

# Prevalence and associated factors of double burden of malnutrition among school adolescence 10-19 years in Burayu town Oromia Special Zone, Ethiopia

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**ABSTRACT:** The double burden of malnutrition is an emerging nutritional problem of the coexistence of underweight and overweight. Obesity affects adolescents from both affluent and poor countries and nutritional status of adolescents in Ethiopia is not well documented, and they are the neglected segment of the population. The study aimed to assess prevalence and associated factors of double burden of malnutrition among adolescents in Burayu town, Ethiopia. A school-based cross-sectional study was conducted. A Stratified sampling was used to select a random sample of 627 adolescents from selected schools. Data on economic characteristics and socio-demographic information were collected by using an interviewer-administered questionnaire, and anthropometric measurements were made by using a digital Seca scale and height measuring board by trained data collectors. Data was entered into Epi-Data version 3.1 software and exported to SPSS version 24. World Health Organization Anthro-plus software was used to analyze anthropometric data. Both binary and multinomial logistic regression analyses was done to identify factors associated with the malnutrition of adolescents. Prevalence of stunting, thinness and overweight was 11.1, 3.9 and 12.1%, respectively. Having small number of children [AOR = 2.069, (95%CI: 1.161, 3.686)] significantly associated with stunting. Sex of adolescents [AOR = 4.454, (95%CI: 1.616, 12.278)], primary school adolescents [AOR = 0.233, (95%CI: 0.066, 0.821)] and secondary school adolescents [AOR = 0.229(95%CI: 0.056, 0.931)] and food sources [AOR = 3.750, (95%CI: 1.446, 9.728)] were significantly associated thinness. Sex of adolescents [AOR = 0.536, (95%CI: 0.318, 0.901)], school type [AOR = 0.326, (95%CI: 0.186, 0.571)] and number of children [AOR = 1.855, (95%CI: 1.086, 3.166)] were significantly associated overweight/obese. The study revealed the coexistence of double burden of malnutrition among in-school adolescents. There is an increasing trend in the level of stunting and overweight/obesity. Number of children that family had being associated with stunting and overweight/obesity. Food source and school level was positive association with thinness. School type and sex of adolescents associated with overweight/obesity.

**Keywords:** Adolescent, children, double burden, malnutrition, overweight, stunting.

## INTRODUCTION

The World Health Organization defines adolescence as a transitional period between childhood and adulthood and those aged 10 to 19 years. Globally it is estimated that by 2030, the youth population will grow; from 1.8 billion in 2015 to 1.9 billion in 2030. In contrast, the proportion of young people in the total population in the African Region will increase from 31.8 to 32.1%. As result, the population

of adolescents in total population will slightly rise from 2015 to 2025 in the region (Ng et al., 2013; WHO, 2017). There are around 315 million of young people (10 to 24 years) living in the African region today, representing 31.8% of the population of Africa (WHO, 2017). The double burden of malnutrition is an emerging nutritional problem of the coexistence of underweight, and overweight and/or

obesity affecting adolescents from both affluent and poor countries. Malnutrition affects all countries and one third of people worldwide. Almost 1 billion people continue to be undernourished and currently about 2 billion people are overweight. Nearly half of all countries face multiple serious burdens of malnutrition (FAO, IFAD & WFP, 2014; James et al., 2000; Bloom et al., 2011). It has been reported that 98.4 million children in Asia have stunted growth, whereas in sub-Saharan Africa, the prevalence is essentially unchanged, from 45.7 million children in 1990 to 55.8 million in 2010 (Neufeld et al., 2013). At the same time, the prevalence of obesity is increasing substantially and, in many countries, approaches that of developed countries (Popkin et al., 2013). Adolescence is a time of rapid physical growth, second only to the first year after birth; during adolescence, children gain up to 50% of their adult weight and skeletal mass and more than 20% of their adult height. Optimal nutrition during this period of life is therefore crucial. Poor nutrition during adolescence will not only affect adult body size, resulting in shortness or thinness but may also affect the nutritional status of any children born to mothers who were malnourished during adolescence (WHO, 2006). WHO indicates that changes in diet and lifestyle resulting from industrialization, urbanization and economic development are having a significant impact on the nutritional status of populations (WHO, 2003). The double burden of malnutrition referred to as “malnutrition in all its forms” is the coexistence of under nutrition including macronutrient and micronutrient deficiencies and over nutrition in the same population across the life-course (Hrimpton et al., 2012). In most regions, under nutrition and over nutrition coexist in the same country, in the same community, or even in the same house hold (Darnton-Hill et al., 2004; Kurz, 1996).

The latest study reports that the prevalence of overweight in developed countries indicated increased from 1980 to 2013, 2 % higher than the rate in developing countries. Sixty two percent of the world's obese people live in developed countries (Wise, 2014). Prevalence of thinness and stunting of adolescents was 4.8 and 5.2%, respectively. Stunting and underweight among girls during adolescence, continuing into adulthood (Gopalan, 1989). In particular, low birth weight are the results of thinness and may also limit school achievement and work productivity (Kramer, 1987). Overweight and obese adolescents are at risk factors of developing non communicable diseases such as cardiovascular disease, diabetes mellitus, arthritis, and some cancers and also suffer from psychological problems such as stigmatization and poor self-esteem (Maket et al., 2012). This rate is increasing as the prevalence of childhood overweight and obesity in developing countries is rising. In nations such as Kiribati, the Federated States of Micronesia, Libya, Tonga, and Samoa, more than 50% of women now have obesity (Ng et al., 2013). Among countries that collect data, there are huge variations of prevalence, ranging from 2.7% in Swaziland to 29.5% in Zambia. In the region, there are

more overweight female adolescents than male adolescents (WHO, 2017).

Adolescence serves as a window of opportunity to break intergenerational cycle of malnutrition and to build a nutritionally healthy adult life. Some nutritional problems originating early in life can be potentially corrected, unless it will lead to life threatening non communicable diseases in adulthood. It is the actual period to shape and consolidate healthy eating and lifestyle behaviors, thereby preventing or postponing the onset of nutrition-related chronic disease in adulthood (Delisle et al., 2000). Socio-demographic, socio-economic factors, Dietary habit, characteristics on behavior, lifestyle, health, sanitation and physical activity related behavior were significantly associated with the nutritional status of adolescents (Teshome et al., 2013; Ahmed et al., 2015; Berbada et al., 2017). Adolescent are largest segments of total population but they are critical vulnerable group to malnutrition. So, to breaking the cycle of intergenerational transmission of malnutrition investing in adolescents will ensure to reduce double burden of malnutrition. Information regarding nutritional status of adolescents in Ethiopia is not well documented, and they were the neglected segment of the population (EDHS, 2016). The national prevalence of underweight and overweight and/or obesity among adolescents is not found. However, in Ethiopia, one study conducted in Wolaita Sodo town Southern Ethiopian 2018 reported that the overall prevalence of thinness, stunting, and overweight/obesity among adolescents was 4.7, 5.2 and 5.0%, respectively (Dereje et al., 2018). Being male learning at a government school, mothers with no formal education owning no cattle, skipping meals and illness in 2 weeks prior to survey were significantly associated with thinness. However, male students who had their house and no cattle were more likely to develop overweight/obesity. Maternal education of secondary school was significantly associated with the stunting (Teferi et al., 2018). Moreover, the study done in Arba Minch town Southern Ethiopian 2017 shows that the magnitude of underweight and overweight were 19.7and 11.2%, respectively. Father educational and occupation status, family size and wealth index were significantly associated with underweight (Berbada et al., 2017). Study from Addis Ababa, Ethiopia, showed that adolescent overweight/obesity is an emerging challenge and it was about 8% and revealed that particularly private school-going adolescents were more affected (Gebreyohannes et al., 2014).

According to WHO (2011) report, nearly three out of four obese adolescents remain obese as adults, increasing their risk of heart disease, type 2 diabetes, stroke and cancers. But still their feeding problems and nutritional status determination using appropriate anthropometric measurements are not enough investigated in these age groups (WHO, 2006). Adolescents are suffering from chronic non communicable diseases (NCDs) that have been mostly neglected by the international community (A Global Community Investment Initiative, 2014). The

available studies in Ethiopia focused on factors related to reproductive issues and the magnitude of under-five years children nutritional problem rather than factors associated with normal growth and development of adolescents (Kassa et al., 2017). Thus, studies that indicate the actual level of adolescents' nutritional problem and investigate related factors have greater potential to design appropriate intervention and are an alarming for timely taking action for non-communicable disease prevention. Therefore, this study aimed to assess prevalence and associated factors of double burden of malnutrition among adolescents in Burayu town, Oromia special Zone, Ethiopia.

## METHODOLOGY

### Study area description

Burayu town is found in Oromia Special Zone located 8 km west of capital city of Ethiopia. The area is geographically situated at 9°3'N and 38°30'E, at an altitude of 2400 meter above sea level. The mean minimum and maximum temperatures are 4.0 and 23.3°C, respectively. The mean relative humidity and rainfall are 50.4% and 43.4 mm, respectively (Ministry of Agriculture, 2004). The town has 6 kebeles and the estimated size of population 250,700, out of this male (49%) and female (51%) (Burayu town Administration report, 2018). This town has 49 primary schools and seven high schools and five preparatory schools. Of which forty one (N = 3619) were primary private schools and eight (N = 2582) are governmental primary schools, which two high schools and one preparatory schools are governmental (N = 2932) and five high schools and 4 preparatory schools are private (N=430) schools with a total number of 10563 students enrolled in both categories of the school at the time of the study.

### Study design

A cross-sectional study was conducted among adolescents during school period of April to June, 2019.

### Source and study population

All primary, secondary, and preparatory school adolescent students were considered as a source of population. All regular students in the selected schools aged between 10 and 19 years at the study area were study population.

### Sampling population

All randomly selected students aged between 10 and 19 years in selected schools of the study area.

### Inclusion and exclusion criteria

Inclusion criteria: School-going adolescents aged between

10 and 19 years who has been attending regular program were included in the study. Exclusion criteria: Adolescents who have spinal curvature (unable to stand), pregnant, and edema due to some other pathological causes were excluded.

### Dependent variables

The dependent variables for this study are double of malnutrition among adolescents in the forms of under nutrition (underweight, thinness and stunting) and over nutrition (overweight and obesity) among adolescence aged 10 to 19 years.

### Independent variables

Data on economic characteristics' and socio-demographic variables (such as age, gender, family size, educational status of household head, occupational status of father, occupational status of mother, type of school, religion and family's residence), socio-economic status, eating habit/nutritional factors, adolescent's behavioral factors (physical work, alcohol drinking, smoking, and eating disorders), environmental factors (presence/absence of latrine, source of drinking water, and personal hygiene) and history of medical illness in the past two weeks were deeply investigated.

### Sample size determination

The sample size was determined by using a single popular-tion proportion formula by considering the following assumptions: 95% confidence level, 19.7% the prevalence of underweight among adolescents in Arba Minch town, South Ethiopia (Berbada et al., 2017) and margin of error 4%, power of 80.0%, design effect 1.5, Z statistic of 1.96 and 10% non-response rate. The sample size calculated as:

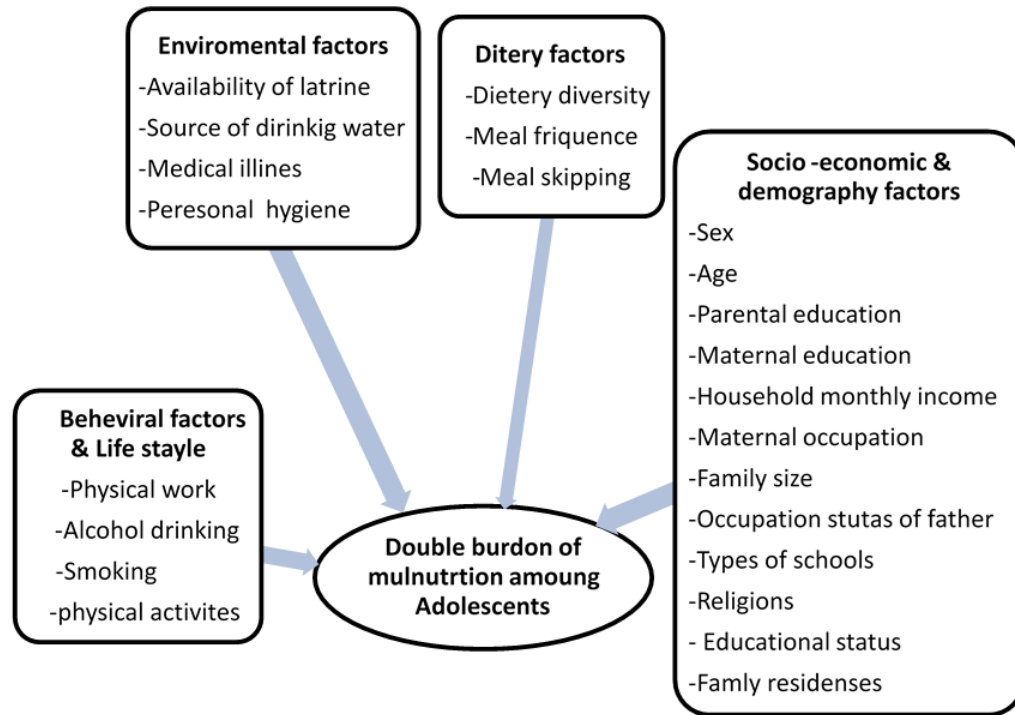
$$N = \frac{(Z \alpha/2)^2 pq}{d^2} = \frac{(Z \alpha/2)^2 p (1 - p)}{d^2} = 380$$

Whereas; N = minimum sample size, Z = Standard normal deviate corresponding to 5% significant level, p = proportion of adolescent population with malnutrition (p = 0.197), d = tolerable error of margin set at 0.04, q = 1 - 0.197, (Z<sub>α/2</sub>) = 1.96.

So, 380\*1.5 = 570. In stratified sampling strategy the design effect might be estimated as 1.5. And 10% non-response rate. 570\*0.1 = 57. Therefore, the final sample size (570+57) was 627 school adolescents.

### Sampling technique and procedure

A multistage sampling technique was used in this study. Among the total of 10,563 students in the Burayu town,



**Figure 1.** Conceptual framework of the study variables.

6,514 were enrolled in government schools while 4049 in private schools. The schools were first stratified in to two: governmental and nongovernmental schools. Using the simple random sampling method four high schools and two preparatory schools and six primary schools from each stratum were selected. Two high schools from government namely Burayu (N = 1811, n = 108) and Burqa Nono (N = 492, n = 29); one preparatory school Burayu (N = 629, n = 37) and the same number from private high schools called Alfiyan (N = 129, n = 10) and Wisdom Sidar (N = 128, n = 9), and one preparatory school Alfiyan (N = 108, n = 6) and government primary schools: Burayu (N = 1184, n = 112), Guje Karsa (N = 533, n=50), Abdi Nono (N = 541, n = 51) and private primary schools Burayu Kata (N = 781, n = 107), Lalise Talent (N = 414, n = 56) and Hill Toop (N = 381, n = 52) were randomly selected and the number of students require in each school were allocated proportionately. Government and private schools were represented by 387 and 240 students, respectively. The representative samples obtained by proportion to population that means sampled population of private primary schools selected by simple random sampling (n) = no of population in randomly selected primary schools\*representative sample of all primary schools divided by total population of all the selected private primary schools. For secondary and preparatory schools, the same formula was applied. In the selected schools, one section per grade was selected randomly that makes a total of 36 sections. The total sample size was proportionally allocated to the number of students found in

the 36 sections. The allocated sample size per each section was also reallocated to the number of female and male students. Simple random sampling was used, to select the study subjects.

### Data collection procedures

#### Data collection tools

A structured interviewer - administered questionnaire was used to collect data. The questionnaire was developed based on the conceptual framework (Figure 1) after thorough review of different literature, and it covered a range of information on socio-economic and demographic characteristics, adolescents' dietary practice, reproductive health, lifestyle, and sanitation of adolescents. The questionnaire was developed from pre-established known sources like reports of an expert committee by WHO and other literatures conducted in developing countries including Ethiopia (Teferi et al., 2018; Berbada et al., 2017). The questionnaire was prepared in English and translated from English to Afaan Oromo and back to English. A height measuring board and portable digital Seca scale was used for measurement of height and weight, respectively.

#### Data quality management

A total of twelve data collectors comprising ten diploma

holder nurses, with previous experience of data collection, and three B.Sc. holder supervisors were employed to collect the data. The data collectors were trained for one day on the objective, methods, and each contents of question by the principal investigator. The questionnaires were pre-tested on 5% of adolescent in schools located outside of the study selected schools. Standardization of measuring scales of weight and height were undertaken. The collected data was reviewed and checked every day for completeness and consistency by the principal investigator and supervisors.

### ***Anthropometric measurements***

Height and weight measurements were taken in duplicate using calibrated equipment and standardized techniques. Height was measured in the standing position to the nearest 0.1 cm using a stable stadiometer with movable headpiece (Seca 213, GmbH & Co., Germany). Weight was measured using weighing scales (Seca 877, Germany) to the nearest 10 g with light clothing taking off shoes and mobile from the pocket. The digital Seca scale was a self-zeroing scale and was calibrated each day before starting data collection by putting 2 kg iron bars on each scale to ascertain accuracy. The students were standing upright on the foot mark on a scale, stand straight, head hold erect such that the external auditory meatus and the lower border of the eye was in one horizontal plane (Frankfurt plane). The buttocks, shoulder blades and heel touch the scale with knees and legs together and arms hanging naturally by the sides. The head and height measurement was read off at maximum inspiration. The average three measurements were taken. Anthropometric measurements were converted to height for- age Z score (HAZ) and BMI-for-age Z score (BAZ) using WHO Anthroplus software version 2.3. The outcome variables were defined based on the indices of HAZ and BAZ, both compare to The World Health Organization Child Growth references population (Onis et al., 2007). Accordingly, adolescents with HAZs less than -2 standard deviations (SDs) below the median were defined as stunted, those with BMI-for height Z scores less than -2 SDs below the median were considered as thin. Conversely, the burden of overnutrition/obesity was measured with BAZ value above 1. Adolescents with BMI-for-age Z-score (BAZ) <-5 or >5 were considered as outliers.

### ***Data entry and analysis***

The data were checked for completeness and consistency during data entry and cleaning. Then the data were entered into the Epi-Data version 3.1 and exported to SPSS version 24. Anthropometric data and other essential variables were exported to WHO Anthro-plus software, a computer program which converts anthropometric data into Z - scores of the indices, BAZ and HAZ, taking age and sex into consideration using WHO (2007) reference

population. Descriptive statistics were used to analyze socio-economic and demographic collected data. While binary logistic regression was done to determine the associations between each independent variable and outcome variable. A p-value of < 0.2 in the bivariate analysis were considered as a variable selection criterion. Accordingly, all variables which were significant at p value of < 0.2 were entered into the multivariable analysis in order to control the possible effects of cofounders. In multivariate analysis, backward selection method was used to identify factors associated with adolescent nutritional status (stunting, normal and overweight/obesity). The adjusted odds ratio with 95% confidence intervals was used to see the strength of association between different variables. A p-value less than 0.05 was considered as statistically significant.

### **Ethical consideration**

An ethical clearance and official letter were obtained from the Research and Ethics Committee of School of Applied Human Nutrition, Bahir Dar University. Permission was secured from Burayu education office and the respective schools. Assent was obtained from Adolescent's family through school director for participants between the ages of 10 to 19 years. And verbal consent was also obtained for willingness of adolescents aged 10 to 19 years and the right to withdraw from the study at any time was also communicated to all participants. All the interviews and anthropometric measurements were conducted in a private place by same sex interviewers.

## **RESULT AND DISCUSSION**

### **Demographic and socio-economic characteristics**

A total of 627 school-going adolescents were included in this study, with the response rate of 100%. Among of these, 5 adolescents were excluded from analysis because of an extreme value (WHO Anthro- plus <-5 and > +5). Out of the respondents 288(46.3%) were males and 334(53.7%) were females and 383 (61.6%) were from government and 239 (38.4%) were from private schools. Regarding respondents' school level, 424(68.2%), 156 (25.1%) and 42(6.8%) were learned primary, secondary and preparatory schools, respectively. The median age of the respondents was 15 and years ranging from 10 to 19 years. The respondents' food source were two types: from own products/farm 466(74.9%) and purchased from market 156(25.1%). Three hundred seventeen (51.0%) of the respondents' families had ≤ 4 children and 305(49.0%) families had >4 children (Table 1).

Descriptive statistics of religion from complete response obtained from 627 households show that, 43.4 and 34.8% were orthodox and protestant, respectively. Current residency of adolescents shows that 96.3% were from

**Table 1.** Socio-demographic and economic characteristics of respondents among school adolescents in Burayu town Oromia Special Zone, Ethiopia, 2019.

Variable	Category	Frequency	Percent
Class level	Primary schools (grade 5-8)	424	68.2
	Secondary schools (grade 9-10)	156	25.1
	Preparatory schools (grade 11-12)	42	6.8
School type	Government	383	61.6
	Private	239	38.4
Sex	Male	288	46.3
	Female	334	53.7
Religion	Orthodox	272	43.4
	Protestant	218	34.8
	Muslim	118	18.8
	Wakefata	14	2.2
Ethnicity	Oromo	484	77.8
	Amhara	67	10.8
	Gurage	43	6.9
	Others	28	4.5
Current residency of adolescents	Urban	599	96.3
	Rural	23	3.7
Number of children family have	≤ 4	317	51.0
	> 4	305	49.0
Father educational status	No formal education	94	15.1
	Grade 1-4	93	15.0
	Grade 5-8	157	25.2
	Grade 9-10	98	15.8
	Grade 11-12	82	13.2
	College and university	98	15.8
Mother occupational status	Housewife	383	61.6
	Merchant	68	10.9
	Government employee	44	7.1
	Daily laborer	17	2.7
	private work	92	14.8
	Others	18	2.9
Father occupational status	Farmer	91	14.6
	Merchant	127	20.4
	Government employee	108	17.4
	Daily laborer	45	7.2
	private work	227	36.5
	Others	24	3.9
Monthly income	<1000	78	12.5
	1001- 2000	100	16.1
	2001- 3000	100	16.1
	3001- 4000	114	18.3
	> 4001	230	37.0
Residential house	Rent	162	26.0
	Owned	460	74.0

**Table 2.** Dietary habit of respondents among school adolescents of Burayu town Oromia Special Zone, Ethiopia, 2019.

Variable	Category	Frequency	Percent
Stable food	Teff	594	95.5
	Others	22	4.5
Food source	Own product	156	25.1
	Market purchased	466	74.9
Eat fruit per day/week	Not at all	35	5.6
	1 day/week	163	26.2
	2 days/week	237	38.1
	3 days/week	168	27.0
	4 days/week and above	19	3.1
Eat vegetables per day/weeks	Not at all	14	2.3
	1 day/week	187	30.1
	2 days/week	225	36.2
	3 days/week	155	24.9
Eat meal per day	4 days/week	41	6.6
	Twice	28	4.5
	three times	412	66.2
	four times	182	29.3

urban while 3.7% rural. Parental educational level show that 15.1% of the households had no formal education while 84.9% can read and write, and some attained higher educational level. The survey result of the main occupation of respondents' mothers shows that 61.6, 10.9, 7.1, 2.7, 14.8 and 2.9% were housewife, merchant, government employee, daily laborer, private work and others, respectively. Whereas The adolescents' family monthly income indicated that 16.1, 16.1, 18.3 and 37.0% earn < 1000, 1001–2000, 2001–3000, 3001–4000 and > 4001 ETB in percentage, respectively (Table 1).

### Dietary habit

Result in Table 2 shows adolescent households eat meal per day twice, three times and four times 28(4.5%), 412(66.2%) and 182(29.3%), respectively. The observed households eating Teff as staple food were found 594(95.5%) and others not consuming Teff were 22(4.5%). One hundred fifty-six (25.1%) of households food source was their own product and 466 (74.9%) purchase food from market.

### Household environmental characteristics

Environmental characteristics were one detrimental factors of adolescent malnutrition. Thus, the survey result show that from 627 surveyed households only family have kept cattle in the house 75.9%. Whereas the safe main

source of drinking water 601 (96.6%) used public safe/tap and while 30 (13.04%) households used dry pit latrine with slap and 285 (45.8%) of them used pit latrine without slap and others 337(54.2%) used flush toilet. Out of respondents sampled households 593(95.3%) had washed hand with soap (Table 3).

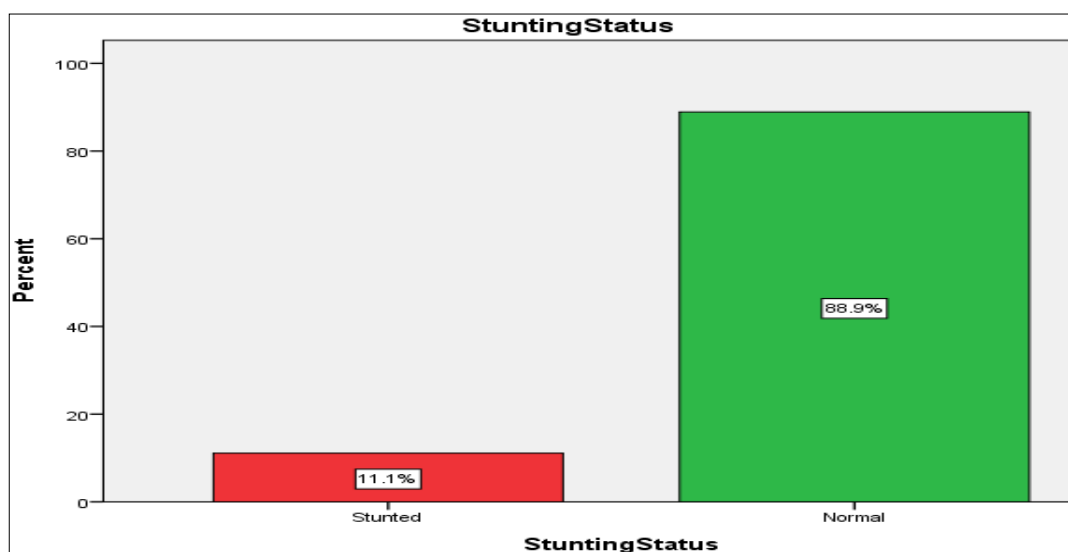
### Magnitude of malnutrition

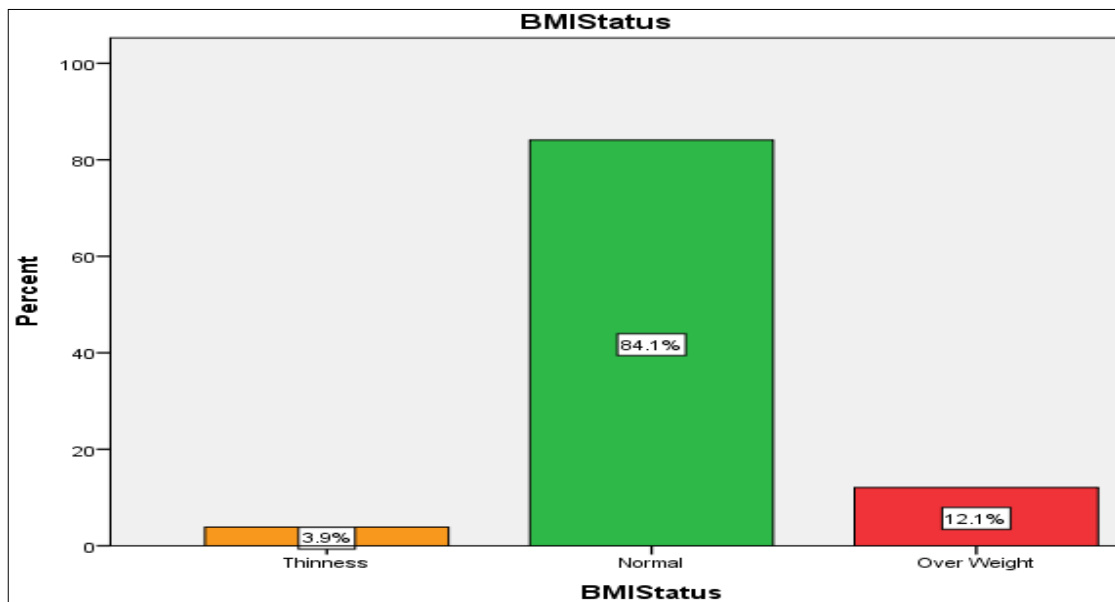
Regarding nutritional status, the mean (SD) scores of HAZ and BAZ were negative, -0.87 (0.99) and -0.24 (1.09), respectively. Prevalence of stunting was 11.1%. The proportion of thinness was 3.9%. The prevalence of overweight and or obesity (overweight/obesity) was 12.1% (Figures 2 and 3). In general, the comparisons between nutritional status of the study participants and the WHO reference population distribution showed skewness of the former to the negative Z scores (Figures 4 and 5).

The Figures 3 to 7 indicated that the prevalence of stunting, thinness and overweight/obesity was 11.1, 3.9 and 12.1%, respectively. Whereas, the study prevalence of thinness was lower comparable to the study conducted in different African country such as Owerri, Imo State, Nigeria (18.6%) and Ethiopia, Walaita Sodo (4.8%) were reported by Chukwuma et al. (2014) and Teferi et al. (2018), respectively. Moreover, at similar observation reported from Arbamichi town (19.7%) (Bebada et al., 2017) and Northern Ethiopia (26.1%) (Ma'alin et al., 2016). While present study prevalence of stunting was higher than those report from Walaita Sodo Town (5.2%) by Teferi

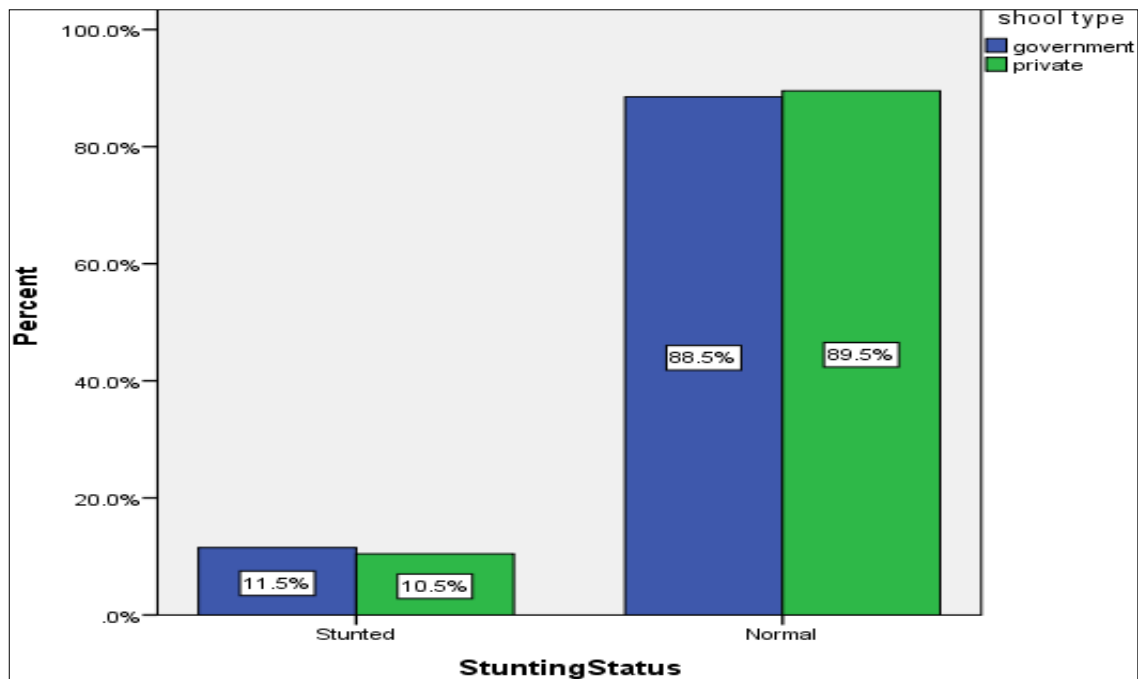
**Table 3.** Characteristics on behavior, lifestyle, health and sanitation among school adolescents in Burayu town Oromia Special Zone, Ethiopia, 2019.

Variable	Category	Frequency	Percent
Wash hand with soap	Yes	593	95.3
	No	29	4.7
Seek in the last two weeks	Yes	136	21.9
	No	486	78.1
Family have cattle in the house	Yes	472	75.9
	No	150	24.1
Chronic illness	Yes	28	4.5
	No	594	95.5
Seeing at night	Yes	554	89.1
	No	68	10.9
Work besides education	Yes	41	6.6
	No	581	93.4
Types of latrine	Dry pit	285	45.8
	Flush toilet	337	54.2
Brush your teeth per day	Yes	128	20.6
	No	494	79.4
Neck swelling problem	Yes	16	2.6
	No	606	97.4
Water source	Safe	601	96.6
	Unsafe	21	3.4
Number minutes at sport activity	Not at all	225	36.2
	< 30 min	224	38.9
	≥ 30 min	155	24.9

**Figure 2.** Stunting status of respondents among school adolescents in Burayu town Oromia Special Zone, Ethiopia, 2019.



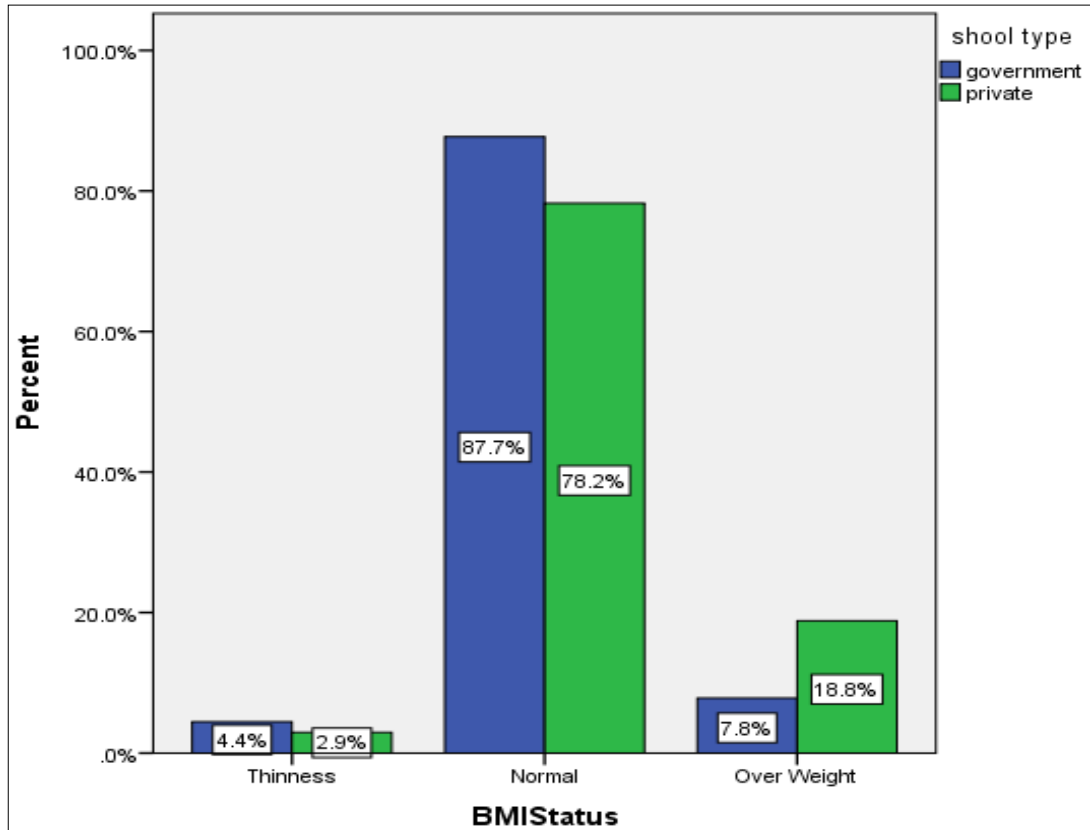
**Figure 3.** BMI status of respondents among school adolescents in Burayu town Oromia Special Zone, Ethiopia, 2019.



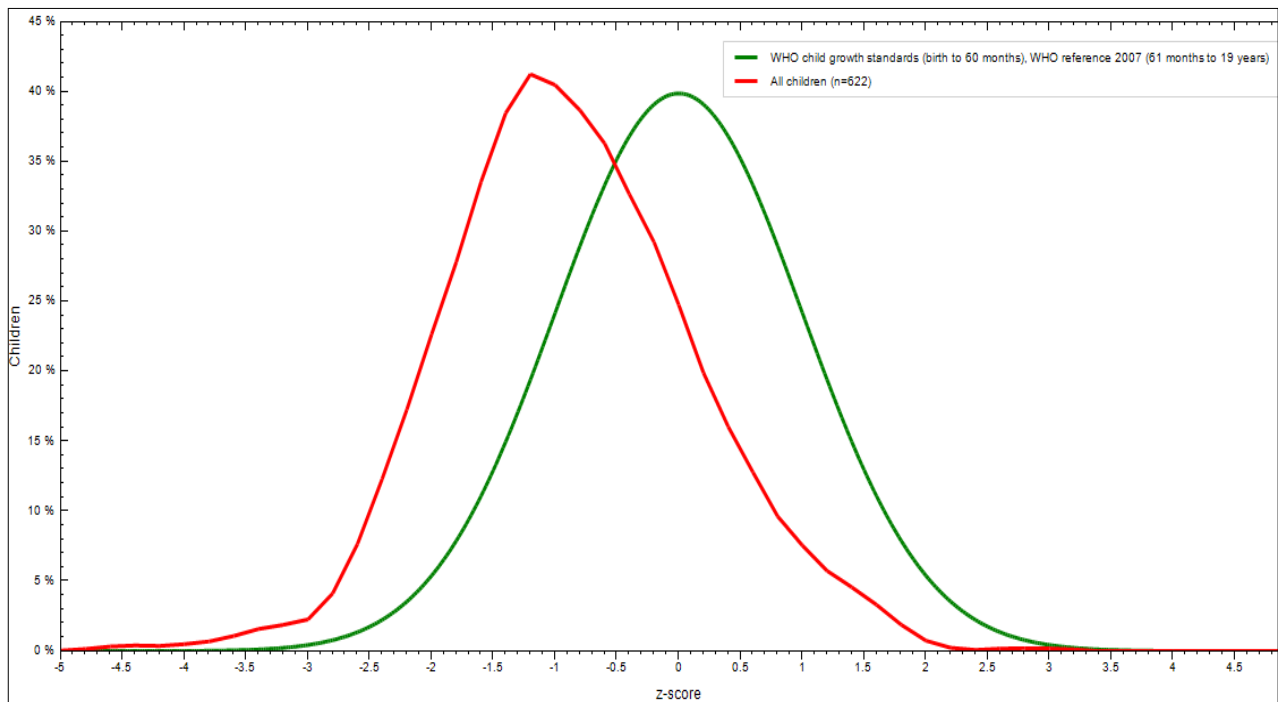
**Figure 4.** Distribution of nutritional status by school of respondents among school-going adolescents in primary, secondary and preparatory school in Burayu town Oromia Special Zone, Ethiopia, 2019.

et al. (2018), but was lower than those reported from Northern Ethiopia (28.5%) by Ma'alin et al. (2016). This study also demonstrated that the alarming prevalence of overweight (12.1%) signals the presence of dual burden of nutrition in the setting. This study observation value was higher compared to reports from Nigeria (11.6%) (Chukwuma et al., 2014), Arbaminchi town (11.2%) (Berbada et al.,

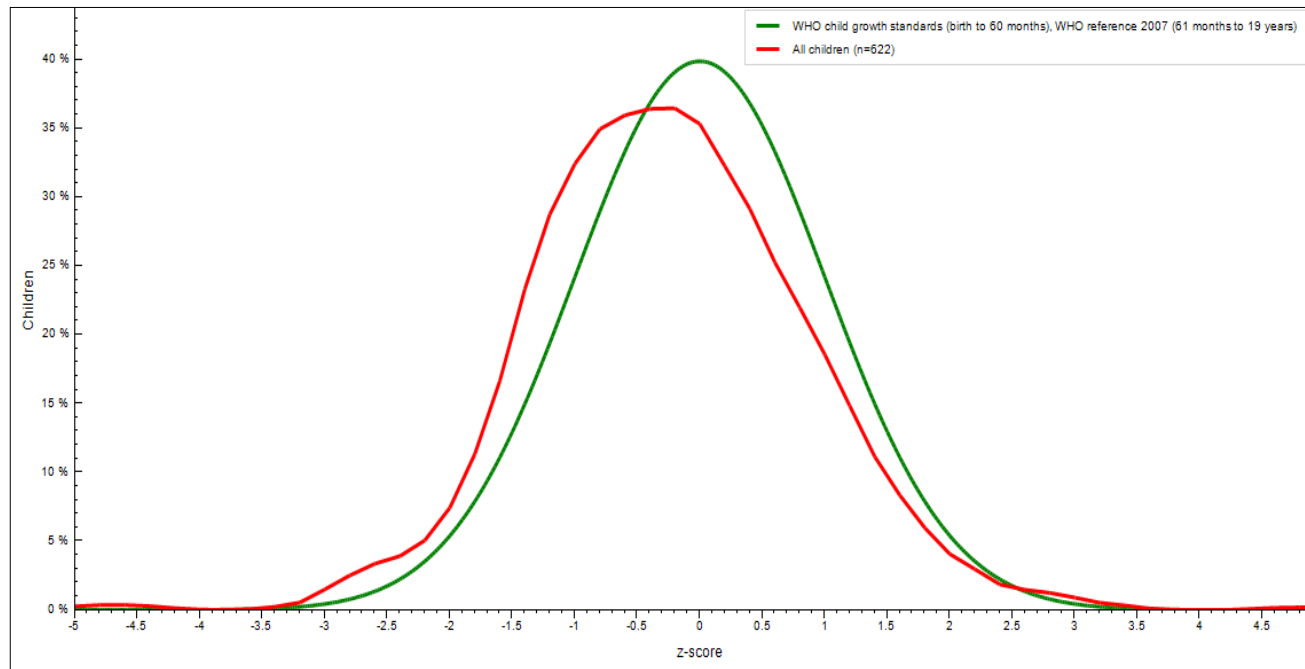
2017), central party of Ethiopia Addis Ababa (9.4 %) (Gebreyohannes et al., 2014). While it was lower compared to the studies done in Hawasa (15.6%) by Teshome et al. (2013). The results implied that the risk of chronic illness on the future adults is vivid, considering such high prevalence overweight/obesity in school going adolescents.



**Figure 5.** Distribution of nutritional status by school of respondents among school-going adolescents in primary, secondary, and preparatory school of Burayu town Oromia Special Zone, Ethiopia, 2019.



**Figure 6.** Comparisons HAZ of the study participants with Z score of WHO reference population, in Burayu town Oromia Special Zone, Ethiopia, 2019.



**Figure 7.** Comparisons BAZ of the study participants with Z score of WHO reference population, in Burayu town Oromia Special Zone, Ethiopia, 2019.

The present study also found a positive association between number children family have under-nutrition and over nutrition (stunting and overweight/obesity). In this study, having smaller number of children may put children at higher risk for malnutrition. This finding was contrary to the research done in Arbaminch (Berbada et al., 2017). This might be due to lack of awareness and knowledge on malnutrition.

#### Factors associated with double burden of malnutrition

From the result of binary logistic regression, number of children family have were significantly associated with the level of stunting. Respondents family that had  $\leq 4$  children were 2 times more likely [AOR=2.069 (95%CI: 1.161, 3.686)] to be stunting than respondents of those family who have  $>4$  children. In multinomial logistic regression, result shown that sex of adolescents, school level and source of foods were statistically significant association with thinness. Similarly, sex of adolescents, number of children family have and type of schools were significantly associated with overweight/obesity. Being male was 4.4 times more likely to be thinness than females [AOR=4.454(95%CI: 1.616, 12.278)]. Primary school adolescents were 23% times less likely [AOR=0.233 (95%CI: 0.066, .821)] and secondary school adolescents were 22% times less likely [AOR=0.229(95%CI: 0.056, .931)] thinness than preparatory school students. Respondents who source their food from own product were 3.7 times more likely [AOR=3.750(95%CI: 1.446,

9.728)] thinness than those purchased from market. Being male was 53% times less likely to be overweight/obese than females [AOR=.536(95%CI: 0.318, 0.901)]. Students who learned at government school were 32% less likely [AOR=.326(95%CI: 0.186, .571)] to be overweight/obese than students who learned private schools. The odds of being overweight/obese among participants whose family have  $\leq 4$  children were 1.8 times more likely [AOR =1.855(95%CI: 1.086, 3.166)] than respondents whose family have  $>4$  children.

In this study, being male was more likely to be thinness than females. This finding is consistent with study done in Arbaminchi (Berbada et al., 2017). This study observed that primary school and secondary school students were less likely to be thinness than preparatory school students. The study also revealed that adolescents from family who source their food source from own products were more likely to be thinness compared to adolescents from family who purchased food from market. This might be due to differences in the feeding habit. This study revealed that male adolescents were less likely to be overweight when compare to female school adolescents. And also, the findings of this study showed that adolescents who were learning in private schools had higher odds ratio of being overweight/obese. This finding was in agreement with the study done in Wolaita Sodo town by Teferi et al. (2018). Moreover, respondents whose family had less than  $\leq 4$  children were observed to be more likely to be overweight/obese than those whose family have  $> 4$  children, this finding was contradicted to the study done in Arbaminchi by Berbada et al. (2017) and Ani et al. (2014) (Tables 4 to 5).

**Table 4.** Binary logistic regression model predicting the likelihood of stunting among school adolescents in Burayu town Oromia Special Zone, Ethiopia, 2019.

Variable	Categories	COR	P-value	AOR (95%CI)	P-value
Sex	M	1.486	0.123**	1.362(0.796, 2.328)	0.259
	F				
Current residence of adolescents	Urban	0.431	0.107**	0.407(0.130, 1.723)	0.122
	Rural				
Number of children family have	≤ 4	1.805	0.026**	2.069(1.161, 3.686)	0.014*
	≥ 4				
Seek in the last two weeks	Yes	0.649	0.210**	0.637(0.313,1.297)	0.214
	No				
Chronic Illness	Yes	0.286	0.0223**	0.242(0.030,1.975)	0.185
	No				

**Table 5.** Multinomial logistic regression model predicting the likelihood of thinness and overweight/obesity among school adolescents in Burayu town Oromia Special Zone, Ethiopia, 2019.

BMI status	Variable	Categories	COR	P-value	AOR (95%CI)	P-value
Thinness	Sex	Male	0.04	4.412	4.454 (1.616, 12.278)	0.004*
		Female				
	Class level	Primary school	0.282	0.021**	0.233n(0.066, .821)	0.023*
		Secondary school	0.250	0.036**	0.229(0.056, .931)	0.039*
		Preparatory school				
Thinness	Number of children family have	≤ 4	1.483	0.352	2.013 (0.821, 4.935)	0.126
		≥ 4				
	Stable food	Teff	0.322	0.083**	0.370 (0.074, 1.853)	0.226
		Others				
	Food sources	Own product	3.086	0.007**	3.750 (1.446, 9.728)	0.007*
Market purchased						
Seeing at night	Yes	0.420	0.097**	0.368 (0.112, 1.214)	0.101	
No						
Overweight or Obesity	Sex	Male	0.653	0.096**	0.536(0.318, .901)	0.019*
		Female				
	School type	Government	0.371	0.00**	0.326(0.186, .571)	0.00*
		Private				
	Number of children family have	≤ 4	1.996	0.007**	1.855 (1.086, 3.166)	0.024*
		≥ 4				
	Food sources	Own product	0.837	0.552	1.638(0.834, 3.218)	0.152
Market purchased						
Types of latrine	Dry pit	0.633	0.074**	0.815(0.314, 2.114)	0.674	
	Flush toilet					
Seeing at night	Yes	0.642	0.216**	0.341(0.115, 1.012)	0.053	
	No					

## Limitation of the study

Variables which can affect malnutrition such as parental weight status, nutritional knowledge and seasonal variation for food insecurity measurement was acknowledged as limitation of the study.

## Conclusion

This study revealed that the prevalence of undernutrition is slightly similar as that of overnutrition, indicating that both forms of malnutrition coexist. There is an increasing trend in the level of stunting and overweight/obesity. Sex, food source and school level was positive association with thinness. While school type and sex of school adolescents associated with overweight/obesity. In general, collaboration among health and education sectors to intervene nutrition problem, nutrition related education and school feeding is recommended to the study area.

## CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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