

Prevalence of Childhood Overweight and Obesity and its Determinant Factors Among Elementary School Children in Addis Ababa, Ethiopia: A Cross Sectional Study

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Abstract

Background: Obesity and overweight pose major risk for serious diet-related chronic diseases, including Type 2 diabetes, cardiovascular disease, hypertension and stroke, and certain forms of cancer. Even though there is no well-documented information recently, chronic diseases that are directly or indirectly related to overweight and obesity are increasing in Ethiopia especially in urban areas.

Objective: the main aim of this study is to determine the prevalence of childhood overweight and obesity and its determinant factors.

Methods: A cross-sectional survey was conducted among 463 elementary school children in Addis Ababa. Study participants were selected using multi stage sampling from 10 public and 10 private elementary Schools. Overweight and obesity was determined using CDC 2000, BMI percentile chart. Socio-demographic and other determinants of childhood overweight were assessed. Data were collected using combination of interview of children and self-administered questionnaire to their parents. Finally data were processed and analysed using Epi info version 3.5.4 and SPSS version 21.

Result: A total 463 children and 463 parents participated in the study. The overall prevalence of underweight, normal, overweight and obesity is 44(9.5%), 360(77.8%), 46(9.9%) and 13(2.8%) respectively. Sex specific prevalence of overweight and obesity shows 7.7% and 3.2% for male and 12% and 2.5% for female respectively. Significant association with overweight was observed among car ownership of the family ($p < 0.001$), number of snacks per day ($p = 0.03$), sweet food preference ($p < 0.001$), buying ice cream ($p = 0.014$), eating breakfast irregularly ($p = 0.034$), walking or riding bicycle for at least 10 minutes per day ($p = 0.009$) and family participation in regular physical activity ($p = 0.023$).

Conclusion and Recommendations: The prevalence of overweight was found to be high even comparable with the global prevalence. Among the factors identified are unhealthy dietary pattern like preferring sweet foods, eating breakfast irregularly, buying ice cream and frequent snacking are strongly associated with overweight. In addition physical inactivity are also important factors impacting on the risk of obesity in children. If Primary preventive measures is not taken immediately, prevalence of overweight and obesity among children in Addis Ababa might increase rapidly in the coming few years. Early interventions on modifiable risk factors by promoting active lifestyles and healthy diets are likely to decrease the rate of childhood obesity.

Keywords: Overweight; Obesity; Children

Background

Obesity has become a global health problem. Obesity and overweight pose a major risk for serious diet-related chronic diseases, including Type 2 diabetes, cardiovascular disease, hypertension and stroke, and certain forms of cancer [1].

The World Health Organization (WHO) estimated that by 2005, at least 1.6 billion and 400 million people aged above 15 years were overweight and obese respectively. It further projected that by 2015, these statistics will increase to 2.3 billion for overweight and 700 million for obesity unless drastic measures are taken to mitigate this burgeoning problem [2].

In Africa, despite a 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 [3].

The prevalence of overweight and obesity is also rapidly increasing among children. The International Obesity Task Force (IOTF) estimates that about 155 million school-going children globally are either overweight or obese [4]. WHO define children as population age group less than eighteen.

Childhood obesity is considered to be a precursor of adverse health effects in adulthood, as overweight children are more likely to become overweight adolescents and adults; 2.8 times more likely in one study in Chinese children [5].

Furthermore, rapid changes in diets and lifestyles that have occurred with industrialization, urbanization, economic development and market globalization have accelerated over the past decade. This is having a significant impact on the health and nutritional status of population, particularly in developing countries and countries

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in transition [6]. In 2005 WHO launched a campaign calling for increased global investment to prevent the growth of chronic disease in developing countries [7].

Despite the fact poverty, nutrition deficiency and unhygienic living condition are major problems in the developing countries, chronic disease that are directly related to overweight and obesity are emerging in an alarming rate. In spite of this scenario people are not using preventive measures against obesity, but they only depend on their daily routine work [8].

According to the study conducted in Addis Ababa in 2007 prevalence of overweight and obesity among primary school children in Addis Ababa were 7.6 % (95%CI =5.85, 9.37%) and 0.9% (95%CI=0.027%,1.53%) respectively. The sex specific prevalence of overweight and obesity were 9.4 and 0.8 for females, 5.4% and 1.1 for boys respectively. The prevalence of overweight in private school was 23.2 % (95%CI= 14.71%, 31.69%). Whereas the overall prevalence of underweight was 13 % (18.1% in boys and 9% in girls) [9-14].

Even though there is no well-documented information recently, chronic diseases become Increasing in Ethiopia especially in urban areas. In Addis Ababa it becomes common to see overweight people in all age group including school children. As far as our knowledge is concerned there is only two documented study done to assess prevalence and determinants of childhood and adolescent overweight and obesity in Addis Ababa. Limited number of research in this area motivates us to select this topic. Though, there is a lack of data concerning overweight and obesity assessment in childhood and adolescence in Ethiopia, clearly the risk of childhood obesity leading to adult morbidity is of great public health significance [15-20].

Due to the above circumstances this study is designed to measure the prevalence of childhood overweight and effect of socio-demographic and life style factors on childhood overweight to stimulate planners and researchers on double burden of disease in Ethiopia which is less recognized problem. As a result this study will have great contribution on designing preventive action of early age overweight and obesity [21-24].

Operational Definition

Overweight

BMI for age greater than or equal to 85th percentile but less than 95th percentile according to the CDC 2000 growth chart.

Obesity

BMI for age greater than or equal to 95th percentile according to the CDC 2000 growth chart.

Moderate exercise

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

Vigorous exercise

Running or jogging, high-intensity aerobic classes, competitive full-field sports (soccer) or basketball.

Children

Population that exist in the age group between 10 to 18 years of age [25].

Methods and Materials

Study design

Cross-sectional survey of childhood overweight and obesity and its determinant factor was conducted.

Study area and period

The study was conducted in Addis Ababa from April 20 to May 7, 2014. Addis Ababa is the capital city of Ethiopia with a great diversity of ethnicity almost home of all ethnicity found in the country. The city is divided in to 10 administrative sub cities namely: Arada, Yeka, Gulele, Addis Ketema, Akaki-kality, Nefassilk-Lafto, Lideta, Bole, Kolfe-keranio and Kirkos. The study included all sub cities. According to 2011/12 report of Addis Ababa Educational Bureau of City Government, there are 765 primary schools. In all this school there are a total of 487, 344 students. From the total number of school 15.03% are owned by government sector and 84.97% are owned by private sector. The study was conducted in 20 selected schools from all sub cities of which 11 were government school and 9 were private.

Source population and study population

The source populations were all elementary school students living in Addis Ababa. Elementary school students from grade 5-8 in 2013/14 academic year were the study population.

Sample size determination

The study employed single population proportion sample size determination formula given below.

$$n = \frac{z\alpha / 2^2 p(1-p)}{d^2}$$

Where: n- is the minimum sample size required

p- Is an estimate of the proportion of the overweight in the population

d- Margin of error for sampling

Z- The standard normal value at (100- α) confidence level.

In this study we consider P= 10% (global prevalence of child hood overweight)

d= 4%

$$n = \frac{(1.96)^2 0.1(1-0.1)}{0.04^2}$$

n= 217+22 (10% of non-respondent) =239

Since multistage sampling was employed, the calculated sample was multiplied by 2 for design effects to control the effect of sampling that could happen due to using sampling method other than simple random sampling. After all, the final sample size became 478.

Sampling procedure

In Addis Ababa there are 10 sub cities, from each sub city one private and one government school were selected by simple random sampling. Only one school administration refused to participate in the study due to this reason another school were selected in the same method from the same sub city. From each school an average of 24 students were selected which in some cases were modified based on their population proportion until it meets the sample size. Since the

study group range from 10-18 years of age, the study participants were selected from grade 5-8. From each grade level one section was selected and from each selected class an average of 6 students was selected by simple random method by making male to female ratio proportional.

When any of the selected participant or their family were not willing to participate on the study another student from the same section with the same sex were selected by lottery method.

Data collection tools

Semi structured questionnaire were used to collect the data. Most of the questions were adapted and modified from previous study [9,26]. The questionnaires were first developed in English and were translated in to local language (Amharic) and review was made by different expertise for consistency of translation of the language. Training was given to data collector and supervisor by principal investigator for Two days. Pre-test and demonstration of instrument was performed at each school for each data collector. Socio-demographic variables: family size, family monthly income, sex of participant child, education level of head of the house hold, ethnicity and possession of car was collected from student family using self-administered questionnaire. Physical activity and eating habit was assessed by interview using questionnaire. Weight was measured by water bath scale. Height measurement was conducted using height measuring board.

Before application the instrument was checked by external tap meter for its accuracy.

Data collection procedure and quality control

Support letter written by Addis Ababa University (AAU) was given for each school principal and permission was requested. In those schools in which we got permission, selections of classes were made. Data collectors and supervisors were recruited with minimum qualification of diploma in any health related fields. Training was given on how to fill questioners and how to take measurement.

After class selection performed in each school, each respective class room teachers in selected class and PI gave orientation to the study participant. The selected students were given parental self-administered questionnaire with consent form to their parents. Those students whose parents consented and returned the questionnaire were further interviewed and their height and weight measurements were taken.

Inclusion and exclusion criteria

Students from grade 5-8 and who give assent (were willing to participate in the study) were included in the study and students from grade 1-4 were excluded in the sample, because students at this level may not respond correctly to the prepared questionnaire. Disable children who are difficult to any physical measurement were excluded. Children is usually refers to age group less than or equal to 18 years old. Any refusal either from parent or student made participant to be excluded from the study [27-29].

Training of data collectors were carried out. Demonstration of interview through and taking measurement was done for each data collectors on one participant to reduce enter observer error. Weight scale was calibrated at 0 with no object on it and placed in level surface before measurement is carried out. Continuous check-up of scales were performed for their reliability. Data collection was supervised for correct implementation of procedures by the principal investigator. The principal investigator supervised and reviewed every questionnaire for

completeness and logical consistency and correction was made in the field. Data coding, entry and cleaning was performed by the principal investigator.

Data processing and analysis

Data was entered and analysed by EPI Info version 3.5.4 and SPSS version 21. Body mass index (BMI) was calculated by; $BMI = \text{weight (kg)}/\text{height square (M}^2)$ using Excel 2010 program. BMI percentiles for age were determined separately for male and female using CDC growth charts developed in 2000 [30].

We select BMI from other methods because of its simplicity and popularity and ability to measure all ranges of nutritional status from underweight to obesity. Variation of overweight with socio-demographic variables, dieting habit, and physical activity was analysed using descriptive statistics to see percentage distribution of overweight over those determinants. To evaluate significance of difference, 95% confidence interval for odds ratio was used. To control effect of confounding and predict the effect of some variables, binary logistic regression was performed [31-35].

Ethical clearance/consent/ confidentiality

The proposal was approved by ethical Review Committee of Addis Ababa University, College of Medicine and Health Sciences. Support letter, written by the Committee was given to Addis.

Ababa education bureau and each selected school. After getting permission from school, each subject in selected classes was given a written consent form to take home to their parents or guardians. If the parents of the selected students were willing to participate in the study, the child was included in the study. If they were not willing the child was replaced by another willing participant [36,37].

Result

Socio demographic characteristics

A total of 478 children from 20 schools (10 private and 10 government schools) were selected to participate in the study, of which 463 participated in the study which gives 96.9% response rate.

The socio demographic characteristics of children participated in the study is shown in (Table 1). Of the 463 children participants 221 (47.7%) were Male and 242 (52.3%) were Female and 306 (66.1%) were between the age of 10-14 and 157 (33.9%) in the age group 15-18 years. Composition of study participant by school type shows 209 (45.1%) were from private school and 254 (54.9%) were from government school.

Prevalence of overweight and obesity

The overall prevalence of underweight, normal, overweight and obesity is 44 (9.5%), 360 (77.8%), 46 (9.9%) and 13 (2.8%) respectively. The distribution of underweight, overweight and obesity by age, sex and school type is depicted in (Table 2). From a total of 221 male study participants 22 (9.9%) were under weight, 17 (7.7%) were overweight and 7 (3.2%) were obese. 22 (9.1%), 29 (12%) and 6 (2.5%) out of 242 female participants were underweight, overweight and obese respectively. According to the distribution shown above girls are more over weight than boys whereas boys are slightly obese. Younger children at age 10-14 are more underweight 36 (11.8%) than 8 (5.1%) older children 15-18 years age classification. They also have lower Proportion of overweight 29 (9.5%) but higher proportion of obese 13 (4.5%).

Variables	Level	Number of student n=463	Percent (%)
Sex	Male	221	47.7
	Female	242	52.3
Age	10-14	306	66.1
	15-18	157	33.9
School type	Private	209	45.1
	Government	254	54.9
Sub city of living	Addis ketema	47	10.2
	Akaki kality	45	9.7
	Arada	49	10.6
	Bole	47	10.2
	Gulelie	43	9.3
	Kirkos	46	9.9
	Kolfe keranio	46	9.9
	Lideta	47	10.2
	Nefas silk-Lafto	49	10.6
	Yeka	44	9.4
Religion	Orthodox	293	63.3
	Muslim	117	25.3
	Protestant	23	5.0
	Catholic	30	6.5
Ethnicity	Amara	208	44.9
	Oromo	85	18.4
	Gurage	118	25.5
	Tigre	31	6.7
	Others	21	4.5
Educational status	Read and write	14	3.0
	Primary education	77	16.6
	Secondary education	180	38.9
	Higher education	192	41.5
Income of the house hold(In ETB)	≤150	8	1.7
	151-650	58	12.5
	651-1400	55	11.9
	1401-2350	81	17.5
	2351-3550	79	17.1
	3551-5000	94	20.3
	>5000	88	19.0
Car ownership	Yes	99	21.4
	No	364	78.6

Table 1: Socio demographic characteristics of participants among Elementary school children in Addis Ababa, in 2014.

The proportion of underweight is less for child from car owner family than those who don't own. Which is 6 (6.1%) for car owner and 38(10.4%) for those who don't. 7 (1.9%) of children whose family do not own car are overweight which is remarkably lower than those who own car 39 (39.4%). The same is true for obesity 12 (12.1%) and 1 (0.2%) for those who have car and for those who don't respectively.

Socio demographic factors related to overweight

Socio demographic related of the child and their parents in association with overweight are described in (Table 3). According to the result females were slightly overweight than male which is 1.6 times

higher than male at (95%CI 0.87, 3.06). Private school children were at higher risk to overweight than government school. They are 6.8 times at higher risk than government school students (95%CI 3.15, 15.01). older children aged 15-18 were also found to have slightly more risk to be overweight than younger aged 10-15, which is 1.6 times higher in older children (95%CI 0.6,2.2).

Children from families who own car was found to be significantly overweight than children from family who do not own car. Children from car owner family were 33 times more likely to be overweight than those who do not (95%CI 14.2,77.5).

Eating habit and food choice

DiETING habit of the respondents shows 5 (1.1%) of the respondent do not consume vegetable while 285 (61.6%) eat vegetable 1-2 times per week, 135 (29.2%) eats 3-4 times per week, and 38 (8.2%) eats 5-7 times per day. The frequency for the consumption of fruit shows 8 (1.7%) did not consume fruit, 285 (61.6%) consume 1-2 times per week, 130 (28.1%) consume 3-4 times per week, 40 (8.5%) consume 5-7 times per week.

The food preference of the participant as they are requested to list five food they prefer to eat most was asked and classified. The result revealed that 421 (90.0%) mention that is classified as animal product as their preferred food, 410 (88.6%) reported food that are rich in carbohydrate in their preference list, 82 (17.7%) listed sweet foods in their preference list, 359 (77.5%) and 419 (90.5%) of the respondent did not mention at least one vegetable or fruit in their preference list.

Out of the entire study participant 62 (13.4%) did not use snack, 325 (70.2%) use snack once in a day, 67 (14.5%) and 9(1.9%) use snack twice and three times a day respectively. The food buying habit of the study participant in addition to the regular diet type and schedule depicted 332 (71.7%) of the total respondent bought cake, 374 (80.8%) biscuit, 197 (42.5%) ice cream and 176 (38.0%) chocolate.

(Table 4) Describe diet related factors associated with overweight among children in Addis Ababa. The result depicted eating snack has strong association with overweight. As the number of snack per day increase the risk to be overweight increases in significant manner. Children who eat snack are 1.7 times at high risk than those who do not (95% CI 0.6, 4.9). Children who eat snack 3 times per day and 2 times are 26 and 10 times at higher risk respectively than those who eat 1 times per day.

The food buying behaviour of the study participant shows buying cake, chocolate, biscuit and ice cream have significantly strong association with overweight. Children who buy cake are 3.5 times more vulnerable to be overweight than those who do not (95% CI 1.4, 9.2). Children who buy biscuit are 5.8 times more risk than those who do not (95% CI 1.4, 24.4). Buying ice cream and chocolate is 11 and 6.2 times more risk than those who don't buy.

Variable	Level	Under weight (%)	Normal weight (%)	Overweight (%)	Obesity (%)
Sex	Male	22(9.9%)	175(79.2%)	17(7.7%)	7(3.2%)
	Female	22(9.1%)	185(76.4%)	29(12%)	6(2.5%)
Age	10-14	36(11.8%)	228(74.5%)	29(9.5%)	13(4.2%)
	15-18	8(5.1%)	132(84.1%)	17(10.8%)	0(0%)
School type	Private	18(8.6%)	143(68.4%)	38(18.2%)	10(4.8%)
	Government	26(10.2%)	217(85.5%)	8(3.1%)	3(1.2%)
Car ownership of the family	Yes	6(6.1%)	42(42.4%)	39(39.4%)	12(12.1%)
	No	38(10.4%)	318(87.4%)	7(1.9%)	1(0.2%)

Table 2: Distribution of underweight, overweight, and obesity by socio demographic among primary school children in Addis Ababa, 2014.

Variables	Level	Proportion		COR(95% CI)	P-value
		Overweight (%)	Not overweight (%)		
Sex	Male	204(92%)	12(7%)	1	0.126
	Female	213(88%)	29(12%)	1.634(0.871-3.064)	
School Type	Government	246(97%)	8(3%)	1	<0.001
	Private	171(82%)	38(18%)	6.833(3.111-15.011)	
Age	10-14	277(90%)	29(10%)	1	0.646
	15-18	140(90%)	17(10%)	1.16(0.616-2.183)	
Ethnicity	Amhara	186(90%)	22(10%)	0.503(0.155-1.628)	0.251
	Oromo	81(95%)	4(5%)	0.210(0.048-0.923)	0.039
	Gurage	106(90%)	12(10%)	0.481(0.139-1.666)	0.248
	Tigre	27(88%)	4(12%)	0.630(0.139-2.859)	0.549
	Others	17(80%)	4(20%)	1	
Car ownership	Yes	60(61%)	39(39%)	33.1(14.2-77.5)	<0.001
	No	357(99%)	7(1%)	1	

Table 3: Socio demographic related factor of the children and their parents in association with overweight among elementary school children in Addis Ababa, 2014.

Variables	Level	Proportion		COR(95% CI)	P-value
		Overweight	Not overweight		
Do you eat snack	Yes	359(89.5%)	42(10.5%)	1.696(0.586-4.908)	0.330
	No	58(93%)	4(7%)	1	
How many times do you eat snack per day	1times	310(9%)	15(5%)	1	<0.001
	2times	45(67%)	22(33%)	10.104(4.884-20.902)	
	3times	4(44%)	5(56%)	25.833(6.287-64.152)	
Food bought by the participants					
Cake	Yes	291(8%)	41(12%)	3.551(1.371-9.196)	0.009
	No	126(9%)	5(4%)	1	
biscuit	Yes	330(8%)	44(12%)	5.800(1.379-24.397)	0.016
	No	87(98%)	2(2%)	1	
chocolate	Yes	141(80%)	35(20%)	6.228(3.071-12.633)	<0.001
	No	276(96%)	11(4%)	1	
Ice cream	Yes	157(80%)	40(20%)	11.040(4.576-26.634)	<0.001
	No	260(98%)	6(2%)	1	
Eating while going to cinema	Yes	58(63%)	34(37%)	8.090(3.750-17.452)	<0.001
	No	221(99%)	2(1%)	0.125(0.027-0.578)	
	I don't go	138(93%)	10(7%)	1	
Extra eating habits					
Eating while watching TV	Yes	129(80%)	32(20%)	1.426(0.461-4.416)	0.538
	No	265(96%)	10(4%)	0.217(0.063-0.746)	
	I don't go	23(85%)	4(15%)	1	
Eating food while studying	Yes	142(83%)	29(17%)	3.304(1.756-6.216)	<0.001
	No	275(94%)	17(6%)	1	
Eating breakfast regularly	Yes	303(88%)	41(12%)	1	0.021
	No	114(95%)	5(5%)	0.324(0.125-0.841)	
Irregular eating habit	Yes	148(87%)	22(13%)	1.666(0.903-3.073)	0.102
	No	269(92%)	24(8%)	1	
Preferred food list					
Vegetable	Yes	103(99%)	1(1%)	1	0.008
	No	314(87%)	43(13%)	14.761(2.016-67.428)	
Fruit	Yes	41(93%)	3(7%)	1	0.471
	No	376(90%)	43(10%)	1.563(0.464-5.262)	
Sweet foods	Yes	46(56%)	36(44%)	29.035(13.515-62.735)	<0.001
	No	371(97%)	10(3%)	1	
Carbohydrate diet	Yes	373(91%)	37(9%)	0.485(0.220-1.071)	0.074
	No	44(93%)	9(7%)	1	

Table 4: Diet related factors associated with overweight among elementary school children in Addis Ababa, 2014.

Children who eat when they watch TV has no association with overweight but children who do not eat while watching TV were 21.7% at lower risk of overweight than those who do not watch TV. Regarding eating breakfast regularly, children who eat breakfast regularly were at lower risk (32%) than those who don't. Eating while studying was found to be strongly associated with overweight. Those who eat while studying were 3.3 times at higher risk than those do not (95%CI 1.75, 6.2).

Physical activity and sedentary life style

Activity related to job, and regular physical activity of the participants and the parent shows 245 (52.9%) of the children do not participate in any work beside learning. 218 (47.1%) participate in moderately intense work for at least 10 minute per day, only 12 (2.6%) participate in vagarious activity for at least 10 minute per day. Out of 463 participant children 240 (51.8%) walk or ride bicycle, 5-7/week, 154 (33.3%) for 3-4 days per week, 40 (8.6%) for 1-2 days/week while 29 (6.3%) do not walk or ride bicycle at all. The participants physical activity status related sport and recreation revealed that 429 (92.7%) participate in moderate physical exercise that cause minor increase heart rate and respiration. Activity performed in school during physical education period is incorporated moderate physical activity 29 (6.3%) do vagarious /intense physical activity that cause major increase in HR and respiration for at least 10 minutes.

Sedentary behaviour of the participants was assessed by different questions. 82 (17.7%) spend less than 6 hours sitting, 260 (56.2%) spend 7-8 hours and 125 (26.1%) spend 9 hours and more.

Physical activity related to work, sport, recreation and sedentary behaviour of the children in association with overweight is shown in table 5. According to the study children who do not participate in any work after school were 4.8 (95%CI 2.2, 10.6) times at higher risk than those who do. Work that need medium energy decrease the risk of overweight by 20.8%. Walking or riding bicycle was also found to be protective for overweight. It decreases the risk by 17.2%. There is also strong association between strong vigorous intense sporting activity and overweight. Children who do not do strong physical activity are 3.2 times at higher risk those who do (95%CI 0.43, 24.8). Moderately intense sporting activity was found to increase the risk of overweight by 20.8%.

Regarding recreation and playing, children who play in any

playing station around their residence were found to be at lower risk of overweight. Those who do not paly were 5.6 times at higher risk than those who do (95% CI2.4, 12.8). Sedentary behaviour of the child was also strongly associated with overweight. Children who sit more than 9 hours per day are 40 times at higher risk (95% CI 6.4, 107) than those who sit 5-6 hours per day considering 4 and half hour school stay. Children from family where there is any member who perform regular physical activity are at lower risk of overweight. Those whose family members do not perform activity were 3.3 times at higher risk than those families do.

Finally binary logistic regression was done to control the effect of confounders. As it is indicated in the table 6, the following variable shows strong association; car ownership of the family (p<0.001), number of snacks per day (p=0.03), sweet food preference (p<0.001), buying ice cream (p=0.014), eating breakfast regularly (p=0.034), walking or riding bicycle for at least 10 minutes per day (p=0.009) and family participation in regular physical activity (p=0.023).

Children who have family car to come from and go school were more likely to be overweight with AOR 28.2 (5.3, 68.5). When confounders were avoided children who prefer sweet food were found to be 25 times at higher risk than those who do not. High risk of overweight was also observed in children who buy ice cream whenever they got money. Walking or riding bicycle daily for at least 10 minute was found to protect overweight. Those children who don't walk or ride bicycle was 10.5 times at higher risk than those who do (AOR 10.5 95% CI (1.8, 61.1)). Family participation in regular physical activity was found to profoundly decrease the risk of overweight. In contrary to the fact and other study habit of buying cake was found to protect overweight p=0.04 (AOR=0.12, 95%CI (0.016, 0.92)).

Discussion

The study was conducted to assess the prevalence of childhood overweight and obesity and its determinants among elementary school children.

Prevalence of overweight and/or obesity

Our study revealed the overall prevalence of underweight, normal, overweight and obesity is 44 (9.5%), 360 (77.8%), 46 (9.9%) and 13 (2.8%) respectively. The prevalence of overweight in our study was found to be consistent with the study conducted in Addis Ababa, Arada

Variable	Level	Proportion		COR(95% CI)	P value
Participation in work after school	Yes	210(96%)	8(4%)	1	<0.001
	No	207(84%)	38(16%)	4.819(2.195-10.578)	
Medium energy work	Yes	207(84%)	38(16%)	1	<0.001
	No	210(96%)	8(4%)	0.208(0.095-0.456)	
Walk or ride bicycle for at least 10 minute	Yes	398(92%)	36(8%)	0.172(0.074-0.397)	<0.001
	No	19(65%)	10(35%)	1	
Vigorous extensive exercise	Yes	28(96%)	1(4%)	1	0.254
	No	389(90%)	45(10%)	3.239(0.430-24.37)	
Moderately extensive exercise	Yes	391(91%)	38(9%)	1	<0.001
	No	14(82%)	3(18%)	0.208(0.095-0.456)	
Playing and recreation around residence	Yes	209(97%)	7(3%)	1	<0.001
	No	208(84%)	39(16%)	5.598(2.448-12.802)	
Number of hours spend sitting per day	5-6	81(99%)	1(1%)	1	0.675
	7-8	255(98%)	5(2%)	1.588(0.183-13.793)	
	≥9	81(67%)	40(33%)	40.00(6.370-107.957)	
Family member who perform regular exercise	Yes	120(96%)	5(4%)	1	0.014
	No	297(88%)	41(12%)	3.313(1.278-8.587)	

Table 5: Sport and physical activity related factor in association with overweight among elementary school children in Addis Ababa, 2014.

Variable	Level (Reference)	AOR(95%CI)	P value
School type	Government	1	0.294
	private	2.3(0.5,10.9)	
Car ownership of the family	Yes	28.2(5.3,68.5)	<0.001
	No	1	
Number of snacks per day	1 times	1	0.029 0.123
	2 times	4.9(1.2,20.7)	
	3 times	9.6(0.5,78.7)	
Eating while studying	Yes	2.16(0.6,7.8)	0.242
	No	1	
Eating breakfast regularly	Yes	0.12(0.01,0.85)	0.034
	No	1	
Sweet food preference	Yes	25.4(6.6,96.9)	<0.001
	No	1	
Vegetable preference	Yes	1	0.486
	No	2.29(0.2,23.6)	
Food bought *cake (reference No)		0.12(0.016,0.92)	0.041
	*Chocolate(reference No)	0.33(0.06,1.73)	0.189
	*Ice cream(reference No)	12.4(1.7,82.1)	0.014
Participation in work after school	Yes	0.5(0.08,3.05)	0.454
	No	1	
Walking or riding bicycle for at least 10 minute per day.	Yes	1	0.009
	No	10.5(1.8,61.1)	
Any family participates in regular physical activity.	Yes	0.2(0.05,0.8)	0.023
	No	1	

* refers that no is the reference

Table 6: Multivariable logistic regression analysis of independent predictors of overweight among elementary school children in Addis Ababa, 2014.

sub city which was 9.4% [38]. But it was higher than the study done 7 years back in the same city which was 7.6% [9]. This could be explained by the change in the life style factors of the society. The prevalence of obesity in our study was 2.8%. This is high proportion compared to the study conducted in Arada sub city, Addis Ababa which was (0.8%) [38]. The reason for this may be due to our study tries to incorporate all sub cities of the town in which people with high economic status may reside. Our study shows males are slightly obese than female but study done in Uganda shows females were more likely to be obese than male (2.9% vs. 1.8%) [21].

Sex specific prevalence of overweight and obesity shows 17 (7.7%) and 7 (3.2%) of male participants were obese. Female participants were 29 (12%) and 6 (2.5%) overweight and obese respectively. High prevalence of overweight is recorded in female. This may be explained by our society culture in which females spent most of their time at home. The finding of this study is also consistent with some of the study done in African country. Study done in Douala, Cameroon in 2010, the prevalence of overweight ranges from 6.4% to 8.2% in boys and from 10.7% to 17.2% in girls, whereas prevalence of obesity ranges from 1.4% to 5.5% in boys and from 2.4 to 8.6% in girls. Prevalence of underweight according to WHO 2007 reference was higher in boys as compared to girls, 5.5% and 9.2% respectively [20]. The sex specific prevalence of underweight was almost equal in our study 22 (9.9%) male and 22 (9.1%) female. This proximate finding between our and Douala study may be due to the same socio economic and life style status of the population [39].

School type prevalence overweight shows 38 (18.2%) and 8 (3.1%) are overweight for private and government school respectively. The

regression of this variable with overweight shows private school children were at higher risk to overweight than government school. They are 6.8 times at higher risk than government school students. This finding is comparable with that of Lebanese private school: a cross sectional study of adolescents in private Lebanese schools, aged 10–18 years indicates that overweight prevalence was 24.4% [40]. This high prevalence of overweight in private school is assumed to be due to high economic status of people in private school than government. People in the higher socioeconomic strata in the population were the most affected when obesity emerged in developing countries [39].

Study conducted in Addis Ababa showed the likelihood of overweight and/or obesity among adolescents increase as the age increase [38] this is the same as our study. Our study revealed out of 306 participant aged 10-14 years 29 (9.5%) were overweight and out of 157 participant aged 15-18, 17 (10.8%) were overweight.

Determinants of overweight

Over the last several decades, an increase in variety, availability, price and aggressive marketing have encouraged a shift in children's food choices from healthy foods such as fruit and vegetables to energy-dense, refined foods including fast-foods and sugar-laden beverages. The energy balance equation holds that obesity is the consequence of chronic positive energy imbalance (16,28,29,30).

Our study revealed food bought by the participants like cake, biscuit, chocolate and ice cream has shown strong association with overweight (Table 4) when confounders were avoided only ice cream showed association. The study conducted in Addis Ababa in primary school children showed the same result [9]. From those food items ever bought by students, chocolate, ice cream and cake showed significant association with overweight. But in logistic regression analysis only ice cream revealed significant association.

The eating pattern of our respondent shows, eating while studying has significant association with overweight. Eating breakfast regularly was found to be protective for overweight. When binary logistic regression was done eating breakfast regularly has significant association. According to our study children who mention sweet food in their preference list was 29 times at high risk than those who don't. Fruit and vegetable preference was found to have positive association with overweight. The finding of our study is consistent with some study done recently. Systematic review of 16 studies from Europe has showed that eating based on schedule is associated with a reduced risk of becoming overweight or obese and a reduction in the BMI in children and adolescents. In UAE, Kerkrade found that 72.2% of non-obese female university students eat their breakfast regularly, and the rest (25.8%) were either overweight or obese [13]. This association could be explained by the fact that skipping meals or failure to maintain a regular eating schedule can result in increased intakes and this problem is usually common in children and adolescents [28].

Physical activity related factors like work besides learning, doing extensively vigorous physical activity and playing in any recreation area around residence were found to have strong association with overweight. At the same time walking or riding bicycle for at least 10 minute per day and doing medium energy work was found to protect overweight by 17% and 21% respectively. When confounders were avoided only walking or riding bicycle has shown strong association. This result was consistent was the study conducted in Arada sub city in 2013 and in Addis Ababa in 2007 which found walking to school or riding bicycle for 30 minute per day decrease the risk of overweight significantly. Another study done in china also indicates the same

finding that those who was walking to and from school, doing low intensity physical activity greater than 2 hours per day, doing moderate/vigorous activity greater than 45 minutes per day were found to reduce risk of overweight [41,42]. This could be explained by walking to and from school and morning joggings provided a potentially important opportunity for establishing daily physical activity that have direct impact on decreasing overweight.

Physical activity levels of youth may depend on environmental features that encourage or discourage physical activity, such as access to recreational facilities, walkability of the environment and low neighbourhood crime rates [16]. The results of our study shows 247 (53.3%) of the participants do not play around their residence. The reason mentioned by the participants were in availability of the places 168 (36.2%) and not allowed by their parents 79 (17.1%). The regression for activity related to recreation and playing around residence shows strong association with overweight. This could be explained by the fact that whenever there is no space to play around residence or children are not allowed to play, there is an increased risk of spending much time sedentarily which is found to be a major risk factor for overweight and obesity.

Children from family in which any family member participate in any regular physical activity were found to decrease the risk of overweight. Those who have no family member who participate in physical activity were 3 times more likely to be overweight than those who don't. Other studies also show the same finding. A recent review of 58 papers found fairly consistent associations between parental dietary intake and children's fat, fruit and vegetable consumption as well as physical activity since children might role model those behaviours of their parents [16,28].

Sedentary behavior of the children was one of the variables that show amazingly strong association. Children who spent sitting more than 9 hours per day were 40 times more likely to be overweight than those who spend 5-6 hours per day (including 4 and ½ hours sitting at school). This finding is almost similar with the study done in Addis Ababa which found significant association between sedentary behavior and overweight. Overweight increases together with sedentary behavior. Sedentary behavior greater than 9 hours per day (including 5 and 1/4hour sitting at school), had the highest prevalence (17.1 %) [9]. Study done in china also showed the same finding. The prevalence of overweight among those whose physical inactivity less than or equal to 2 hours per day and greater than 2 hour per day was 4.9% and 7.3% respectively [42].

Strength and limitation

Our study has several strengths. This study used BMI as a criterion for classification which is mostly accepted and recommended to screen overweight and obesity for children aged 2-20 years. It is also the third in its kind to the country due to this reason it can motivate different researcher to do more investigation on overweight and obesity (the double burden of malnutrition in Ethiopia) and can also serve as a reference for future investigators.

Our study has also limitations. The study did not assess many other factors that influence the risk of childhood obesity. Weight gain during pregnancy, maternal obesity and birth weight have been shown to be strongly associated with childhood obesity [8,22,29]. Since the study is cross sectional it may not be strong to demonstrate direct cause and effect relationship between risk factors and outcome. During interview there might be a potential for recall and social desirability bias in the

frequency of dietary habits, physical activity and sedentary behaviours of the participants. Also the food frequency questionnaire did not account for portion size. It is also possible that other unidentified confounders such as genetic factors may have influenced the findings of our study.

Conclusions and Recommendation

In conclusion, the findings of this study have shed light on the prevalence and determinants of obesity among primary school children in Addis Ababa. The prevalence of childhood obesity in this population was found to be low. However, the prevalence of overweight was found to be high even comparable with the global prevalence. Among the factors identified are unhealthy dietary pattern like preferring sweet foods, eating breakfast irregularly, buying ice cream and frequent snacking are strongly associated with overweight. In addition physical inactivity are also important factors impacting on the risk of obesity in children. If Primary preventive measures is not taken immediately, prevalence of overweight and obesity among children in Addis Ababa , might increase rapidly in the coming few years.

Based on the findings we suggest that promoting active lifestyles and healthy diets should be a national public health priority. There is a need of longitudinal study to investigate the relationship between vegetable intake and overweight and/or obesity. We also recommend further studies to be done to increase our understanding of genetic factors in relation to overweight and of the prenatal, perinatal and postnatal predictors of childhood obesity. Because early interventions on modifiable risk factors are likely to decrease the rate of childhood obesity, educational programs about obesity and associated health consequences should start early in childhood so as prevent the increasing prevalence of childhood obesity in Ethiopia.

Abbreviations

- AAU: Addis Ababa University
- AOR: Adjusted Odds Ratio
- BMI: Body Mass Index
- CDC: Centre for Disease Control
- COR: Crude Odds Ratio
- CI: Confidence Interval
- EMR: Eastern Mediterranean Region
- ETB: Ethiopian Birr
- IOTF: International Obesity Task Force
- OR: Odds Ratio
- SPSS: Statistical Package for the Social Sciences
- WHO: World Health Organization

Competing Interests

The authors declare that we have no competing interests.

Authors' Contributions

Both of the authors (BG & AC) contributed to the design of the study and the interpretation of data. BG performed the data analysis and drafted the manuscript. Both authors critically revised the draft manuscript. Both authors read and approved the final manuscript.

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