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Adiposity in adolescent students of selected schools of Dhaka City

Abstract

Background: Worldwide the prevalence of adiposity gradually increases and it is the central cause of noncommunicable diseases. The adolescents are most vulnerable because the changes in lifestyle make the fertile soil for adiposity on them. The aim of this study was to find out the prevalence and risk indicators of adiposity in urban adolescent students in Dhaka city.

Methods: A cross sectional study was conducted in conveniently selected four secondary schools in Dhaka city. Four hundred and fifty students of both genders and from class six to eight were included in the study. A semi-structured, pre-tested, self-administered questionnaire was used for collection of data on socio-economic, dietary habits and physical activities related variables. Anthropometric measurements were taken for height, weight and three points (triceps, subscapular and calf) of skin fold thickness. Herpenden skin fold caliper was used for measuring skin fold thickness and the percentage of body fat was calculated by Slaughter equation. Percentage of body fat was classified into four categories (low, mid, upper and obesity).

Results: Percentage of body fat of 10% students was at obesity level. Among boys, 8.66% had obesity level percent fat mass while 1.56% of girls were at that level. Students of English medium school (p=0.008) and high income families (p=0.015) had higher adiposity. Housewife mothers (p=0.005) had higher proportion of obese children. Participants taking higher frequency of beef and mutton (p<0.001), chicken (<0.001), milk and milk products (p=0.003) and egg (p<0.001) had more obesity. On the other hand, students who took green (<0.001) vegetables regularly were associated with less obesity. Watching TV (<0.001) and playing computer games (<0.001) more frequently were also associated with higher adiposity.

Conclusion: The prevalence of adiposity in urban adolescent students in Bangladesh is high. Higher socioeconomic status, high intake of rich food and less physical activity influence adiposity. This study might help the policy makers in understanding the size of the adiposity problem in Bangladesh and to take necessary steps in preventing this ensuing problem.

Keywords: adiposity, adolescent, student, urban, Dhaka, Bangladesh

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Abbreviations: NCDs, non-communicable diseases; FM, fat mass; BMI, body mass index; PAQ-A, physical activity questionnaire for adolescent; SFTs, skin fold thickness; FFQ, food frequency questionnaire; BADAS, Bangladesh diabetic association

Introduction

The rapid rise of non-communicable diseases (NCDs) in recent years is one of the major health challenges to the world. In 1999, NCDs were responsible for 60% of deaths in the world and 43% of the global burden of disease. By the year 2020, the global impact of NCDs has been projected to cause up to 73% of deaths and 60% of the disease burden.[1] In recent years the developing countries which struggle with most of their limited health resources to combat communicable diseases, are now face double burden of both communicable diseases and NCDs.[2] Adiposity is the central cause of non-communicable diseases like hypertension, diabetes, ischemic heart disease, stroke, dyslipidemia and so on.[3] The burden of this diseases rises due to rise of adiposity. About 1.2billion adolescents today make up 18 percent of the World's population and more than half of all adolescents live in Asia.[4] The initial presentation of obesity is then linked to high blood pressure, insulin resistance and high blood lipids and persistant rise of these conditions then turned into NCDs most commonly cardiovascular diseases, particularly hypertension and diabetes mellitus.

Most of the epidemiological studies describe the problem of obesity, not adiposity. Obesity literally means excessive amount of total body fat relative to body wt. BMI is used in most of the study as a measuring tool to identify persons who are obese. On the other hand, adiposity is the term literally means the state of being fat. Adiposity actually measure fat mass (FM) of the body, either in total or in percentages. Fat mass (FM) means all extractable lipids from adipose and other tissues in the body.[5] Though the both terms are interchangeably used, there are differences between adiposity and obesity. Obesity, measured by BMI is based on only height and weight of a person but individual body compositions (fat and fat free mass) are not considered here. BMI could not give the accurate measure

of fat mass. Persons having same BMI may differ their body fat percentage. For this reason adiposity based on body fat percentage is better predictor of non communicable diseases than obesity based on BMI.

Nowadays, adiposity is one of the most widespread and major problems affecting children and adolescents and is a global nutritional concern. The etiology of adiposity is multi factorial. It is known that the adiposity is a result of increase energy intake and decrease physical activities. Energy is stored in the body in the form of adipose tissue when there is imbalance between energy intake and expenses. This imbalance is influenced by social, economic, environmental, cultural factors. The adolescents are the most vulnerable groups as they are the early adopters and dietary and personal behavior are developed in this period.

Unfortunately the new generation adolescents are less physically active. They spend less time in physical exercise and outdoor games. Moreover, TV watching, computer and video games are more popular to them and this has also been linked to increased obesity and to poorer health.[6–8] Adiposity can be measured in many ways. Anthropometric methods like body mass index (BMI), waist hip ratio and skin fold thickness are the suitable for measuring adiposity in field researches. Currently, the body mass index (BMI) is used widely as an indicator of the risk of overweight and of presence of overweight, because of the relative ease and accuracy of the basic measurement. However, the BMI has limitations; it tends to have high specificity, but low and variable sensitivity in children and adolescents.[9] Further, the validity of BMI across diverse samples of youth has not been evaluated. Skin fold thickness measures fat directly from body and the researchers are now recommend the skin fold measurement as the indicator of adiposity.[10]

Thus adiposity is increasingly seen as a public health problem in both developed and developing world. In Bangladesh a study was previously done regarding prevalence of obesity in children age 5-15years.[11] However, no study yet was done regarding adiposity in adolescents. The national burden of adiposity in adolescents is still unknown. A sound understanding of the prevalence, etiology regarding the problem are required if strategies for the prevention and treatment of this epidemic are to be developed. The study attempts to find out the prevalence and risk indicators of adiposity.

Methods

A cross sectional study was conducted in purposively selected four secondary schools in Dhaka city from July 2011 to June 2012 and on 450 students including both sexes from class six to eight. A semi-structured, pre-tested, self-administered questionnaire was used for collection of data on socio-economic, dietary habits and physical activities related variables. Physical activity questionnaire for adolescent (PAQ-A) manual was used to assess the physical activity level of the students. The PAQ-A is a self-administered, 7-day recall instrument. It was developed to assess general levels of physical activity of adolescent students of age 10 to 19years. The PAQ-A can be administered in a classroom setting and provides a summary physical activity score derived from nine items, each scored on a 5-point scale. Nutritional intake of the students was taken by Food Frequency Questionnaire (FFQ). Anthropometric measurements were taken for height, weight and three points (triceps, subscapular and calf) of skin fold thickness. Skinfold thickness (SFTs) has measured using a harpenden skin fold caliper (BATY international limited, United Kingdom) to the closest 0.2mm on to the right side of the body (triceps, calf, subscapular) with a constant spring pressure of 10g/mm^2 and a resolution of 0.20mm. Slaughter et al (1988) equation was used in this study and % of body fat (BF) was measured by following equation:[12]

$$Boys: \ \%BF = 0.735(\Sigma 2SKF)c + 1.0 \ \left[c = triceps + calf\right]$$

$$If \ \Sigma 2SKF \ is \ > 35mm \ then$$

$$\%BF = 0.783(\Sigma 2SKF)d + 1.6 \ \left[d = triceps + subscapular\right]$$

$$Girls: \ \%BF = 0.610(\Sigma 2SKF)c + 5.1 \ \left[c = triceps + calf\right]$$

$$\%BF = 0.546(\Sigma 2SKF)d + 9.7 \ \left[d = triceps + subscapular\right]$$

Percentage of body fat was classified into four categories -low, mid, upper and obesity. Data were imported in SPSS 16.0 version and analyzed. Descriptive statistics were computed for background characteristics of their family. Statistical associations between categorical variables were tested using chi-square test and mean difference of continuous variables by independent t-test. Ethical approval was obtained from the Ethical Review Committee of Bangladesh Diabetic Association (BADAS). Written permission was obtained from authority, i.e. Principal/Governing body of the school. Informed written assent from students and consent from their parents/guardian were taken.

Results

Figure 1 shows the prevalence of adiposity among adolescent students. Almost two third (63.1%) of total student had mid level of percentage of body fat. Upper level of body fat is seen in 3.8%. Low level was seen in 22.9% participants. Percentage of body fat in obesity level among the student was 10.2%. Among boys, 8.66% had obesity level percentage of body fat and 56.9% had mid level of percentage of body fat. Among girls, 1.56% had obesity level of body fat and 6.2% had low level of body fat.

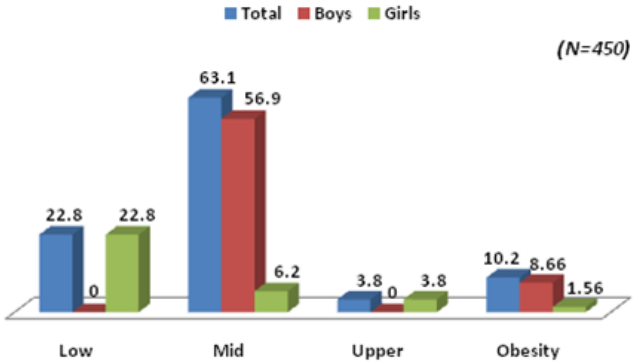

Figure 1 Prevalence of adiposity among students.

Table 1 shows the influence of socioeconomic and demographic indicators on adiposity. Participants having family income >30,000 TK had significantly higher adiposity (14.6%) than participants having income <30,000 TK (5.8%) (p=0.015). Participants who studied in English medium school had significantly higher adiposity (15%) than who read in Bangle medium school (5.7%) (p=0.008). Participants' mother who were housewives showed more adiposity in their children (13.4%) than mothers who were in service (4.9%) (p=0.005).

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Table 1 Socioeconomic & demographic indicators and adiposity

Characteristics	Low (n=103)	Mid (n=284)	Upper (n=17)	Obesity (n=46)	$\chi 2$	*P*
	n(%)	n(%)	n(%)	n(%)		
Age(years)						
<14	26(25.7)	59(58.4)	5(5.0)	11(10.9)		
≥14	77(22.1)	225(64.5)	12(3.4)	35(10.0)	1.25	ns
Monthly Family Income(Taka)						
<30,000	58(25.9)	144(64.3)	9(4.0)	13(5.8)		
≥30,000	45(19.9)	140(61.9)	8(3.5)	33(14.6)	10.44	0.015
Total Family Member						
<5	70(25.9)	158(58.5)	11(4.1)	31(11.5)		
≥5	33(18.3)	126(70.0)	6(3.3)	15(8.3)	6.18	ns
Family Type						
Nuclear	93(23.7)	245(62.3)	14(3.6)	41(10.4)		
Joint	10(17.)	39(68.4)	3(5.3)	5(8.8)	1.62	ns
Type of School(Medium)						
English	44(20)	136(61.8)	7(3.2)	33(15.0)	11.71	0.008
Bangla	59(25.7)	148(64.3)	10(4.3)	13(5.7)		
Father's Highest Education						
Up to graduation	56(24.5)	144(62.9)	11(4.8)	18(7.9)		
Post graduation & professional	47(21.3)	140(63.3)	6(2.7)	28(12.7)	4.35	ns
Mother's Highest Education						
Up to HSC	61(22.1)	179(64.9)	10(3.6)	26(9.4)		
≥Graduation	42(24.1)	105(60.3)	7(4.0)	20(11.5)	1.03	ns
Mother's Occupation						
Working mother	43(28.3)	99(65.1)	4(2.6)	6(3.9)		
House wife	60(20.1)	185(62.1)	13(4.4)	40(13.4)	12.71	0.005

Ns, not significant(80 BDT=1 US$)

Table 2 shows the influence of physical activity on adiposity. This table shows that the participants who were less physically active had more adiposity. Highest proportion of participants having adiposity was in 1st quarter (14.3%). It was followed by 2nd (12.7%) & 3rd quarter (8.5%) and only 7.6% of participants were in 4th quarter.

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Table 2 Quartiles of physical activity and adiposity

Quartiles of physical activity	Percentage of body fat				χ^2	*P*
	Low(n=103)	Mid(n=284)	Upper(n=17)	Obesity(n=46)		
	n(%)	n(%)	n(%)	n(%)		
1st quartiles	25(23.8)	62(59.0)	3(2.9)	15(14.3)	3.36	ns
2nd quartiles	15(21.1)	47(66.2)	0(0)	9(12.7)		
3rd quartiles	26(20.2)	83(64.3)	9(7)	11(8.5)		
4th quartiles	37(25.5)	92(63.4)	5(3.4)	11(7.6)		

Ns, not significant

Table 3 showed the influence of sedentary activities like watching TV, playing computer games and sleep on adiposity. Participants' mean time spending in TV watching is significantly associated with adiposity (p=0.001). About 7.5% participants who spent their time in playing computer games up to 65minute had higher adiposity whereas 16.2% had higher adiposity who spending more than 65minutes in playing computer games (p>0.001).

Table 4 shows the influence of food habit of the participants on adiposity. Students who took protein containing foods like beef and mutton (p<0.001), chicken (p<0.001), milk and milk products (p=0.003) and egg (p<0.001) had significant association with adiposity. On the other hand, students who took green and yellow vegetables (p<0.001) regularly had less chance of being adiposity.

Table 3 Sedentary activities and adiposity

Characteristics	Low(n=103)	Mid(n=284)	Upper(n=17)	Obesity(n=46)	χ2	*P*
	n(%)	n(%)	n(%)	n(%)		
Mean time spent in watching TV(in minutes)						
Up to 67 minute	87(27.7)	182(58.0)	11(3.5)	34(10.8)		<0.001
>67 minutes	16(11.6)	102(75.0)	6(4.4)	12(8.8)	15.48	
Mean time spent in playing computer games(in minutes)						
Up to 65minutes	86(27.9)	188(61.0)	11(3.6)	23(7.5)		<0.001
>65minutes	17(12.0)	96(67.6)	6(4.2)	23(16.2)	18.82	
Mean time duration of sleep in 24 hours(in hours)						
Up to 8hrs	96(24.6)	238(61.0)	15(3.8)	41(10.5)		
>8hrs	7(11.7)	46(76.7)	2(3.3)	5(8.3)	6.47	ns

Ns, not significant

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Table 4 Food habit and adiposity

Characteristics	Category of percentage of body fat				$\chi 2$	*P*
	Low(n=103)	Mid(n=284)	Upper(n=17)	Obesity(n=46)		
	n(%)	n(%)	n(%)	n(%)		
Beef /Mutton						
1-6times/week	95(45.0)	85(40.3)	14(6.6)	17(8.1)	1.29	<0.001
≥7times/week	8(3.4)	197(83.5)	2(0.8)	29(12.3)		
Chicken						
1-6times/week	92(35.5)	129(49.8)	12(4.6)	26(10.0)	59.93	<0.001
≥7times/week	11(5.8)	153(81.0)	5(2.6)	20(10.6)		
Fish						
1-6times/week	19(25.0)	47(61.8)	4(5.3)	6(7.9)	1.22	ns
≥7times/week	84(22.5)	237(63.4)	13(3.5)	40(10.7)		
Milk & milk products						
Never /week	26(33.3)	42(53.8)	3(3.8)	7(9.0)		
1-6times/week	53(23.8)	133(59.6)	14(6.3)	23(10.3)	20.13	0.003
≥7times/week	24(16.1)	109(73.2)	0(0.0)	16(10.7)		
Egg						
Never/week	7(77.8)	1(11.1)	1(11.1)	0(0.0)		
1-6times/week	63(33.0)	99(51.8)	12(6.3)	17(8.9)	51.97	<0.001
≥7times/week	33(13.2)	184(73.6)	4(1.6)	29(11.6)		
Green Leafy Vegetables						
1-6times/week	2(1.20)	142(84.5)	1(0.6)	23(13.7)	84.96	<0.001
≥7times/week	101(35.8)	142(50.4)	16(5.7)	23(8.2)		
Yellow orange vegetables						
1-6times/week	30(19.7)	93(61.2)	9(5.9)	20(13.2)	7.016	ns
≥7times/week	54(23.4)	152(65.8)	4(1.7)	21(9.1)		
Burger/Sandwich/Pizza						
Never /week	2(16.7)	6(50.0)	2(16.7)	2(16.7)		
1-6times/week	66(22.1)	192(64.4)	10(3.5)	30(10.1)	6.95	ns
≥7times/week	35(25.0)	86(61.4)	5(3.6)	14(10.0)		
French Fry/Potato Chips						
1-6times/week	101(23.1)	278(63.5)	15(3.4)	44(10.0)	6.46	ns
≥7times/week	2(16.7)	6(50.0)	2(16.7)	2(16.7)		
Chicken Fry/Nugget/Kebab						
Never /week	15(19.5)	49(63.6)	4(5.2)	9(11.7)		
1-6times/week	73(24.6)	184(62.0)	9(3.0)	31(10.4)	3.22	ns
≥7times/week	15(19.7)	51(67.1)	4(5.3)	6(7.9)		
Carbonated Drink						
Never /week	2(16.7)	6(50.0)	2(16.7)	2(16.7)		
1-6times/week	52(22.4)	149(64.2)	8(3.4)	23(9.9)	6.61	ns
≥7times/week	49(23.8)	129(62.6)	7(3.4)	21(10.2)		

Ns, not significant

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Discussion

The primary objective of the study was to find out the prevalence of adiposity in urban adolescent students. This was a cross sectional study and four hundred fifty adolescent students were included in this study. About two-third (63.1%) of total student had midlevel of percentage of body fat. Upper level of body fat was seen in 3.8% and low level was seen in 22.9% participants. Percentage of body fat in obesity level among the student was 10.2%. To the best of our knowledge this type of study was hardly done not only in Bangladesh but also in South East Asia. Few studies were done previously worldwide regarding socioeconomic and demographic factors on adiposity whereas dietary factors and physical activity influences were extensively studied. In India, so far only few studies were done to know the influence of socioeconomic factors on adiposity although the spectrum of their studies was limited. In this study socioeconomic and demographic factors were extensively studied. Both Bangla and English medium school and public and private school were included in the study so that the participants of both higher and middle class could be incorporated. The distribution of monthly income showed the overall status of the urban community. However, when compared with adiposity, monthly income showed significant differences in adiposity. Those family income >30,000 TK had significantly higher adiposity (14.6%) than those income <30,000 TK (5.8%) p=0.015. So, higher socioeconomic group had more adiposity. This is similar to an Indian study which reveals children of higher classes belonging to higher socioeconomic group are also in greater risk of obesity.[13]

In this study the participants of both Bangla and English medium schools were included. Participants who studied in English medium school had significantly higher adiposity (15%) than those read in Bangla medium school (5.7%) (p=0.008). This finding was similar to a previous study of India which showed that English medium students had higher adiposity.[11] The study showed that participants of small family members (<5 persons) had higher adiposity (11.5%) than large family (≥5) members (8.3%). The same was true for the participants of nuclear family had more adiposity (10.4%) than the joint family (8.8%). However, these are not significantly associated. In Bangladesh nuclear family had less family members than joint family and in joint family the usual number of family members are more than 5 persons. The two findings correlate well and it can be concluded from this study that small family members had chance of higher adiposity than larger ones.

Food habits are different in different community. Most of the studies regarding adiposity were done in western community. Previous studies established the relationship between fast food, energy rich foods and carbonated drinks with adiposity.[14–16] This may not be true in Bangladesh as these foods are not taken as frequently as that of western world. However, protein containing foods are costly in Bangladesh and these foods are more consumed by the affluent community of Bangladesh. In the present study, there was significant association between consumption of protein containing food and adiposity. On the other hand both green and yellow vegetables showed inverse relation with adiposity. So, participants taking green and yellow vegetables had less adiposity. Other foods including fast food did not show any association with adiposity. These findings can be interpreted as the role of food on adiposity is different in different community. This is possible because the food habit is not same in different country. This study measured the level of physical activities and shows the relationship between level of physical activities and adiposity. In many literatures it was shown that the lack of physical activities is one of the most important risk indicators for adolescent adiposity.[17,18] An Indian study shows that Children playing outdoor games for less than 30minute are prone to be obese.[11] Besides outdoor games, there are many activities that may influence the adiposity of these age groups. In many studies in developed world the relationship between TV watching and weight status in children are now established.[7,19,20] These studies interpreted that TV watching is a sedentary activity and so it increases the body weight. The present study showed participant's level of sedentary activities like watching TV, playing computer games had significant effect on adiposity.

Conclusion

The increase in adolescent obesity over past several years, together with health related problems and costs involved with it, has made it one of the emerging health problems in Bangladesh especially in urban areas. The aim of this study is to find out the prevalence and risk indicators of adiposity in urban adolescent students in Bangladesh. The study found high prevalence of adiposity in adolescent students in Dhaka city. This study showed students of English medium school and high income families were associated with adiposity. Housewife mothers and more educated parents had influence on adiposity in their children. This study found that protein containing foods like beef, mutton, milk and egg had significant association with adiposity. This study showed that sedentary activities like watching TV and playing computer games were significantly associated with adiposity. This study will help the health personnel and policy makers of the country to know the burden of adiposity in our country and to do necessary steps for lowering the risk indicators of this condition.

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Conflict of interest

Author declares that there is no conflict of interest.

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