

# Prevalence of Overweight and Obesity and Associated Factors among Private Primary School Students in Gulele Sub-City of Addis Ababa, Ethiopia

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## Abstract

**Introduction:** The rise in overweight and obesity among school children and adolescents confirms that childhood obesity is a global 'epidemic'. In Africa, despite a high prevalence of under nutrition, the prevalence of obesity is increasing at an alarming rate. The study was conducted to assess the prevalence of overweight, obesity and associated factors in private primary school students in Gulele sub city, Addis Ababa, Ethiopia.

**Methods:** We conducted institution based cross sectional study. The study aimed to provide information on the prevalence of overweight and obesity in private primary school students in Gulele sub-city. A random sample of 950 private primary school students aged 12–15 years old was taken using simple random sampling. Data was collected from each student by taking anthropometric measurements and by direct interviewing. Measurements of weight and height were conducted using calibrated digital bath balance and height measuring board in standing position respectively. To analysis the data, binary logistic regression and multivariable logistic regression analysis was conducted.

**Results:** The overall prevalence of overweight and obesity was found to be 14.9%. The result of this study revealed that being female (AOR=1.80 with 95% CI: (1.16, 2.64)) and taking soft drinks four or more times per week (AOR=1.50 with 95%CI: (0.40, 4.59)) were significantly and positively associated with overweight and obesity. In addition, students who come from small households (less than 4 family members) had 3.03 times higher odd of being overweight or obese (AOR=3.03 with 95% CI; 1.83, 5.01) compared to those who come from large family (family members of four and above).

**Conclusion:** Overweight and obesity among private primary school children has to be considered seriously due to its increasing trend and consequences of health problem. Promotion for healthy (low-energy density) diets and facilities for regular practice of physical exercise are among our recommendations.

**Keywords:** Overweight; Obesity; Logistic regression; Private primary school; School children; Addis ababa

**Abbreviations** AOR: Adjusted Odd Ratio; BMI: Body Mass Index; CDC: Centers for Disease Control and Prevention; COR: Crude Odd Ratio; CSA: Central Statistics Agency; GBD: Global Burden of Disease; HH: head of households, KG: kindergarten, UOG: University of Gondar; WHO: World Health Organization

## Introduction

The rise in overweight and obesity among school children and adolescents confirms that childhood obesity is a global epidemic [1]. In Africa, despite a high prevalence of under nutrition, the prevalence of obesity is increasing at an alarming rate [2]. This could be due to lack of awareness towards healthy life style. Childhood obesity is associated with cardiovascular, endocrine, pulmonary, musculoskeletal and gastrointestinal complications, and may have psycho-social consequences (poor self-esteem, depression, eating disorders [1-5].

Overweight and obesity in childhood are known to have significant impact on both physical and psychological health; for example, they are associated with hypertension, abnormal glucose tolerance, and infertility. In addition, psychological disorders such as depression occur with increased frequency in obese children [5,6].

The fastest overweight and obesity growth rates are found in Africa, the number of overweight or obese children in 2010 doubled than what it was in 1990. In Africa, despite a high prevalence of under nutrition, the prevalence of overweight is increasing at an alarming rate. A study conducted in 2014 in Addis Ababa, Ethiopia reported the prevalence of overweight among high school students to be 8.6% with 95% CI (4.0, 12.0%), the prevalence of obesity as 0.8% with 95% CI (0.4, 2.0%); and the overall prevalence of overweight and obesity to be 9.4% [2,4,7].

Weight gain and subsequent overweight in children is a worldwide growing problem. The unregulated consumption of sugar-sweetened beverages is considered to be one of the contributions of this problem [2,7-12].

Although the mechanism of overweight and obesity development is not fully understood, it is confirmed that overweight and obesity occurs when energy intake exceeds energy expenditure. However, environmental factors and lifestyle preferences seem to play major roles in the rising prevalence of overweight and obesity worldwide [9,11,13-15].

There is no study conducted in Addis Ababa private primary school students even though some literatures reported that, the prevalence of overweight and obesity is increasing at an alarming rate in both developed and developing countries [16-19]. Particularly, we were selected the private primary school students because it is an affluent area compared to those students who are attended in governmental primary schools. Thus, the aim of this study was to estimate the prevalence of overweight and obesity in private primary school children and to identify triggering factors. Moreover, this study provides scientific information that might be used for informed decision on overweight and obesity among private primary school children and adolescents in the study area.

## Methods and Materials

### Study setting

Gulele, the study area, is among the ten sub cities in Addis Ababa City Administration with an estimated total population of 296,660 according the 2007 projected population of Central Statistics Agency (CSA) report. The sub city has a total of 51 primary schools of which 18 are governmental, 33 are private primary schools and four high schools; two preparatory schools and 51 kindergartens (KGs). Institution based cross sectional study was conducted in Gulele sub-city of Addis Ababa from November 2016 to April 2017.

**Study design and period:** Institution based cross sectional study was conducted in Gulele sub-city of Addis Ababa from 25 November 2016 to April 17/ 2017.

**Source population:** The source populations were all private primary school regular students attending schools in Gulele Sub-city administration and in the age range of 12-15 years old.

**Study population:** All regular students in the randomly selected 10 private primary school in the academic year 2016/2017 and in the age range of 12-15 years old students.

**Sampling procedure:** Out of the 33 private primary schools using simple random sampling technique 10 (30%) of the private primary schools were selected using lottery method. The total sample size was proportionally allocated to each school according to the number of students using proportional allocation. The students were given assent and parental self-administer consent form to give their consent to participate in the study. Then, those assented and consented students and parents /guardians were included in the study. Finally, a random sample of 950 students aged 12-15 years old was taken using simple random sampling technique. Moreover, the students were further interviewed and their height and weight measurements were taken.

**Sample size determination:** The sample size was determined using single population proportion formula, with the assumptions of 95% confidence interval (two sided), taking tolerable margin of error (d) less than two percent (1.945%), overall prevalence of overweight and obesity (p) of 9.4%. Adding 10% of non-response rate, 950 final sample sizes was taken.

**Data collection procedure and quality control:** The interviewers and supervisors were trained in data collection and measurement techniques for two days. To measure height & weight, important instruments were fulfilled first. To create common understanding in data collection two days training was given to data collectors. Finally, data was collected by taking anthropometric measurements and by using a structured standardized questionnaire of (WHO Global physical activity questionnaire (GPAQ) analysis guide) [20] which is a guide and reference for the questionnaire although some modification were done based on the objective of this particular study.

After the development of structured questionnaire, the data collection was held using interviews and recording of weight and height/anthropometric measurements. The interview was conducted separately to children and guardians. Moreover, demographic data like age, sex, family size and ethnic group of the students were asked. Measurements of weight and height were taken using calibrated digital bath balance or digital weight scale and height measuring board in standing position respectively. Measurement of weight was recorded to the nearest 0.1 kg and the height was recorded to the nearest 0.5 cm. As much as possible, the weight was measured with minimum clothing. Five Bachelor of Science (BSc) health professionals, two Master of public health (MPH) candidates and the principal investigator were involved in the data collection. Every day, the digital bath balance or digital weight scale was calibrated and the scales indicators were checked against zero reading after weighing every student. Supervisors were verifying the consistency and completeness of the questionnaire on a daily basis. Careful and strict attention was given for data entry by the investigator.

**Data analysis procedures:** Data was checked for consistency and entered to SPSS version 20 for analysis. Frequencies were computed to clean and check data for missed variables and outliers. Individual body mass index (BMI) was compared with age and sex specific BMI for age percentile according to center for disease prevention and control (CDC) growth chart cut off point. Weight per height square ( $BMI = w/h^2$ ) of each study participant was calculated and finally the finding was categorized as underweight, normal, overweight and obesity based on the CDC growth chart cut of point. Univariate, bivariate and multivariable analyses were performed to account for confounders. Finally, BMI for age greater than or equal to 85th percentile but less than 95th percentile according to the CDC 2000 growth chart was considered as overweight while BMI for age greater than or equal to 95th percentile according to the CDC 2000 growth chart was considered as obese.

### Study variables

**Dependent variables:** Overweight and Obesity.

**Independent variables:** Sex, age, eating habit and physical activity.

#### Operational definition:

- **Overweight:** BMI for age greater than or equal to 85th percentile but less than 95th percentile according the CDC 2000 growth chart [21].
- **Obesity:** BMI for age greater than or equal to 95th percentile according the CDC 2000 growth chart [21].

**Eating habit:** Taking proper and balanced food diet.

**Physical activity:** Low-impact aerobic exercise classes, brisk walking or hiking, recreational team sports (volleyball, soccer, etc.).

**Ethical approval and consent to participate:** Ethical clearance was obtained from Institutional Review Board of University of Gondar. Permission letter was obtained from Gulele Sub-city Education Office and respective School Directors, where the actual study was conducted. Verbal consents and assent were obtained from both the parents/guardians and from the study subjects. All the rights of the parents/guardians and the study subjects were clearly stated in the questionnaire. Study participants were well informed about the purpose and significance of this study in improving the general health of the population and requested to cooperate for an interview as well as for taking anthropometric measurements through written consent. The guardians and study subjects were also informed that they could refuse or discontinue participation at any time. Finally, information was recorded anonymously to maintain confidentiality and privacy of respondents.

From ten private primary schools, 950 students were interviewed with 100% response rate and their height and weight measurements were taken. Of these, 463 (48.7%) were 14 years old and 304 (32%) were 13 years old. The mean ( $\pm$  SD) age of the students were 13.45 ( $\pm$  0.796) years old.

Among the total 950 students, 472 (49.7%) were females. Regarding their school grade, 508 (53.5 %) and 341 (35.9%) were grade eight and grade seven respectively. Almost half, 478 (50.3%), of the students were followers of Orthodox religion while 346 (36.4%) were Muslims. About 370 (39%) were Amhara ethnic groups and 327 (34.4%) were Oromo. Five hundred and twenty (54.7%) of the households the selected students belong to had four and above family members. About  $\frac{3}{4}$  of the head of the households, 717 (75.5%), were males.

Nearly half of the head of the households, 456 (48%), were merchants, 183 (19.3%) government employees and 830 (87.4%) of the students' parents had average monthly incomes of  $\geq$  1,001 Eth Birr which is higher income. The educational status of almost half of the students' parents, 485 (51.1%), was college degree and above; whereas 295 (31.1%) had secondary (9th-12th) grades education. About three fourth, 731 (76.9%), of the students family/relatives had no history of overweight and obesity (Table 1).

Variables	Frequency	Percent (%)
<b>Age of student</b>		
12 years	135	14.2
13 years	304	32
14 years	463	48.7
15 years	48	5.1
<b>Sex of the student</b>		
Male	478	50.3
Female	472	49.7
<b>Grade of the student</b>		
7th grade	341	35.9
8th grade	508	53.5
Other grades	101	10.6
<b>Religion of the student</b>		

Orthodox	478	50.3
Muslim	346	36.4
Protestant and others	126	13.3
<b>Ethnicity</b>		
Oromo	327	34.4
Amhara	370	38.9
Tigray and Others	253	26.7
<b>Family size</b>		
less than 4	430	45.3
4 & above	520	54.7
<b>Sex of the head of house hold</b>		
Male	717	75.5
Female	233	24.5
<b>Occupation of the head of house hold</b>		
Merchant	456	48
government employee	183	19.3
NGO employee	180	18.9
Daily labor and Others	131	13.8
<b>Monthly income</b>		
lower income	26	2.7
middle income	94	9.9
higher income	830	87.4
<b>Education of the head of house hold</b>		
No formal education	47	4.9
primary(1-8th)	123	12.9
secondary(9-12th)	295	31.1
college & above	485	51.1
<b>History of overweight &amp; obesity in family</b>		
Yes	219	23.1
No	731	76.9

**Table 1:** Socio Demographic Characteristics of Private Primary School Students.

### Risk Factors Associated with Overweight and Obesity

In the multivariable logistic regression; sex of the students, family size, fruit intake, vegetable intake and soft drink intake were significantly associated ( $p$ -value  $<0.05$ ) with overweight and obesity. The odd of being overweight among females was 1.8 times those male students (Adjusted Odd Ratio (AOR)=1.80 with 95% CI: (1.16, 2.64)). Odds of being overweight and obese among students who took soft

drinks four or more times per week was 1.5 (AOR=1.50 with 95% CI: (0.40, 4.59)) times higher than those who did not take soft drink. In addition, students small households (less than 4 family members) had 3.03 times higher odd of being overweight or obese (AOR=3.03 with 95% CI; 1.83, 5.01) compared to those who come from large family

(family members of four and above). Moreover, those who took fruit one or more days per week (AOR=0.37 with 95% CI: 0.17, 0.80) and with those who took vegetable one or more days per week (AOR=0.33 with 95% CI: 0.14, 0.79) revealed inverse correlation with overweight and obesity (Table 2).

Variables		Overweight /obesity		COR with 95% CI	AOR with 95% CI
		Yes	No		
Sex of the student	Male	52	426	1	1
	Female	90	382	1.93(1.33-2.79)	1.80(1.16,2.64)*
Family size	Less than 4	109	321	5.01(3.31-7.58)	3.03(1.83,5.01)*
	4 and above	33	487	1	1
Monthly income	Lower and middle	8	112	1	1
	higher income	134	696		0.49(0.19,1.28)
Fruits intake per week	no intake	29	40	14.67(7.42-29.03)	6.36(2.61,15.50)*
	1day	96	424	0.31(0.18-0.53)	0.37(0.17, 0.80)*
	2 or more days	17	344	1	1
Vegetables intake per week	no intake	25	35	14.28(5.95-34.31)	4.26(1.39,13.04)*
	1 day	96	417	0.32(0.18-0.60)	0.33(0.14,0.79)*
	2 days	13	196	0.09(0.04-0.19)	0.23(0.08,0.63)*
	3 or more days	8	160	1	1
Soft drinks intake	no intake	4	47	1	1
	One time	17	199	1.00(0.32-03.12)	1.01(0.17, 2.2)
	Two times	15	138	1.28(0.40-4.04)	1.17(0.32, 4.20)
	Three times	35	182	2.26 (0.77-6.67)	1.50(0.44,5.17)
	Four and above	71	242	3.45(1.2-9.89)	1.6(0.40,4.59)
Snack intake in a day	Yes	126	640	2.07(1.19-3.57)	0.83(0.45,1.53)
	No	16	168	1	1
Eating while TV watch	Yes	106	533	1.52(1.01-2.28)	0.77(0.49,1.21)
	No	36	275	1	1
Walking 30 minute in a day	Yes	107	414	1	1
	No	35	394	1.29(0.91-1.86)	0.86(0.50,1.50)
Regular exercise	Yes	23	258	1	1
	No	119	550	2.43(1.52-3.88)	0.87(0.47,1.59)
Transportation	On foot	14	174	1	1
	By taxi	128	634	2.51(1.41-4.47)	0.86(0.44,1.71)

Note: 1.00=Reference; \*=significant at 5% level of significance

**Table 2:** Multivariable analysis of factors associated with overweight and obesity.

## Discussion

In this study, the prevalence of overweight and obesity among the private primary school students was 10% with 95% CI (8.2, 12%) and 4.9% with 95% CI (3.6, 6.4%) respectively. Overall prevalence of overweight and obesity was found to be 14.9%. This result was consistent with prevalence studies done among school-aged students in Ghana and Uganda, in which the prevalence of overweight and obesity were 10.4% with 95% CI (8.8-12.1) and 4.2% with 95%CI (2.4-5.1) respectively. Our finding was also consistent with finding of a prevalence study done among children and adolescents in South Africa, in which the prevalence of overweight and obesity were 12.1% and 5% respectively.

However, this finding was slightly higher than the study conducted among adolescent students in Addis Ababa a year before this study, in which the prevalence of overweight was found to be 8.6% with 95% CI (4.0, 12.0%). But the prevalence of obesity was lower; i.e. it was 0.8% with 95% CI (0.4, 2.0%). Moreover, the finding was lower than a cross sectional study conducted in Saudi Arabia, where about 21.8% of the students were overweight and 15.7% were obese. This might be due to high socioeconomic status and the highly energy dense foods consumed in Saudi Arabia [6].

This study revealed that overweight and obesity are significantly associated with sex of the students. The odd of being overweight was 80% times higher among female than male students (AOR=1.80 with 95% CI: 1.16, 2.64). This finding was consistent with the study done in Canada showing a relatively low prevalence of overweight or obesity in boys and a higher prevalence, reaching 20%–25% in late adolescent girls. Factors suggested to play a role in this gender disparity include possible differences in the energy needs between boys and girls, the levels of physical activity, behavioral or cultural phenomena and timing of sexual maturation. It also indicated that overweight and obesity were significantly associated with soft drink intake. Students those who took soft drink four or more times per week had 50% higher risk of being overweight (AOR=1.50 with 95% CI: 0.40, 4.59) than those who do not take soft drinks. As expected this might be due to difference in energy as some soft drinks naturally contain higher calories. In addition, students from households with less than 4 family members had 3.03 times higher odd of being overweight or obese (AOR=3.03 with 95% CI; 1.83, 5.01) relative to those who had family members of four and above. This difference could be due to economic capacity of the households to buy and utilized highly energy dense foods. As expected, eating fruits and vegetables regularly reduced risk of overweight and obesity significantly.

## Conclusion

The finding of this study revealed that overweight and obesity were major public health problem among students of private primary schools. This study also tried to assess the factors associated with them. As a result, the finding showed that sex of the students and their soft drink taking frequencies were factors directly associated with overweight and obesity; i.e. the prevalence of overweight and obesity were higher among the female students and soft drink takers. Whereas vegetable and fruit consumptions; and households (HHs) who had family size of 4 and above were inversely related. Therefore, this study would play a great role in guiding the health planners, policy makers and administrators to develop proper management tools in order to prevent psychosocial and physical complications or consequences of overweight and obesity initially.

## Limitation of the Study

There was a potential for recall and social desirability bias in the frequency of dietary habits and physical activity. Particularly, expected obese students felt shame when they asked to measure their weight. Secondly, the food frequency questionnaire did not account for how much portion size someone uses.

## Declarations

### Availability of data and materials

The raw data of the research is available.

### Ethical approval and consent to participate

The study was approved and cleared by Institutional Review Board of University of Gondar University. Verbal and written consents and assent were obtained from both the parents/guardians and from the study subjects. All the rights of the parents/guardians and the study subjects were clearly stated in the questionnaire delivered to them. Clients were well informed about the purpose, advantage and significance of this study. The guardians and study subjects were also informed that they could refuse or discontinue participation at any time. Finally, information was recorded anonymously to maintain confidentiality and privacy of the study participants.

### Consent to publish

No applicable

### Competing interests

We, the authors, declare that we have no competing interests.

### Funding

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### Authors' contribution

AMG initiated the research, wrote the research proposal. Both the authors AMG and MNH made substantial contribution to the design, data collection analysis and interpretation of the results. They also drafted, edited and revised critically the manuscript. Finally, we approved the final manuscript.

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