema, a post graduate student from AAU, school of public health. I am here to collect information on the current status of the magnitude and associated risk factors of double burden of malnutrition. I am requesting you to participate in this study which would require your response to an interview on some related issues, measuring weight, height, waist circumference and hip circumference. The study findings would also be used to design and implement control strategies in the study area in the future. Your name will not be written in this form and will never be used in connection with any information you tell us. All information given by you will be kept strictly confidential. Your participation is purely voluntary and you are not obligate to answer any question you do not wish to answer. If you feel discomfort with the interview, you can withdraw any time after you get involved in the study. This interview will take about 30 minutes.

Could I have your Permission to continue?

1. If yes, continue the interview.
2. If no, skip to the next participant by writing reasons for his/her refusal.

For any questions you have, you can contact the Principal Investigator by: **09 13 40 32 82**

Interviewer: Code _____ Name _____ signature _____

Date of interview _____ Time started _____ Time completed _____

Result of interview: 1. Completed 2. Respondent not available 3. Refused 4. Partially completed

Checked by: Supervisor: Name _____ Signature _____

Annex 2: English Version of the Questionnaire

Part I : Socio-Demographic Questions

Name of the school _____

Student's code / Identification number _____

Date of data collection ____/ ____/ ____

S.N	Socio-Demographic information	Response	Code
101	Sex	1. Male 2. Female	
102	Residence	1. Urban 2. Rural	
103	Age	-----	
104	Gradelevel of the student	1. 9 2. 10	
105	Schoolownership	1. Governmental 2. Community 3. Private	
106	Religion	1. Orthodox 2. Muslim 3. Catholic 4. Protestant 5. Other _____	
107	What is the highest level of education your mother has completed?	1. No formal education 2. 1-4 grade 3. 5-8 grade 4. 9-10 grade 5. 11-12 grade 6. College/ university completed	
108	What is the highest level of education your father has completed?	1. No formal education 2. 1-4 grade 3. 5-8 grade 4. 9-10 grade 5. 11-12 grade 6. College/ university completed	
109	How many people including yourself, live in yourhousehold?	-----	

110	Wealth index	QUESTIONS..... -----	
111	Fathers occupational status	1.Farmer 2.Merchant 3.Government employer 4.Private 5.Daily labourer 6.Jobless 7.Others	
112	Mothers occupational status	1.House wife 2.Merchant 3.Government employer 4.Private 5.Daily labourer 6.Jobless 7.Others	
113	Is there vehicle to transport family from place to place?	1. Yes 2. No	

Part-II : Household Food Insecurity Access Scale (HFIAS) Measurement Tool

S.N	QUESTION	RESPONSE OPTIONS
2.1.	In the past four weeks, did you worry that your household would not have enough food?	0 = No (skip to Q2.2) 1=Yes
2.1.a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)
2.2.	In the past four weeks, were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?	0 = No (skip to Q2.3) 1=Yes
2.2.a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)
2.3	In the past four weeks, did you or any household member have to eat a limited variety of foods due to a lack of resources?	0 = No (skip to Q2.4) 1 = Yes
2.3a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)
2.4.	In the past four weeks, did you or any household member have to eat some Foods that you really did not want to eat because of a lack of resources to obtain other types of food?	0 = No (skip to Q2.5) 1 = Yes
2.4.a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)

		weeks)
2.5.	In the past four weeks, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?	0 = No (skip to Q2.6) 1 = Yes
2.5.a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)
2.6.	In the past four weeks, did you or any other household member have to eat fewer meals in a day because there was not enough food?	0 = No (skip to Q2.7) 1 = Yes
2.6.a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)
2.7.	In the past four weeks, was there ever no food to eat of any kind in your household because of lack of resources to get food?	0 = No (skip to Q2.8) 1 = Yes
2.7.a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)
2.8	In the past four weeks, did you or any household member go to sleep at night hungry because there was not enough food?	0 = No (skip to Q2.9) 1 = Yes
2.8.a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)
2.9	In the past four weeks, did you or any household member go a whole day and night without eating anything because there was not enough food?	0 = No (questionnaire is finished) 1 = Yes

2.9.a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)
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Part III : Physical Activity And Sedentary Activity

Physical Activity		
<p>Next I am going to ask you about the time you spend doing different types of physical activity in a typical week. Please answer these questions even if you do not consider yourself to be a physically active person.</p> <p>Think first about the time you spend doing work. Think of work as the things that you have to do such as paid or unpaid work, study/training, household chores, harvesting food/crops, fish. <i>[Insert other examples if needed]</i>. In answering the following questions 'vigorous-intensity activities' are activities that require hard physical effort and cause large increases in breathing or heart rate, 'moderate-intensity activities' are activities that require moderate physical effort and cause small increases in breathing or heart rate.</p>		
Questions	Response	Code
Activity at work		
301	Does your work involve vigorous-intensity activity that causes large increases in breathing or heart rate like <i>[carrying or lifting heavy loads, digging or construction work]</i> for at least 20 minutes continuously?	Yes 1 No 2 <i>If No, go to P 4</i>

302	In a typical week, on how many days do you do vigorous-intensity activities as part of your work?	Number of days	<input type="text"/>	
303	How much time do you spend doing vigorous-intensity activities at work on a typical day?	Hours minutes	: <input type="text"/> : <input type="text"/> hrs mins	
304	Does your work involve moderate-intensity activity that causes small increases in breathing or heart rate such as brisk walking [or carrying light loads] for at least 20 minutes continuously?	Yes No	1 2 If No, go to P 7	
305	In a typical week, on how many days do you do moderate-intensity activities as part of your work?	Number of days	<input type="text"/>	
306	How much time do you spend doing moderate-intensity activities at work on a typical day?	Hours minutes	: <input type="text"/> : <input type="text"/> hrs mins	
Travel to and from places				
The next questions exclude the physical activities at work that you have already mentioned.				
Now I would like to ask you about the usual way you travel to and from places. For example to work, for shopping, to market, to place of worship. [insert other examples if needed]				
307	Do you walk or use a bicycle (<i>pedal cycle</i>) for at least 20 minutes continuously to get to and from places?	Yes No	1 2 If No, go to P 10	

Recreational activity (Continued)			
Questions		Response	Code
311	In a typical week on how many days do you do vigorous –intensity sports,	-----	
312	How much time do you spend doing vigorous –intensity sports, fitness or recreational activities in a typical	Hours: minutes -----	
313	Do you do any moderate-intensity sports that cause small increases in breathing or heart rate for at least 10	1. Yes 2. No if no go to P 16	
314	In a typical week on how many days do you do moderate –intensity sports,	-----	
315	How much time do you spend doing moderate –intensity sports, fitness or recreational activities in a typical	Hours: minutes -----	
Sedentary behavior			
<p>The following question is about sitting or reclining at work, at home, getting to and from places, or with friends including time spent(sitting at a desk sitting with friends, traveling in a car, bus, reading, playing card or watching television), but not include time spent sleeping</p>			
316	How much time do you usually spend Sitting on a typical day?	Hours: minutes -----	

Part IV: Wealth index of households related questions

Wealth index of households related questions				
501	Private home	1. Yes	2. No	
502	Electricity?	1. Yes	2. No	
503	An electric mitad?	1. Yes	2. No	
504	A refrigerator	1. Yes	2. No	
505	A television?	1. Yes	2. No	
506	A Bajaj?	1. Yes	2. No	
507	Motor cycle	1. Yes	2. No	
508	A radio	1. Yes	2. No	
509	mobile telephone	1. Yes	2. No	
510	A table	1. Yes	2. No	
511	A chair	1. Yes	2. No	
512	A bed with cotton/ sponge/spring matters	1. Yes	2. No	
513	A kerosene lamp/pressure lamp	1. Yes	2. No	
514	Annual farm product per quintal			
514a	Wheat	1.Yes	2.No	----- quintal
514b	barley	1.Yes	2.No	----- quintal
514c	Maize	1.Yes	2.No	----- quintal
514d	Shinbra	1.Yes	2.No	----- quintal
514e	Teff	1.Yes	2.No	----- quintal
515	Does household own any agricultural land	1. Yes	2. No	
515a	How many (local units) of agricultural land do you own	Private -----(local unit)	By rent ----- (local units)	
516	Presence of cattle's	1. Yes	2. No	
516a	Milk cows, oxen or bulls	-----	in no	
516b	Horses, donkeys, or mules	-----	in no	
516c	Goats /Sheep?	-----	in no	
516d	Chickens?	-----	in no	

Part V: Anthropometric Measurements

S.N	Measurements	Response	Code
401	Weight	In kilograms (Kg) _____	
402	Height in centimeters	In centimeters _____	
403	Waist circumference	In centimeters _____	
404	Hip circumference	In centimeters _____	

THANK YOU!

Annex 3 : Amharic version of Participant’s Consent and Information Sheet

**አዲስ አበባ ዩኒቨርሲቲ ጤና ሳይንስ ኮሌጅ የህብረተሰብ ጤና
አጠባበቅ ትምህርት ክፍል**

የጥናቱ መግለጫና የፈቃደኝነት መግለጫ ቅጽ

ጤናይስጥልኝ!

ስሜ-----ይባላል።እዚህ የመጣሁት በአዲስአበባ ዩኒቨርሲቲ በህ/ሰብጤናየት/ት መስክ የድህረ ምረቃ ተማሪ የሆነውን ደሳለኝ አጀማን ወክዬ ስለ ምግብ አጥረትና ከመጠን ያለፈ ወፍረት መኖር/መጠን ናተያያዥ መንስኤዎች በሁለተኛ ደረጃ ተማሪዎች ለማጥናት ነው ። በቃለመጠይቁ እንዲሳተፉ እጠይቆታለሁ ።ለማጠናወጥ ጥናት የተወሰኑ ጥያቄዎቻን እጠይቅሃለሁ/እጠይቅሽለሁ።በዚህ መጠይቅ ስለማህበራዊ ና ዲሞክራሲያዊ፤ የምግብ ዋስትና ፤ሰለአካላዊ እንቅስቃሴ ና በመቀመጥ የምታሳልፈውን/የምታሳልፈውን ጊዜ በተመለከተ እጠየቅሀለሁ/እጠይቅሻለሁ ።ከዚህ በተጨማሪ የአንተን/አንችን ከብደት፣ቁመት፣የወገበዙሪያ ናየዳሌ ዙሪያ መጠንእለካለሁ።የማገኘወ መረጃ ከከብደት መጨመር ጋር ተያይዘወ የሚመጡ የጤና ችግሮች ለመከላከል እቅድ ለማወጣት ይረዳናል።ከአንተ/ችየማገኘወን መረጃ በምስጢር እጠብቃለሁ።ከአንተ/ችየምንሰበስበወ መረጃከአንተ/ች ስም ጋር አይያያዝም።በዚህ ጥናት ወሰጥ ለመሳተፍ በቅድሚያ የተሳታፈወን ፈቃደኝነት እንጠይቃለን።መልስ መስጠት የማትፈልግበት/የማትፈልገበት ጥያቄ ካለ አትገደድም/አትገደጅም።

በዚህጥናትለመሳተፍፈቃደኛነህ/ሽ? 1.አዎ 2.አይደለም

መልሱ “የለም” ከሆነ አመስግነው መጠይቁን ያቋርጡ።ለጥናቱ ፈቃደኛ ያልሆኑበትን ምክንያት በመጠየቅ ና በማስታወሻዎ ላይ በመያዝ ለጥናቱ ተቆጣጣሪ ፖርት ያድርጉ።

ለማንኛውም አይነት ጥያቄ ዋና አጥኚውን ማነጋገር ይችላሉ። **ሞባይል: 09 13403282**

የተጀመረበትሰዓት ----- ያለቀበትሰዓት -----
መረጃሰብሳቢው፡ስም----- ፊርማ-----ቀን፡-----
የተቆጣጣሪ፡ስም----- ፊርማ-----ቀን፡-----

Annex 4 : Amharic version of the questionnaire

ከጤና ጋር የተያያዘ የምርምር ወይም ጥናታዊ ፅሁፍ መረጃ

መሰብሰቢያ የተዘጋጀ መጠይቅ

ክፍል አንድ:- ማህበራዊ ና ዲሞክራሲያዊ ሁኔታ

የተማሪው ኮድ/የመጠይቁ መለያ ቁጥር-----

መጠይቁ የተካሄደበት ቀን-----/ -----/ -----

የትምህርት ቤቱ ስም-----

ተ.ቁ	ጥያቄዎች	መልስ	
101	ፆታ	1. ወንድ 2. ሴት	
102	መኖርያ	1. ገጠር 2. ከተማ	
103	ዕድሜ	-----	
104	የት/ትደረጃ	1. 9 2. 10	
105	የት/ትቤቱ አይነት	1. የመንግስት 2. የማህበረሰብ 3. የግል	
106	ሀይማኖት	1. ኦርቶዶክስ 2. ፕሮቴስታንት 3. ሙስሊም 4. ካቶሊክ 5. ሌላ(ይጠቀስ.....)	
107	የእናትህ/ሽየት/ትደረጃ	1. መፃፍ ና ማንበብ የማይችል 2. መፃፍ ና ማንበብ የሚችል 3. 1-4ክፍል 4. 5-8 ክፍል 5. 9-12 ክፍል 6. ከዲፕሎማ በላይ	
108	የአባትህ/ሽየት/ትደረጃ	1. መፃፍ ና ማንበብ የማይችል 2. መፃፍና ማንበብ የሚችል 3. 1-4ክፍል	

		4. 5-8 ክፍል 5. 9-12 ክፍል 6. ከዲፕሎማሲያ	
109	አንተን/አንቺን ጨምሮ በቤት ውስጥ ስንት ሆናችሁ ነዉ የምትኖሩት	-----	
110	የአባትህ/ሽዋና መተዳደርያ ስራ ምንድነው?	1. ገበሬ 2. ነጋዴ 3. የመንግስት ሰራተኛ 4. የጉልበት/የቀን/ ሰራተኛ 5. የግል ስራ 6. ስራ የሌለው 7. ሌላ (ይጠቀስ).....	
111	የእናትህ/ሽ ዋና መተዳደርያ ስራ ምንድነው?	1. የቤት አመቤት 2. ነጋዴ 3. የመንግስት ሰራተኛ 4. የጉልበት/የቀን/ ሰራተኛ 5. የግል ስራ 6. ስራ የሌለው 7. ሌላ (ይጠቀስ)-----	
112	ከቦታ ወደ ቦታ የምትንቀሳቀሱበት መኪና አላችሁ	1. አዎ 2. የለም	

ክፍል ሁለት፡- ክፍል ሁለት፡ የቤተሰብ የምግብ ዋስትና ሁኔታ ለመዳሰስ የተዘጋጀ መጠይቅ

ተ.ቁ			
2.1.	ባለፈው አንድ ወር ውስጥ በቤታችሁ ውስጥ የምግብ ዕጥረት እዳያጋጥሞት ተጨንቀው ያወቃሉ?	0- የለም \longrightarrow 1-አዎ	ወደ ጥያቄ 2.2
2.1.a	መልስህ/ሽ አዎ ከሆነ ይህ ለምን ያህል ጊዜ ተከስቷል?	1- አልፎአልፎ (አንዴወይሁለቴ) 2- የተወሰነጊዜ (3-10) 3- ብዙጊዜ (ከ10 ጊዜ በላይ)	
2.2.	ባለፈው አንድ ወር ውስጥ አንተ/ቺ ወይም ሌላ የቤተሰብ አባል በምግብ እጥረት ምክኒያት የሚፈልጉትን ምግብ ሳይመገቡ ቀርተዋል?	0-የለም \longrightarrow 1-አዎ	ወደ ጥያቄ 2.3
2.2.a	መልስህ/ሽ አዎ ከሆነ ይህ ለምን ያህል ጊዜ ተከስቷል?	1- አልፎአልፎ (አንዴወይሁለቴ) 2- የተወሰነጊዜ (3-10) 3- ብዙጊዜ (ከ10 ጊዜ በላይ)	
2.3.	ባለፈው አንድ ወር ውስጥ አንተ/ቺ ወይም ሌላ የቤተሰብ አባል በምግብ አቅርቦት ምክኒያት የሚመገቧቸው የምግብ አይነቶች ቀንሰዋል?	0-የለም \longrightarrow 1-አዎ	ወደ ጥያቄ 2.4
2.3.a	መልስህ/ሽ አዎ ከሆነ ይህ ለምን ያህል ጊዜ ተከስቷል?	1- አልፎአልፎ (አንዴወይሁለቴ) 2- የተወሰነጊዜ (3-10) 3- ብዙጊዜ (ከ10 ጊዜ በላይ)	
2.4.	ባለፈው አንድ ወር ውስጥ አንተ/ቺ ወይም ሌላ የቤተሰብ አባል በምግብ አቅርቦት ምክኒያት የሚፈልጉትን የምግብ አይነት ተመግበዋል?	0-የለም \longrightarrow 1-አዎ	ወደ ጥያቄ 2.5
2.4.a	መልስህ/ሽ አዎ ከሆነ ይህ ለምን ያህል ጊዜ ተከስቷል?	1- አልፎአልፎ (አንዴወይሁለቴ) 2- የተወሰነጊዜ (3-10) 3- ብዙጊዜ (ከ10 ጊዜ በላይ)	
2.5.	ባለፈው አንድ ወር ውስጥ አንተ/ቺ ወይም ሌላ የቤተሰብ አባል በምግብ እጥረት ምክኒያት የሚመገቡትን የምግብ መጠን ቀንሰዋል?	0-የለም \longrightarrow 1-አዎ	ወደ ጥያቄ 2.6

2.5.a	መልሱ አዎ ከሆነ ይህ ለምንህል ጊዜ ተከስቷል?	1- አልፎአልፎ (አንዴወይሁለቴ) 2- የተወሰነጊዜ (3-10) 3- ብዙጊዜ (ከ10 ግዜበላይ)	
2.6.	ባለፈው አንድ ወር ውስጥ በምግብ እጥረት ምክኒያት አንተ/ቺ ወይም ሌላ የቤተሰብ አባል በምግብ እጥረት ምክኒያት በቀን ምግብ የሚበሉባችው ጊዜያት ቀንሰዋል?	0-የለም \longrightarrow 1-አዎ	ወደ ጥያቄ 2.7
2.6.a	መልሱ አዎ ከሆነ ይህ ለምንህል ጊዜ ተከስቷል?	1- አልፎአልፎ (አንዴወይሁለቴ) 2- የተወሰነጊዜ (3-10) 3- ብዙጊዜ (ከ10 ግዜበላይ)	
2.7.	ባለፈው አንድ ወር ውስጥ በምግብ እጥረት ምክኒያት ማንኛውም የሚበላ ምግብ ከቤት ጠፍቶ ያውቃል?	0-የለም \longrightarrow 1-አዎ	ወደ ጥያቄ 2.8
2.7.a	መልሱ አዎ ከሆነ ይህ ለምን ያህል ጊዜ ተከስቷል?	1- አልፎአልፎ (አንዴወይሁለቴ) 2- የተወሰነጊዜ (3-10) 3- ብዙጊዜ (ከ10 ግዜበላይ)	
2.8	ባለፈው አንድ ወር ውስጥ አንተ/ቺ ወይም ሌላ የቤተሰብ አባል በምግብ እጥረት ምክኒያት እየተራቡ ምግብ ሳይበሉ ተኝተው ያውቃሉ?	0-የለም \longrightarrow 1-አዎ	ወደ ጥያቄ 2.9
2.8.a	መልሱ አዎ ከሆነ ይህ ለምን ያህል ጊዜ ተከስቷል?	1- አልፎአልፎ (አንዴወይምሁለቴ) 2- የተወሰነጊዜ (3-10) 3- ብዙጊዜ (ከ10 ጊዜበላይ)	
2.9	ባለፈው አንድ ወር ውስጥ ማንኛውም የቤተሰብ አባል በምግብ እጥረት ምክኒያት እየተራቡ ቀን ና ለሊት ሙሉ ምግብ ሳይበሉ ቀርተው ያውቃሉ?	0-የለም 1-አዎ	የለም ካሉጥያቄ 2.9aን (ይዘለሉት)
2.9.a	መልሱ አዎ ከሆነ ይህ ለምን ያህል ጊዜ ተከስቷል?	1- አልፎአልፎ (አንዴወይምሁለቴ) 2- የተወሰነጊዜ (3-10) 3- ብዙጊዜ (ከ10 ግዜበላይ)	

ክፍል-ሦስት:አካላዊ እንቅስቃሴ

አካላዊእንቅስቃሴ			
ከዚህ ቀጥቶ የተለያዩ የአካል እንቅስቃሴ በማካሄድ የሚያሳልፉአቸውን ጊዜያት በተመለከተ እጠይቅዎታለሁ።			
ጥያቄ	መልስ	እለፍ	
ከስራ ጋርየተያያዙ አካላዊ እንቅስቃሴ			
301	ስራዎ ብርቱ ጉልበት የሚጠይቅ ተግባር ወይም ቶሎ ቶሎ መተንፈስን ወይም ፈጣን የልብ ምት ሊያስከትል የሚችል ተግባር ያለማቋረጥ ቢያንስ ለ20ደቂቃ ይጠይቃል?	1.አዎ 2.የለም	ቁ.304
302	አብዛኛውን ጊዜ በሳምንት ስንት ቀን ብርቱ ጉልበት የሚጠይቅ ተግባር ያከናወናሉ?	የቀን ብዛት -----	
303	ብርቱ ጉልበት የሚጠይቁትን ተግባራት ከሚያከናውኑባቸው ቀናት በቀን ለምንያህል ጊዜይሰራሉ?	ሰዓት:ደቂቃ — :—	
304	ስራዎ መጠነኛ ጉልበት የሚጠይቅ ተግባር ወይም መጠነኛ የመተንፈስ ወይም የልብ ምት ፍጥነት ጭማሪ ሊያስከትል የሚችል ተግባር ያለማቋረጥ ቢያንስ ለ20ደቂቃ ይጠይቃል?	1.አዎ 2.የለም	ቁ.307
305	አብዛኛውን ጊዜ መጠነኛ ጉልበት የሚጠይቁ ስራዎችን በሳምንት ስንት ቀን ያከናወናሉ?	የቀን ብዛት -----	
306	መጠነኛ ጉልበት የሚጠይቁ ተግባራት ከሚያከናውኑባቸው ቀናት በአንዱ ቀን ለምንያህል ጊዜይሰራሉ?	ሰዓት : ደቂቃ — :—	

ከቦታቦታ እንቅስቃሴ

ከዚህ ቀጥሎ ከቦታ ቦታ ሲንቀሳቀሱ በብዛት የሚጠቀሙባቸውን መንገዶች • እጠይቅዎታለሁ።

307	ከቦታ ቦታ በሚንቀሳቀሱበት ጊዜ ለ20 ደቂቃ ያለማቋረጥ በእግርዎ ወይም በብስክሌት ይሄዳሉ።	1.አዎ 2.የለም →	ቁ.310
308	በሳምንት ውስጥ ስንት ቀንክ 20 ደቂቃ ያላነሰ ያለማቋረጥ በእግርዎ ወይም በብስክሌት ይሄዳሉ።	የቀን ብዛት -----	
309	በነዚህ ቀናት ውስጥ በቀን ምን ያህል ሰዓት ሳያቋርጡ የእግር ወይም የብስክሌት ጉዞ ያደርጋሉ?	ሰዓት ደቂቃ — :—	

ከመዝናናትና ከስፖርት ጋር የተያያዙ እንቅስቃሴዎች

310	ከፍተኛ የልብ ምት ወይም የአተነፋፈስ ፍጥነት መጨመር ሊያስከትል የሚችል ስፖርት በያንስ ለ10 ደቂቃ ያክል ሳያቋርጡ ይሰራሉ?	1.አዎ 2.የለም →	ቁ.313
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311	አበዛኛውን ጊዜ በሳምንት ስንት ቀን ከፍተኛ የልብ ምት ወይም የአተነፋፈስ ፍጥነት መጨመር ሊያስከትል የሚችል ስፖርት በያንስ ለ10 ደቂቃ ያክል ያለማቋረጥ ይሰራሉ?	የቀን-ብዛት _____	
-----	---------------------------------------------------------------------------------------------------------	---------------	--

312	እስፖርት ከሚሰሩባቸው ቀናት ውስጥ በአንዱ ቀን ሳያቋርጡ ለምን ያክል ጊዜ ከፍተኛ የልብ ምት ወይም የአተነፋፈስ ፍጥነት መጨመር ሊያስከትል የሚችል ስፖርት ይሰራሉ?	ሰዓት _____ ደቂቃ _____ —	
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313	መጠነኛ የሆነ የልብ ምት ወይም የአተነፋፈስ ፍጥነት መጨመር ሊያስከትል የሚችል ስፖርት ቢያንስ ለ10 ደቂቃ ያክል ሳያቋርጡ ይሰራሉ?	1.አዎ 2.የለም →	ቁ.316
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314	አበዛኛውን ጊዜ በሳምንት ስንት ቀን መጠነኛ የሆነ የልብ ምት ወይም የአተነፋፈስ ፍጥነት መጨመር ሊያስከትል የሚችል ስፖርት ቢያንስ ለ10ደቂቃ ያክል ሳያቋርጥ ይሰራሉ?	የቀንብዛት _____	
315	እስፖርት ከሚሰሩባቸው ቀናት ውስጥ በአንዱ ቀን ሳያቋርጥ ለምን ያክል ጊዜ መጠነኛ የሆነ የልብ ምት ወይም የአተነፋፈስ ፍጥነት መጨመር ሊያስከትል የሚችል ስፖርት ሳያቋርጥ ይሰራሉ?	ስድስት _____ ደቂቃ _____ _____	
Sedentary behavior			
316	አበዛኛውን ጊዜ በቀን ለምን ያክል ጊዜ ተቀምጠው ያሳልፋሉ?	ስድስት _____ ደቂቃ _____ _____	

ክፍል አራት: የቤተሰብ የሀብት ሁኔታ

የቤተሰብ የሀብት ሁኔታ:			
501	መኖሪያ ቤቱ የግልነው?	1. አዎን	2. የለም
502	ሙብራት አላችሁ?	1. አዎን	2. የለም
503	ኤሌልክትሪክ ምጣድ አላችሁ?	1. አዎን	2. የለም
504	ፍሪጅ አላችሁ?	1. አዎን	2. የለም
505	ቴሌቪዥን አለችሁ?	1. አዎን	2. የለም
506	ባጃጅ አላችሁ?	1. አዎን	2. የለም
507	ሞተር ሳይክል አላችሁ?	1. አዎን	2. የለም
508	ሬድዮ አላችሁ?	1. አዎን	2. የለም
509	የሞባይል ስልክ አላችሁ?	1. አዎን	2. የለም
510	ጠረጴዛ አላችሁ?	1. አዎን	2. የለም
511	ወንበር አላችሁ?	1. አዎን	2. የለም
512	አልጋ እና ከጥጥ /አሲፓንጅ/አስፐርንግ የተሰራ ፍራሻ/አላችሁ?	1. አዎን	2. የለም
513	ኩራዝ ወይንም ፋኖስ አላችሁ?	1. አዎን	2. የለም

514	አመታዊ የምርት ገቢ በኩንታል ስንት ነው ስንዴ ገብስ በቆሎ ጤፍ	----- ኩንታል ----- ኩንታል ----- ኩንታል ----- ኩንታል ----- ኩንታል	
515	የለማ መሬት በሄክታር አለዎት የግል የለማ መሬት የክራይ የለማ መሬት	1. አዎ 2. የለም ----- ገመድ/ጥማድ/ሄክታር ----- ገመድ/ጥማድ/ሄክታር	
516	የእንስሳት ሃብት አለዎት	1. አዎ 2. የለም	
	የእንስሳት መጠን እና በአይነት በቤተሰብ ደረጃ በሬ፣ ላም፣ ጥጃ ፈረስ፣ አህያ በግ ፍየል ዶሮ የንብቀፎ	-----በቁጥር -----በቁጥር -----በቁጥር -----በቁጥር -----በቁጥር -----በቁጥር	

ክፍል አምስት፡አካላዊ ልኬት

ተ.ቁ	ልኬት	መልስ	እለፍ
401	ቁመት	በሴንቲ ሜትር _____	
402	ክብደት	በኪሎ ግራም _____	
403	የወገብዙሪያ	በሴንቲ ሜትር _____	
404	የዳሌዙሪያ	በሴንቲ ሜትር _____	

አመሰግናለሁ!!!

Annex 5a: Bivariate and Multivariate Logistic Regressions analysis tables (SPSS Output)

Socio demographic Variables		Nutritional status			UNDERWEIGHT	
		normal	underweight	Overweight &/obesity	COR(95%CI)	AOR(95%CI)
Sex	male	174	66	36	1.7(1.2,2.6)*	1.59(0.9,2.7)
	female	241	52	31	1	1
Age group	14-16	220	73	37	1.4(0.9, 2)	1.1(0.6,1.9)
	17-19	195	45	30	1	1
Residence	rural	97	27	11	0.9(0.5,1.5)	0.9(0.2,3.5)
	urban	318	91	56	1	1
School type	government	259	84	29	1.4(0.9,2.3)	0.9(0.5,1.7)
	private	156	34	38	1	1
grade	9	221	59	47	0.8(0.5,1.3)	1.1(0.6,1.8)
	10	194	59	20	1	1
Family size	<=5	203	24	42	0.26(0.16,0.43)*	0.2(0.1, 0.4)*
	>5	212	94	25	1	1
Mothers' Educational status	No education	82	53	16	5.7(2.9,11.2)*	1.8(0.7,4.6)
	Primary	118	32	14	2.4(1.2,4.8)*	1.1(0.4,2.6)
	Secondary	99	20	15	1.8(0.8,3.8)	1.3(0.5,3.1)
	More than secondary	116	13	22	1	1
Fathers' Educational status	No education	62	44	2	13(5.8,29)*	12(4, 34)*
	Primary	96	41	13	7.9(3.5,17)*	6.8(2.5, 18)*
	Secondary	108	25	23	4.3(1.8,9.9)*	4(1.5, 10.9)*
	More than secondary	149	8	29	1	1
Mothers' occupational status	housewife	131	43	11	1.4(0.3,7)	1.5(0.2,10)
	merchant	117	32	27	1.2(0.2,5.9)	1.7(0.2,13)
	Government employee	124	31	15	1.12(0.2,5.4)	1.8(0.2,14)
	Daily labourer	8	4	2	2.2(0.3,15.7)	1.9(0.15,24)
	Private work	26	6	10	1.03(0.17,6)	1.6(0.17,14)
	NGO	9	2	2	1	1
Fathers' occupational status	Farmer	96	30	12	0.6(0.3,1.2)	1.1(0.3,3.7)
	Merchant	82	9	17	0.2(0.1,0.5)*	0.25(0.1,0.6)*
	Government employee	154	41	21	0.5(0.3,0.9)*	0.67(0.3,1.3)
	Private work	83	38	17	1	1
Wealth index	Lowest	57	32	5	3.9(1.9, 8)*	9.7(3, 30)*
	Second	81	41	10	3.5(1.7, 7)*	5.5(1.9,15.7)*
	Middle	99	14	16	0.9(0.4,2.2)	1.9(0.6, 6.4)
	Fourth	87	18	21	1.4(0.6, 3)	2.7(0.9, 7.8)
	Highest	91	13	15	1	1

Annex 5b: Bivariate and Multivariate Logistic Regressions analysis tables (SPSS Output)

Socio- demographic variables		Nutritional status			OVERWEIGHT/OBESITY	
		normal	underweight	Overweight &/obesity	COR(95%CI)	(AOR95%CI)
Sex	male	174	66	36	1.6(0.9,2.7)	1.9(0.9,3.7)
	female	241	52	31	1	1
Age group	14-16	220	73	37	1.1(0.6,1.8)	0.8(0.4,1.6)
	17-19	195	45	30	1	1
Residence	rural	97	27	11	0.6(0.3,1.2)	0.2(0.04,1.6)
	urban	318	91	56	1	1
School type	government	259	84	29	0.4(0.2,0.7)*	0.5(0.2,1.2)
	private	156	34	38	1	1
grade	9	221	59	47	2(1.1,3.6)*	2(1.01,4.1)*
	10	194	59	20	1	1
Family size	<=5	203	24	42	1.7(1.03,2.9)*	2.6(1.3,5.5)*
	>5	212	94	25	1	1
Mothers' Educational status	No education	82	53	16	1.03(0.5,2.1)	2.1(0.7, 6)
	Primary	118	32	14	0.6(0.3,1.2)	0.7(0.2, 2)
	Secondary	99	20	15	0.8(0.4,1.6)	1.5(0.6, 4)
	More than secondary	116	13	22	1	1
Fathers' Educational status	No education	62	44	2	0.16(0.03,0.7)	0.2(0.03,0.9)*
	Primary	96	41	13	0.6(0.3,1.4)	0.6(0.2,1.6)
	Secondary	108	25	23	1.1(0.6,2)	1.06(0.4,2.4)
	More than secondary	149	8	29	1	1
Mothers' occupational status	housewife	131	43	11	0.3(0.07,1.9)	0.1(0.01,0.8)*
	merchant	117	32	27	1.03(0.2,5)	0.2(0.02,2.1)
	Government employee	124	31	15	0.5(0.1,2.7)	0.17(0.01,1.5)
	Daily labourer	8	4	2	1.12(0.12,9.9)	0.3(0.01,5.7)
	Private work	26	6	10	1.7(0.3,9.4)	0.3(0.02, 3)
	NGO	9	2	2	1	1
Fathers' occupational status	Farmer	96	30	12	0.6(0.2,1.35)	1.7(0.2,10.6)
	Merchant	82	9	17	1.01(0.4,2.1)	1.4(0.5,4)
	Government employee	154	41	21	0.67(0.3,1.3)	0.6(0.27,1.7)
	Private work	83	38	17	1	1
Wealth index	Lowest	57	32	5	0.5(0.18,1.5)	0.2(0.03,0.7)*
	Second	81	41	10	0.7(0.3,1.7)	0.23(0.1,0.8)*
	Middle	99	14	16	0.9(0.4, 2)	0.21(0.1, 0.7)*
	Fourth	87	18	21	1.4(0.7, 3)	0.5(0.18, 1.8)
	Highest	91	13	15	1	1

The reference category is: normal weight, *=significant at P-value<0.05, COR=Crude odds ratio, AOR=Adjusted odds ratio, CI=Confidence interval