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Magnitude and Determinants of Overweight and Obesity among High School Adolescents in Addis Ababa, Ethiopia

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***Abstract*–Background:** The 2004 World Health Assembly called for specific actions to halt the overweight and obesity epidemic that is currently penetrating urban populations in the developing world. Adolescents require particular attention due to their vulnerability to develop obesity and the fact that adolescent weight tracks strongly into adulthood. However, there is scarcity of information on the modifiable risk factors to be targeted for primary intervention among urban adolescents in Ethiopia. This study was aimed at determining the magnitude and risk factors of overweight and obesity among high school adolescents in Addis Ababa. **Methods:** An institution-based cross-sectional study was conducted in February and March 2014 on 456 randomly selected adolescents from 20 high schools in Addis Ababa city. Demographic data and other risk factors of overweight and obesity were collected using self-administered structured questionnaire, whereas anthropometric measurements of weight and height were taken using calibrated equipment and standardized techniques. The WHO STEPS instrument for chronic disease risk was applied to assess dietary habit and physical activity. Overweight and obesity status was determined based on BMI-for-age percentiles of WHO 2007 reference population. **Results:** The prevalence rates of overweight, obesity, and overall overweight/ obesity among high school adolescents in Addis Ababa were 9.7% (95%CI = 6.9-12.4%), 4.2% (95%CI = 2.3-6.0%), and 13.9% (95%CI = 10.6-17.1%), respectively. Overweight/obesity prevalence was highest among female adolescents, in private schools, and in the higher wealth category. In multivariable regression model, being female [AOR(95%CI) = 5.4(2.5,12.1)], being from private school [AOR(95%CI) = 3.0(1.4,6.2)], having >3 regular meals [AOR(95%CI) = 4.0(1.3,13.0)], consumption of sweet foods [AOR(95%CI) = 5.0(2.4,10.3)] and spending ≥3 hours/day sitting [AOR(95%CI) = 3.5(1.7,7.2)] were found to increase overweight/ obesity risk, whereas high Total Physical Activity level [AOR(95%CI) = 0.21(0.08,0.57)] and better nutrition knowledge [AOR(95%CI) = 0.160.07,0.37)] were found protective. **Conclusions:** More than one in ten of the high school adolescents were affected by overweight/obesity with dietary habit and physical activity are important modifiable risk factors. Well-tailored nutrition education program targeting lifestyle change should be initiated with more emphasis to female adolescents and students in private schools.

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I. Background

UNICEF defined adolescents as those have age between 10 and 19 years [1]. In 2009 world was home to 1.2 billion individuals aged 10–19 years, that forming 18% of world population. The vast majority of adolescents (88%) live in developing countries [1], [2]. Adolescent is transition between childhood to adult life, is one of the most dynamic stages of human development and usually been thought of as a period characterized by good health; however, millions of adolescents face significant challenges such as overweight and obesity [2].

World Health Organization defined overweight and obesity as excessive fat accumulation that may impair health [3], [4]. The prevalence of excess weight is increasing in both developed and developing countries, but at different rates and different patterns [5]-[7]. Overall; about 30% of American in 2008, 22%–25% of European in 2008, 23.2%-34.2% of Oceania in 2007, 5.2%-36.4% of Asian in 2002 and less than 20% of African in 2008 adolescents were overweight or obese [6]. In developing countries with emerging economies classified by the World Bank as lower- and middle-income countries [8], the rate of childhood overweight and obesity has been more than 30% higher than that of developed countries [3].

Increasing trend in the prevalence of overweight/obesity among children and adolescents has been documented over the last few decades in Africa [9]. Ethiopia is one of lower income country in sub-Saharan Africa showing experiencing a shift from underweight to overweight and obesity particularly in urban settings [10], [11]

Overweight and obesity has negative health impacts in children and adolescents, as well as in adults. Some of the health impacts of overweight and obesity are type two diabetic mellitus, heart diseases, stroke, high blood pressure, gall bladder and fatty liver diseases, arthritis and some cancers which are often referred as non-communicable diseases [2], [7]. In addition, overweight and obesity in children and adolescents has impact on reductions in quality of life and a greater risk of teasing, bullying, social isolation, lifelong negative body image and low self-esteem [12].

Currently overweight and obesity are linked to more deaths worldwide than underweight [3], hence; now ranks as the fifth leading global risk for mortality [12]. As WHO estimated in

2008 in Ethiopia the prevalence of death due to overweight and obesity was 7.4% and 1.1% respectively [13].

Overweight and obesity are rarely caused by hormonal or genetic defects [14], but the reasons for the dramatic worldwide increase in overweight and obesity in children and adolescents are unclear [15]. However, it must be noted that adulthood overweight and obesity related diseases are usually traced back to overweight and obesity in childhood and adolescents. Once adults are obese; it is often difficult for them to lose weight through physical activity and healthy diet [16]. Available evidences showed that one of the effective ways to prevent obesity in the adult life is prevention and management of children and adolescents overweight and obesity [17]. Therefore, this study was assessed magnitude and determinants of overweight and obesity among high school adolescents in Addis Ababa, Ethiopia.

II. Methods

A. Study Setting, Design and Sampling

An institution-based cross-sectional study was conducted in Addis Ababa city among high school adolescents aged 13 to 19 years in February and March 2014. Addis Ababa is the administrative and business capital of Ethiopia with total population of 2.7 million during the 2007 national population and housing census [18]. The City has 55 public and 58 private high schools that enrolled 61,271 and 39,996 students in 2013, respectively (Addis Ababa City Administration data).

Sample size was determined using sample size formula for single population proportion. Total of 456 study subjects were decided to estimate overweight and obesity prevalence of 16% (with 95% CI and 5% margin of error), after considering design effect of 2 and 10% non-response rate [11]. This sample size was equally distributed between public (228) and private schools (228).

A two-stage probability sampling procedure was applied to select the study subjects. First, 20 study high schools (10 from each of the private and public schools) were randomly selected from the 113 (55 public and 58 private) high schools in the city. Then, computer generated random numbers were used to select the required number of study participants from each school which was allocated proportionally.

B. Data Collection and Measurement

Self-administered structured questionnaires were deployed to gather data on demographic characteristics, wealth status, dietary habit, physical activity, and nutrition knowledge. The English version of the questionnaire was translated into Amharic language and, then pretested on students from high schools not included in the study. Family wealth was assessed using selected household assets previously applied by studies in similar context [11]. Principal Component Analysis (PCA) was used to translate the asset information into latent factors, and the first PCA factor explaining most of the variation was taken as wealth score. The wealth score was divided into quintiles that were subsequently aggregated into low (the lowest two quintiles), middle (the middle two quintiles), and high (the upper quintile) wealth categories.

The WHO STEPS instrument for chronic disease risk surveillance [19] and the Global Physical Activity Questionnaire (GPAQ) Analysis Guide [20] were used to assess dietary habit and physical activity of participants. Dietary habit was assessed by a Food Frequency Questionnaire that asks about weekly frequency of consumption for different food groups and food items. This approach was designed to obtain qualitative data on usual dietary intake over a long period [19]. Subjects were asked about days per week and hours per day, they spend on different activities that were grouped under comprehensive domains of work (vigorous and moderate intensity), transport, and leisure (moderate and vigorous intensity) activities. Then metabolic equivalents (MET in minutes per week) were calculated for each physical activity domain [20], and summed together to generate Total Physical Activity (TPA) level. Besides, participants were asked about the number of hours in a typical weekday they spend on sedentary activities like sitting, watching television, playing games or cards, reading, or travelling in a car.

Ten knowledge questions were asked about the causes of overweight and obesity, balanced diet and healthier foods, and health risks associated with weight status. The response given for each question was coded '1' for correct answers and '0' for incorrect answers or 'I don't know'. Then, based on the sum of their responses to all questions, subjects were categorizing as more knowledgeable (scored > 8/10) and less knowledgeable (scored < 8/10).

Five diploma Nurses conducted anthropometric measurements, after they were given a two-day practical training. Weight and height measurements were taken using calibrated equipment and standardized techniques [19] with subjects wearing only school uniform and no shoes. Weight was measured to the nearest 0.1 Kg using an electronic scale (SECA 876, Germany), and height to the nearest 0.1 cm using a portable stadiometer (SECA 213, Germany). Body Mass Index (BMI) was computed by dividing weight (Kg) to height square (m^2). Individual BMI-for-age percentiles were generated based on the WHO 2007 reference population using WHO AnthroPlus version 1.0.1. Subjects were categorized into thin/underweight, normal, overweight, and obese categories using BMI-for-age percentile cut-offs of <5, ≥ 5 but < 85, ≥85but <95 and ≥95, respectively [21]. Overweight and obese categories were merged to create overweight/obesity category (overweight including obesity) for regression analysis.

C. Statistical Analysis

Data were coded, entered and cleaned using EpiData version 3.1 and all statistical tests were performed using SPSS version 16.0. Proportion (95%CI), mean (SD), and median were used to describe the study population by explanatory variables and BMI status. Population prevalence for overweight and obesity was calculated by weighting for school type in the general population. Bivariate logistic

regression analysis was done to identify the differentials of overweight and obesity in the study population. Multivariable logistic regression was fitted to determine the independent predictors of overweight/obesity among the explanatory variables. Stepwise backward regression procedure was applied by including variables with significant or marginally significant association (p-value <0.25) during the bivariate analyses. All statistical tests were considered significant at alpha less than 0.05.

TABLE I
CHARACTERISTICS OF STUDY PARTICIPANTS AND THEIR FAMILY, HIGH SCHOOL ADOLESCENTS FROM ADDIS ABABA CITY, MARCH 2014

Variables	Frequency (%)
School type	
Public	229 (51.3)
Private	217 (48.7)
Sex	
Female	203 (45.5)
Male	243 (54.5)
Age in year	
13-16	240 (53.8)
17-19	206 (46.2)
Grade level	
9	160 (35.9)
10	132 (29.6)
11	81 (18.2)
12	73 (16.4)
Religion	
Orthodox	239 (53.6)
Muslim	100 (22.4)
Catholic	21 (4.7)
Protestant	65 (14.6)
Others	21 (4.7)
Father education	
No formal education	38 (8.5)
Primary school	66 (14.8
Secondary school	102 (22.9)
More than secondary	240 (53.8)
Mother education	
No formal education	62 (13.9)
Primary school	70 (15.7)
Secondary school	119 (26.7)
More than secondary school	195 (43.7)
Father occupation	
Government employee	131 (29.4)
NGO employee	87 (19.5)
Merchant	122 (27.4)
Others	106 (23.8)
Mother occupation	
Governmental employee	98 (22.0)
NGO employee	54 (12.1)
Merchant	127 (28.5)
House wife	167 (37.4)
Family size	
≤ 4	103 (23.1)
>4	343 (76.9)

D. Ethical Consideration

The Ethics Review Board of Jimma University approved the study protocol. Written consent was obtained from parents of all the study participants by sending them information sheet and consent form through their corresponding study adolescents.

III. RESULTS

From the 456 students sampled for this study, analysis was based on 446 students giving a response rate of 97.8%. The mean (SD) age of study subjects was 16.52 (±1.22) years, where 240 (53.8%) of the participants were between 13 and 16 years and the rest 206 (46.2%) were between 17 and 19 years. About half of the study participants were males (54.5%) and from private schools (48.7%). Majority of participants' parents, 240 (53.8%) of the fathers and 195 (43.7%) of the mothers, attended more than secondary education (Table I)

The median BMI of the study participants was 19.902 Kg/m^2 ranging from 14.32 Kg/m^2 to 37.71 Kg/m^2. Of the 456 subjects assessed, 46 subjects were overweight, 22 were obese and 38 were underweight, giving overweight, obesity and underweight prevalence rates of 9.7% (95%CI = 6.9%-12.4%), 4.2% (95%CI = 2.3%-6.0%) and 9.0% (95%CI = 6.3%-11.6%), respectively. The combined prevalence of overweight and obesity was 13.9% (95%CI = 10.6% - 17.1%). Overweight/obesity prevalence was the highest in private (23.0%) than public schools (7.9%) [COR (95%CI) = 3.5 (1.9, 6.2)], and female adolescents (27.6%) than their male counterparts (4.9%) [COR (95%CI) = 7.3 (3.8, 14.1)]. Similarly, the prevalence of overweight/obesity was high among study subjects in the high wealth category (29.2%) followed by the middle (15.6%) and low (7.9%) wealth categories [high vs. low wealth categories COR (95%CI) = 4.83 (2.37, 9.85)].

In bivariate analysis, overweight/obesity was significantly associated with family wealth status, sex, school type, family size, nutrition knowledge, sedentary lifestyle, level of physical activity, meal frequency, consumption of snacks and sweet foods, and weekly frequency of consumption of fruits, vegetables, milk and milk products; and meat. However, there were no association between overweight/obesity and other explanatory variables such as age, grade level, religion, parent education, parent occupation, and frequency of consumption for cereals and soft drinks (Table II).

Finally, in multivariable regression model, school type, sex, meal frequency, sweet foods consumption, sedentary lifestyle, physical activity level, and nutrition knowledge were the variables that independently predicted overweight/obesity (Table III). After adjusted for other predictors in the final model, the risk of overweight/obesity was 3 times higher in private schools than in public schools [AOR (95%CI) = 3.0 (1.4, 6.2)], and 5.4 times higher among females than males [AOR (95%CI) = 5.4 (2.5, 12.1)].

Of the dietary factors usual meal frequency and sweet foods consumption were the independent determinants for the occurrence of overweight/obesity. Adolescents consuming

more than three meals per day were 4 times more likely to be overweight/obese than those with less than three meals per day [AOR (95%CI) = 4.0 (1.26, 12.95)]. The risk of obesity was also significantly higher among adolescents who consumed at least one sweet food item during the last week than those who did not [AOR (95%CI) = 5.0 (2.44, 10.32)].

TABLE II
OVERWEIGHT/OBESITY BY EXPLANATORY VARIABLES AMONG HIGH SCHOOL ADOLESCENTS IN ADDIS ABABA CITY, MARCH 2014

Variables	Overweight/obesity[1]		COR (95%CI)	Variables	Overweight/obesity[1]		COR (95%CI)
	Yes (%)	No (%)			Yes (%)	No (%)	
Socio-demographic factors				**Dietary factors (days/week)**			
School type				Fruit consumption			
Public	18 (7.9)	211 (92.1)	1	< 3 days	31 (20.1)	124 (80.0)	2.5 (1.24, 5.17)*
Private	50 (23.0)	167 (77.0)	3.5 (1.97, 6.24)*	3-4days	25 (15.9)	132 (84.1)	1.9 (0.92, 4.00)
Sex				>4days	12 (9.0)	122 (91.0)	1
Male	12 (4.9)	231 (95.1)	1	Cereals consumption			
Female	56 (27.6)	147 (72.4)	7.3 (3.80, 14.14)*	< 3 days	9 (15.5)	49 (84.5)	1.0 (0.49, 2.35)
Age in year				3-4 days	14 (17.9)	64 (82.1)	1.3 (0.66, 2.49)
13-16	40 (16.7)	200 (83.8)	1	>4 days	45 (14.5)	265 (85.5)	1
17-19	28 (13.6)	178 (86.4)	0.42 (0.10, 1.67)	Vegetables consumption			
Grade level				< 3 days	25 (20.3)	98 (79.7)	1.9 (1.65, 2.26)*
9	29 (18.1)	131 (81.9)	1	3-4 days	17 (12.8)	116 (87.2)	0.61 (0.30, 1.22)
10	14 (10.6)	118 (89.4)	0.53 (0.27, 1.06)	>4 days	26 (13.7)	164 (86.3)	1
11	14 (17.3)	67 (82.7)	0.94 (0.46, 1.90)	Milk & milk products			
12	11 (15.1)	62 (84.9)	0.80 (0.37, 1.70)	0/No intake	19 (12.2)	137 (87.8)	1
Religion				1-2 days	10 (6.9)	135 (93.1)	0.53 (0.24, 1.19)
Orthodox	41 (17.2)	198 (82.8)	1	3-4 days	15 (20.8)	57 (79.2)	1.9 (0.90, 3.99)
Muslim	12 (12.0)	88 (88.0)	0.66 (0.33, 1.31)	>4 days	24 (32.9)	49 (67.1)	3.5 (1.78, 7.00)*
Catholic	4 (19.0)	17 (81.0)	1.1 (0.36, 3.55)	Meat consumption			
Protestant	10 (15.4)	55 (84.6)	0.88 (0.41, 1.86)	0/No intake	4 (6.8)	55 (93.2)	1
Others	1 (4.8)	20 (95.2)	0.24 (0.03, 1.85)	1-2 days	7 (4.7)	141 (95.3)	0.26 (0.10, 1.69)
Father level of education				3-4 days	36 (20.6)	139 (79.4)	1.2 (0.59, 2.4)
No formal education	6 (15.8)	32 (84.2)	1	>4 days	21 (32.8)	43 (67.2)	2.5 (1.06, 5.70)*
Primary school	10 (15.2)	56 (84.8)	0.95 (0.31, 2.86)	Soft drinks consumption			
Secondary school	12 (11.8)	90 (88.2)	0.71 (0.24, 2.05)	0/No intake	14 (13.1)	93 (86.9)	1
Above secondary	40 (16.7)	200 (83.3)	1.1 (0.41, 2.71)	1-2 days	22 (12.1)	160 (87.9)	0.91 (0.44, 1.87)
Mother level of education				3-4 days	19 (19.6)	78 (80.4)	1.6 (0.76, 3.43)
No formal education	6 (9.7)	56 (90.3)	1	>4 days	13 (21.7)	47 (78.3)	1.8 (0.79, 4.22)
Primary school	8 (11.4)	62 (88.6)	1.2 (0.39, 3.68)	At least one snack per day			
Secondary school	15 (12.6)	104 (87.4)	1.3 (0.49, 3.66)	No	8 (5.7)	132 (94.3)	1
Above secondary	39 (20.0)	156 (80.0)	2.3 (0.93, 5.80)	Yes	60 (19.6)	246 (80.4)	4.0 (1.86, 8.66)*
Father occupation				Meals per day			
Government employee	20 (15.3)	111 (84.7)	1	< 3	24 (21.4)	88 (78.6)	1
NGO employee	14 (16.1)	73 (83.9)	1.1 (0.50, 2.24)	3	23 (8.1)	260 (91.9)	0.8 (0.44, 1.60)
Merchant t	18 (14.8)	104 (85.2)	0.96 (0.48, 1.91)	> 3	21 (41.2)	30 (58.8)	3.0 (1.36, 6.58)*
Others	16 (15.1)	90 (84.9)	1.9 (0.68, 5.57)	Sweet food in last 7 days			
Mother occupation				No	25 (7.7)	300 (92.3)	1
Government employee	18 (18.4)	80 (81.6)	1	Yes	43 (35.5)	78 (64.5)	6.3 (3.63, 10.9)*
NGO employee	11 (20.4)	43 (79.6)	1.1 (0.492, 2.62)	**Physical activity factors**			
Merchant	15 (11.8)	112 (88.2)	0.60 (0.28, 1.25)	Total physical activity level			
Housewife	24 (15.5)	141 (84.4)	0.76 (0.38, 1.47)	Low	18 (32.1)	38 (67.9)	8.0 (3.88, 16.29)*
Family size				Moderate	32 (17.7)	149 (82.3)	1.8 (1.41, 3.36)
≤4	28 (27.2)	75 (72.8)	1	High	18 (8.6)	191 (91.4)	1
>4	40 (11.7)	303 (88.3)	0.35 (0.20, 0.61)*	Daily time spent on sitting			
Wealth index score				< 3 hours in a day	13 (4.6)	272 (95.4)	1
Low	14 (7.9)	164 (92.1)	1	>3 hours in a day	55 (34.2)	106 (65.8)	6.1 (3.45,10.87)*
Medium	28 (15.6)	151 (84.4)	2.17 (1.10, 4.28)*	Nutrition knowledge			
High	26 (29.2)	63 (70.8)	4.83 (2.37, 9.85)*	Less knowledgeable	52 (25.5)	152 (74.5)	1
				More knowledgeable	16 (6.6)	226 (93.4)	0.2 (0.11, 0.37)*

*: Significant association, p-value <0.05 for univariate logistic regression analysis
1: Overweight including obesity, BMI-for-age ≥85th percentile of the WHO reference population [21]

Overweight/obesity was found that negatively associated with physical activity. When adolescents were grouped by their total physical activity level (TPA), 20% reduction in the odds of overweight/obesity was observed in the high TPA group compared the low TPA group [AOR (95%CI) = 0.207 (0.075, 0.569)]. Overweight/obesity was lower in the moderate TPA group when compared to the low TPA group with a marginally significant association [AOR (95%CI) = 0.395 (0.153, 1.015)].

Regarding sedentary lifestyle, subjects spending ≥ 3hours a day sitting were three and half times more likely to develop overweight/obesity than those who spend lesser time [AOR (95%CI) = 3.5 (1.69, 7.15)]. When subjects were assessed based on their weight status related nutrition knowledge, the risks of being overweight/obese was significantly lower among the more knowledgeable adolescents than those who were with lesser knowledge [AOR (95%CI) = 0.16 (0.07, 0.37)].

TABLE III
DETERMINANTS OF OVERWEIGHT/OBESITY AMONG HIGH SCHOOL ADOLESCENTS IN ADDIS ABABA CITY, MARCH 2014

Variables	AOR(95%CI)	P-value
School type		
Public	1	
Private	3.0 (1.40, 6.22)	0.004
Sex		
Male	1	
Female	5.4 (2.45, 12.13)	0.000
Regular meals in a day		
< 3 regular meal	1	
3 regular meal	0.74 (0.32, 1.72)	0.489
>3 regular meal	4.0 (1.26, 12.95)	0.019
Sweet foods in the previous week		
No	1	
Yes	5.0 (2.44, 10.32)	0.000
Total physical activity		
Low	1	
Moderate	0.40 (0.15, 1.01)	0.054
High	0.21 (0.08, 0.57)	0.002
Daily time spent on sitting		
< 3 hours	1	
≥3 hours	3.5 (1.69, 7.15)	0.001
Nutrition knowledge		
Less knowledgeable	1	
More knowledgeable	0.16 (0.07, 0.37)	0.000

IV. DISCUSSION

The study showed that the prevalence of overweight in the study participants was 9.7 % and the prevalence of obesity was 4.2% based on BMI- for -age classification. The combined prevalence of obesity and overweight was 13.9%. The present study finding was comparable with the result of a study conducted in Addis Ababa on age group 15-49 years of women which contain 15-19 year-old female adolescents' overall prevalence where was 16.1% (10). In addition, in Hawassa prevalence of overweight and obesity was 12.9% and 2.7% respectively [11]. However, the prevalence of overweight and obesity in this finding was lower than that of developed country such as Italy [22]. One of the possible reasons for the differences in prevalence of overweight and obesity could be cultural difference in dietary intakes and difference in socio-economic status [23]-[25].

In this study, prevalence of overweight and obesity was higher in adolescents studying in private high schools than governmental high schools. There were similar finding from different countries; India [26] and Pakistan [27]. This finding might be related to adolescents in private schools come from families with higher socioeconomic status had high risk than that of low income families [11], [22], [28], [29].

Similarly, in current study prevalence of overweight among female adolescents was higher than male adolescents. Study conducted in South Africa school children aged 13–17 years showed females were more likely to be overweight and obese than male [30], [31]. In addition, study finding from Ghana showed significant association between sex and overweight/ obesity; where females were more likely to be overweight/ obesity than males [32]. Possible reason could be related to boys are generally more physically active compared to girls especially during adolescent [20], [24]. Concerns about body image, particularly among adolescent girls, may lead to problematic eating behaviours such as irregular meal patterns that may result in increased weight gain [11], [33].

Prevalence of overweight/obesity indicates remarkable difference between girls and boy in which overweight/obesity among private school students is comparable to studies from developed country Italia [22], where the prevalence was more among boys than girls. This difference might need further research.

According to Ezendam et al. HD numbers of daily meals were positively associated with body fat [34]. Similarly, in this study findings risk of obesity was significantly higher among adolescents who consumed three meals and more than per day than less than three meals per day. This finding was consistent with study findings of [23] and [28]. The study show higher intake of food has positive energy [19].

The consumption of sweet as a key contributor to the epidemic of overweight and obesity in children and adolescents had been strongly debated; however large portions of energy-dense foods were found to be positively associated with obesity in children and adolescents [30], [35]. In the present study, adolescents consumed more likely to be overweight as compared to adolescents not consumed sweet food. The result was consistent with study conducted in Ethiopia and Bangladesh [28], [35]. This could be explained as sweet food item are calorie dense food which result in positive energy balance to their consumers. Whereas, from Hawassa inconsistent finding found concerning the effect of sweet consumption on the prevalence of overweight and obesity. The discrepancy of result might be related to overweight or obese adolescent in the study area deliberately restricted consumption of sweet food in order to control additional weight gain [11], while in the present study overweight adolescents' pone to sweet food.

Physical activity and sedentary behaviour are two components of energy expenditure that contribute to the development of children and adolescents overweight and obesity [36]-[38]. One of the main factors contributing to increased adiposity is lower energy expenditure caused by decreased PA [19], [39]. The finding also showed that lack of physical activity had statistical significant association with overweight. This finding in line with study finding from Pakistan where adolescents had lack of physical activity was more at risk than active adolescents [27]. Supporting result from USA revealed that regular physical activity was an important factor in reducing the prevalence of overweight and obesity [34], [38]. Consistent findings [11], [19], [28], [36] [19], [41] showed lack of physical activity had positive association with overweigh and obesity. This finding might be related to lack of energy expenditure because of lack of physical activity [19].

There was positive significant association between daily times spent on sitting and overweight/obesity. This finding was in line with finding in Bangladesh and USA [35], [38], [40]. This finding might be related to positive energy balance caused by lack of physical activities [19] since overweight and obese adolescent in this study finding were prone to sweet food.

In the present study, adolescents had less knowledge on nutrition were more prone to overweight than adolescents who had more knowledgeable on nutrition. Similar finding from England showed that less knowledgeable adolescents were 5.3 times more likely to be obese than knowledgeable adolescents [42]. Other study suggests that increase prevalence of overweight among adolescent is due to deficit in nutritional knowledge in the adolescents [43]. This finding might be related to adolescents who had little knowledge concerning nutrition prone to sweet food, as knowledge is a predisposing factor for eating behaviour.

Knowledge is not sufficient factor for dietary behaviour change [44], [46]-[48], hence study from USA revealed that nutritional awareness had no relationship to overweight and obesity. Furthermore, nutritional knowledge was not different between obese and non-obese adolescents [45], while in this study the risks of being overweight/obese was significantly lower among the more knowledgeable adolescents than those who were with lesser knowledge. This result might be due to overweight/obese adolescents not having access for information on nutrition. There are some limitations like media exposure to message that encourage intake of high energy dense food was not addressed in this study. BMI cannot differentiate level of overweight as fat mass and fat free mass; hence the study might be subjected to misclassification bias.

V. Conclusions

Higher prevalence rate of overweight/obesity have been observed in adolescents of adds Ababa high schools. The prevalence of overweight/obesity was much higher in girls when compared with boys of both private and government school adolescents. Hence, it is a serious problem and requires immediate attention; creating an awareness program in the schools and parents should encourage their children to involve in more physical exercises, sports and outdoor activities and healthy eating habits, thus avoiding the march toward at risk of overweight and obesity.

Authors' Contributions

MS conceived of the study. MS and AAA conducted the statistical analyses and interpretation. MS. MS, MW and AAA wrote up the results and approved the final manuscript

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