

Prevalence and Factors Associated with Overweight and Obesity among Primary School Children (9–14 Years) in a Selected Area of Dhaka, Bangladesh: A Cross-Sectional Study

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Abstract

Introduction: Childhood obesity is a threat worldwide; notably, some Asian nations are experiencing a shift toward obesity at a younger age. The context of overweight/obesity remains unexplored, more among younger age groups in Bangladesh. This study assessed prevalence and factors associated with overweight/obesity among 9–14-year-old school-going children studying in public and private primary schools in a selected area of Dhaka, Bangladesh. **Materials and Methods:** This descriptive cross-sectional study involved 150 children recruited from four purposively selected primary schools, following simple random sampling technique. Body mass index was assessed to classify children following the Centers for Disease Control and Prevention age and sex-specific cutoff points. Data were analyzed using SPSS, version 20, and Chi-square/Fisher's exact test was done to determine association. **Results:** A higher prevalence of overweight/obesity was observed among boys (67.1%) compared to girls, and the mean age was 11.6 years. Overweight and obesity were prevalent among girls (35.7% and 17.9%, respectively) in public schools and boys (38.8% and 32.7%, respectively) in private schools. The magnitude was higher (>80.0%) among those not participating in sports at school ($P = 0.002$) or outside school ($P < 0.001$). They exposed (97.5%) to sedentary behaviors ($P < 0.001$) and preferred fast food (60.8%) as regular meals ($P = 0.001$). Their dietary chart lacked an adequate serving of vegetables and fruits in a week. **Conclusions:** Overweight/obesity is prevalent among 9–14-year-old school-going children, and behavior factors are major determinants of childhood obesity. Effective public health interventions are required to address this emerging health problem.

Keywords: Bangladesh, children, obesity, sedentary lifestyle

INTRODUCTION

Globally, overweight and obesity among children became a major public health concern. It is recognized as a major public health problem for developed countries such as Canada, the United States, Australia, and many European countries.^[1] Some South East Asian low-and-middle-income countries are now facing a paradox of double burden of malnutrition, where undernutrition is continuing and overweight/obesity increasing gradually.^[2] This also became a problem of developing countries including Bangladesh, especially for those living in urban areas.^[3] According to the World Health Organization estimates, the prevalence of overweight/obesity among children and adolescents aged 5–19 years risen a state of 4% in 1975 to 18% in 2016.^[4] Childhood obesity is rapidly increasing due to undergoing economic transitions, demographic

changes, and urbanization.^[5] This has already recognized as a global problem with important consequences for survival, the incidence of chronic diseases, healthy development, and the economic productivity of individuals and societies.^[6] This could lead to premature death and disability in adulthood, and the most significant health consequences are cardiovascular diseases, diabetes, osteoarthritis, and certain types of cancer.^[7]

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An increasing number of countries are now affected by the growing risk of overweight/obesity among children.^[8] In Bangladesh, the prevalence of overweight and obesity among children varies based on different sources. A systematic review and meta-analysis revealed that the prevalence varied from 1.0% to 23.0% among children and 1.7% to 25.6% among adolescents.^[9] In 2014, a school-based countrywide study demonstrated that among children (6–15 years), 9.6% were overweight and 3.5% were obese.^[10] In recent years, the problem of childhood obesity in the country received attention due to its association with adulthood obesity and increased risk of comorbidities. However, there is a paucity of recently published data on the status of overweight and obesity, particularly among 9–14-year-old primary school-going children in the urban area targeting to assess dietary and physical activity patterns of children. This study was aimed to assess the prevalence and identify factors influencing the weight status of 9–14-year-old school-going children studying in public and private primary schools in a selected area of Dhaka, Bangladesh.

MATERIALS AND METHODS

Study aim and design

A descriptive cross-sectional study was conducted to assess the prevalence and associated influencing factors with overweight/obesity among 9–14-year-old children who attended in selected public and private primary schools in Dhaka city, capital of Bangladesh.

Study site and study population

The study site was Khilgaon Thana (23°44' and 23°46' North latitudes and 90°24' and 90°29' East longitudes) of Dhaka city, with an area of 14.83 km². Schools were selected based on three criteria: (i) a good number of students, (ii) reputation of the school, and (iii) availability of playgrounds within school premises. Out of nine schools, four schools (public – 2 and private – 2) were selected purposively. The study population was children (boys and girls) aged 9–14 years enrolled in selected schools. Young respondents between the ages of 7 and 18 are not homogeneous groups, and their thinking process and reasoning skills develop gradually. Structured interviews are feasible for 9-year-old children who can answer well-designed questions with some consistency.^[11] As this study focused on primary schools, this age group was considered for getting reasonable responses.

Inclusion and exclusion criteria

The children's age did not fall between the range of 9–14 years, or using growth hormone replacement therapy, suffering from chronic illness, chromosomal disorders were excluded from the study.

Sampling strategy and sample

The sample size was calculated using formula $n = (Z^2 \times p(1-p))/e^2$, where n is sample size, $Z = 1.96$ (95% confidence interval), $p =$ prevalence of overweight and obesity (13.2%),^[10]

and $e =$ margin of error (6%), the minimum sample size was 122. This study involved 150 children recruited using a simple random sampling technique. An equal number of children ($n = 75$) were chosen from each type of school to have a comparison between public and private schools. A list of all eligible children studying in selected schools was prepared that worked as the sampling frame. Through a computer-generated random sequence, a list of 150 children was drawn from this sampling frame.

Anthropometric measurements

The measurement was carried out during school hours as time allocated by the school authority. Height (cm) was measured using a portable, locally manufactured stadiometer, standing upright on the flat surface without shoes. Weight (kg) was measured by a digital weight machine with a light school uniform, without shoes, and recorded nearest to 0.1 kg. Body mass index (BMI) was calculated as weight (kg)/height (m²), usually used to screen for weight categories that may lead to health problems.^[12] BMI was assessed to classify children following the Centers for Disease Control and Prevention age and sex-specific cutoff points. Children were categorized into four groups: underweight (<5th percentile), normal weight (5th–84th percentile), overweight (85th–94th percentile), and obese ($\geq 95^{\text{th}}$ percentile) using age and sex-specific percentiles of BMI.^[12,13]

Ethical approval

The Research Defense Committee of American International University-Bangladesh (AIUB) approved the study proposal (ethical approval reference number: 15-98602-2). Assent of children was obtained through a signed informed consent waiver by head teachers and from accompanied caregivers of children (father/mother/guardian). Verbal consent was obtained from children before conducting the interviews. This study involved the noninvasive procedures and strictly adhered to ethical principles during the entire study process.

Data collection and fieldwork

The team collected data from September to November 2016. Data from children were collected by conducting school visits using a pretested, semi-structured, and interviewer-administered questionnaire. Data were collected on sociodemographic variables and information on exposures of interest: their regular habit of engaging household activities; participating in sports; exposure to sedentary activities (playing video/computer games, using a mobile phone/internet, and watching television); food habits; and food preferences.

Data analysis

The team checked data completeness, and analysis was done using the Statistical Package for the Social Sciences (SPSS) version-20 (IBM Corp., Armonk, NY). Study descriptive statistics were presented in frequency tables, mean, whenever appropriate. Chi-square test and Fisher's exact test was performed between the outcome variable (overweight/obese) and selected independent variables for measuring association.

$P < 0.05$ was considered as the significance level. There were no missing data.

RESULTS

The mean age of overweight/obese children was ± 11.6 years, and 67.1% were boys. Around two-thirds (63.3%) were in Grade 5 from private schools (58.2%) [Table 1]. Most of the children's fathers completed the primary level of education (35.4%) and engaged in private sector 31.6%, followed by business (26.6%). Mothers were mostly (84.8%) homemakers and completed the primary level of education (48.1%) [Table 2].

The prevalence of overweight/obesity was varied considering the sex of children and types of schools. The prevalence of overweight 36.0% (95% CI: 1.11–1.48) and obesity 25.3% (95% CI: 0.98–1.34) was comparatively higher among children enrolled in private schools. Overweight and obesity were more prevalent among girls in public schools (35.7% and 17.9%, respectively) and boys in private schools (38.8% and 32.7%, respectively) [Table 3].

The association between the factors studied and overweight/obesity was measured in this study. Around 95.0% of overweight/obese children usually not engaged with household activities such as cleaning, preparing snacks/foods, taking care of siblings, gardening, and this could be influential in growing obesity ($P < 0.001$). Participation in sports was significantly associated with overweight/obesity. Compared to other groups, it was remarkably low for overweight/obese children, where only 17.7% participated in school ($P = 0.002$) and 16.5% after school ($P < 0.001$). They were more exposed (97.5%) to sedentary behaviors such as playing video/computer games, using a mobile phone/internet, and watching television for ≥ 120 min in a day, and this association was statistically significant $P < 0.001$. The association between eating breakfast, having money for buying foods, food purchase practices,

and overweight/obesity was statistically nonsignificant. The majority of the children reported having breakfast almost regularly. They were given money to buy food at school, and among food choices, overweight/obese children mostly (60.0%) bought fast food. Food preference for regular meals was significantly associated with overweight/obesity; however, relation with vegetable and fruit consumption was statistically nonsignificant. Their dietary chart lacked five servings of vegetables ($P = 0.109$) and fruits ($P = 0.174$) in a week, and it was lower than other groups of children. They also preferred fast food (60.8%) as a regular meal ($P = 0.001$), whereas other groups preferred homemade food [Table 4].

DISCUSSION

Findings demonstrated a high prevalence of overweight and obesity in a representative sample of 150 school children (9–14 years) in Khilgaon area of Dhaka city. Underweight in children is still a greater problem than overweight/obesity in the country,^[9,14] but the capital city had a higher prevalence of overweight/obesity (52.7%) among this age group of children. As a result of the nutritional transition, double burden of malnutrition among children is now a common phenomenon in Bangladesh and countries located in Asia and Pacific regions.^[15,16]

In this study, the prevalence of overweight and obesity among boys and girls was found different in the case of public and private schools. A countrywide epidemiological study demonstrated that overweight/obesity was prevalent among boys in urban areas; however, this status varied based on the type of school of children.^[10] The present study revealed that overweight and obesity were more prevalent among girls (35.7% and 17.9%, respectively) in public schools and boys (38.8% and 32.7%, respectively) in private schools. In contrast to this finding, an earlier study demonstrated a higher prevalence of overweight among girls (26.7%) in selected English medium private schools in Dhaka.^[17] Another school-based study revealed a prevalence of overweight (14.0%) and obesity (23.0%) among girls aged 9–17 years.^[18] However, the present study findings showed that the prevalence of overweight/obesity is rising both in boys and girls in the city. Several studies reported an increasing trend of overweight/obesity both in boys and girls in India and Pakistan.^[19–21] Corresponding to the results of this study, a study in Nepal revealed a high prevalence of overweight among boys studying in private schools that is 2.1 times higher than public schools.^[22]

The etiology of overweight/obesity is likely to include numerous factors.^[23] High-energy intake and food preference are major contributors to the development of overweight/obesity in children.^[23,24] In the country, food consumption patterns and dietary habits of school-going children have changed markedly during the past few decades.^[25] Projection of urbanization growth is 50% during 2015–2029,^[26] and children are more exposed to city culture with a sedentary lifestyle and high intake of dense foods, soft drinks, and less nutritious

Table 1: Demographic characteristics of the children (n=150)

Characteristics	Underweight (%) (n=16)	Normal weight (%) (n=55)	Overweight/obese (%) (n=79)
Sex			
Boy	56.2	61.8	67.1
Girl	43.8	38.2	32.9
Age (years) (mean)			
Mean age	11.3	11.4	11.6
Religion			
Muslim	87.5	94.5	93.7
Hindu	12.5	5.5	6.3
Type of school			
Public	62.5	58.2	41.8
Private	37.5	41.8	58.2
Grade			
Four	68.8	49.1	36.7
Five	31.2	50.9	63.3

Table 2: Demographic characteristics of the children's parents (n=150)

Characteristics	Underweight (%) (n=16)	Normal weight (%) (n=55)	Overweight/obese (%) (n=79)
Educational status of fathers			
No formal education	18.8	10.9	6.3
Primary (Grade 1-5)	37.5	36.4	35.4
SSC passed	12.5	16.4	17.7
HSC passed	0.0	14.5	12.7
Graduation	12.5	16.3	25.4
Don't know	18.7	5.5	2.5
Occupation of fathers			
Self-employed	25.0	27.3	22.8
Government employee	0.0	3.6	5.1
Private employee	37.4	32.7	31.6
Business	18.8	27.3	26.6
Others†	18.8	9.1	13.9
Educational status of mothers			
No formal education	31.3	16.4	11.4
Primary (Grade 1-5)	31.3	49.1	48.1
SSC passed	18.7	23.6	27.8
HSC passed	0.0	3.6	8.9
Graduation	0.0	1.8	2.5
Don't know	18.7	5.5	1.3
Occupation of mothers			
Homemaker	75.0	74.6	84.8
Self-employed	0.0	3.6	6.3
Government employee	6.2	1.8	2.5
Private employee	0.0	12.7	5.1
Others††	18.8	7.3	1.3

†Driver (CNG/auto), rickshaw puller (public schools); emigrant (private schools). ††Maid/servant (public schools); sewing (private schools). CNG: Compressed natural gas.

Table 3: Prevalence of underweight, normal weight, overweight, and obesity by sex of the children (n=150)

Characteristics	Boy (%)	Girl (%)	Total (%)	95% CI	
				Lower	Upper
Public schools (n=75)					
Underweight	17.0	7.1	13.3	0.90	1.50
Normal weight	44.7	39.3	42.7	1.17	1.52
Overweight	23.4	35.7	28.0	1.24	1.71
Obese	14.9	17.9	16.0	1.09	1.74
Private schools (n=75)					
Underweight	2.0	19.2	8.0	1.40	2.26
Normal weight	26.5	38.5	30.7	1.22	1.65
Overweight	38.8	30.8	36.0	1.11	1.48
Obese	32.7	11.5	25.3	0.98	1.34

CI: Confidence interval

foods.^[27] This study identified fast food preference as a major influencing factor in developing overweight/obesity among children. This also reported in other studies as a potential risk factor for developing overweight/obesity among children in the country.^[8,17,28] Studies in India and Pakistan indicated regular consumption of fast food (42.9% and 80.0%, respectively) among this group of children.^[19,21] A study conducted in Sri

Lanka reported high-energy intake, low fruits, and vegetable consumption as contributory factors for obesity among adolescent girls.^[29] This study found that similar, overweight/obese children usually lacked consuming adequate servings of vegetables and fruits in a week. Studies in India, Pakistan, Nepal, and Sri Lanka demonstrated that children from a higher socioeconomic status were more prone to obesity than those from low-income families.^[19,21,22,29] Although a study among the urban population in the country showed a similar trend,^[25] this study did not find any attributable relations between parents' education, occupation, and overweight/obesity among this age group of children.

It has appeared that the majority (>80.0%) of the overweight/obese children are not participating in sports at school or after school. They were less active in assisting with household activities and greatly exposed to sedentary behaviors. Publications also illustrated a rising trend of overweight/obesity with urbanization, dietary practices, sedentary lifestyle, and high economic income groups.^[15,30] A study conducted among English medium schools also identified food habits, less active lifestyles, and high levels of sedentary activities as the major contributors to developing obesity.^[17] Another study reported fast food preference as an important contributor to developing obesity and not found any relationship with participation in sports.^[28] It

Table 4: Factors associated with overweight/obesity among children (n=150)

Characteristics	Underweight (%) (n=16)	Normal weight (%) (n=55)	Overweight/obese (%) (n=79)	P#
Assist in household activities				
Yes	25.0	61.8	5.1	<0.001
No	75.0	38.2	94.9	
Participate in sports at school ≥ 60 min/day ≤ 5 days				
Yes	37.5	60.0	17.7	0.002*
No	62.5	40.0	82.3	
Participate in outdoor sports after school ≥ 60 min/day ≤ 5 days				
Yes	43.8	45.5	16.5	<0.001
No	56.2	54.5	83.5	
Exposed to sedentary behaviors ≥ 120 min/day				
Yes	68.8	36.4	97.5	<0.001
No	31.2	63.6	2.5	
Regular practice of eating breakfast				
Yes	87.5	94.5	81.0	0.060
No	12.5	5.5	19.0	
Given money for buying food at school				
Yes	100.0	98.2	94.9	0.802
No	0.0	1.8	5.1	
Types of food buy at school (n=145)				
Ice-cream	18.8	11.1	9.3	0.595
Chocolate	6.2	9.3	9.3	
Bread item	12.5	31.5	18.7	
Street food	62.5	44.4	2.7	
Fast food	0.0	3.7	60.0	
Consumption of ≥ 5 serving vegetables ≤ 5 days				
Yes	37.5	34.5	20.3	0.109
No	62.5	65.5	79.7	
Consumption of ≥ 5 serving fruits ≤ 5 days				
Yes	31.2	41.8	16.5	0.174
No	68.8	58.2	83.5	
Food preference for a regular meal				
Homemade food [†]	62.5	54.5	32.9	0.001
Fast food ^{**}	25.0	20.0	60.8	
Sweet food ^{***}	12.5	25.5	6.3	

[†]Rice, vegetable, fish, meat, etc., ^{**}French fry, chicken fry, sandwich, burger, etc., ^{***}Sweets, pudding, chocolate, ice cream, etc., #Fisher's exact test was performed since the expected cell frequencies were less than five, *Chi-square test

has revealed that the dynamics of childhood obesity are complex and influenced by numerous factors. It is most likely that high consumption of food rich in fat and calories, less involvement in sports/activities, and a sedentary lifestyle played an important role in rising overweight/obesity among this age group of children. Similar findings were reported in studies conducted in different parts of India, Pakistan, Nepal, and Sri Lanka, which established the relationship between dietary patterns, sedentary behaviors, and obesity.^[19-22,29] It is worth mentioned here that Dhaka city is lacking strategic urban planning and also public parks, open places/land for physical activities.^[31] Fast food promotion is common, these are readily available, and children easily become habituated to these unhealthy foods and beverages. These also indirectly influenced this rising trend, which indicates a serious public health concern, and urgent actions should be taken to tackle this issue in the country.

CONCLUSIONS

This study reports the prevalence and factors associated with overweight/obesity among 9–14-year-old school-going children in a selected area of Dhaka, Bangladesh. Positive energy balance with higher fat intake, lack of participation in outdoor sports, sedentary lifestyle, and fast food culture seems to be among the major underlying factors for the increasing prevalence of overweight/obesity among children. Introducing children to healthy food at an early age means that they are more likely to make healthier food choices as they grow up. Proper food habit, less screen time, more play, and recreation time are the keys to prevent children from becoming obese. There is a great need for developing public health policy/strategies to ensure early detection and targeted interventions (e.g., campaign for healthy foods; ensure availability of public parks and open places/land for

physical activities; behavior modification program targeting children, caregivers, and schools, etc.) to prevent overweight/obesity among school children. However, more robust studies need to be designed to identify all factors associated with childhood obesity to design better control programs in the country context.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

- Wang Y, Lobstein T. Worldwide trends in childhood overweight and obesity. *Int J Pediatr Obes* 2006;1:11-25.
- World Health Organization. Strategic Action Plan to Reduce the Double Burden of Malnutrition in the South-East Asia Region 2016-2025. Regional Office for South-East Asia, World Health Organization; 2016. Available from: <http://apps.who.int/iris/handle/10665/253377>. [Last accessed on 2020 Apr 09].
- Sultana, S. Prevalence and Risk Factor of Childhood Overweight and Obesity in Primary School Children of Dhaka City. University of Oslo; 2010. Available from: <https://bit.ly/2KCBh5o>. [Last accessed on 2020 Apr 09].
- World Health Organization. Factsheet on Obesity and Overweight. Available from: <http://www.who.int/en/news-room/fact-sheets/detail/obesity-and-overweight>. [Last accessed on 2020 Apr 09].
- Popkin BM. The nutrition transition and obesity in the developing world. *J Nutr* 2001;131:871S-8S.
- Black RE, Victora CG, Walker SP, Bhutta ZA, Christian P, de Onis M, *et al.* Maternal and child undernutrition and overweight in low-income and middle-income countries. *Lancet* 2013;382:427-51.
- World Health Organization. WHA Global Nutrition Targets 2025: Childhood Overweight Policy Brief. Geneva, Switzerland: World Health Organization; 2014. Available from: http://www.who.int/nutrition/topics/globaltargets_overweight_poli_cybrief.pdf. [Last accessed on 2020 Apr 09].
- Bhurosy T, Jeewon R. Overweight and obesity epidemic in developing countries: A problem with diet, physical activity, or socioeconomic status? *ScientificWorldJournal* 2014;2014:964236.
- Biswas T, Islam A, Islam MS, Pervin S, Rawal LB. Overweight and obesity among children and adolescents in Bangladesh: A systematic review and meta-analysis. *Public Health* 2017;142:94-101.
- Bulbul T, Hoque M. Prevalence of childhood obesity and overweight in Bangladesh: Findings from a countrywide epidemiological study. *BMC Pediatr* 2014;14:86.
- Leeuw DE. Improving data quality when surveying children and adolescents: Cognitive and social development and its role in questionnaire construction and presenting. Naantali Finland; 2011. Available from: <https://bit.ly/2UnUMBw>. [Last accessed on 2020 April 09].
- CDC Growth Charts: United States Advance Data from Vital and Health Statistics. No. 314. Atlanta: National Center for Health Statistics; 2000.
- Barlow SE; Expert Committee. Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: Summary report. *Pediatrics* 2007;120 Suppl 4:S164-92.
- Biswas T, Garnett SP, Pervin S, Rawal LB. The prevalence of underweight, overweight and obesity in Bangladeshi adults: Data from a national survey. *PLoS One* 2017;12:e0177395.
- Khan SH, Talukder SH. Nutrition transition in Bangladesh: Is the country ready for this double burden. *Obes Rev* 2013;14 Suppl 2:126-33.
- Helble M, Francisco K. The Imminent Obesity Crisis in Asia and the Pacific: First Cost Estimates. ADBI Working Paper 743; 2017.
- Rahman NM, Reza AS, Islam AM, Rahman A, Nath KA. Prevalence of obesity and overweight among English medium school children of Dhaka city in Bangladesh. *J Environ Sci Natural Resources* 2014;7:63-7.
- Zabeen B, Tayyeb S, Naz F, Ahmed F, Rahman M, Nahar J, *et al.* Prevalence of obesity and central obesity among adolescent girls in a district school in Bangladesh. *Indian J Endocrinol Metab* 2015;19:649-52.
- Mahajan BP, Purty JA, Singh Z, Cherian J, Natesan M, Arepally S, *et al.* Study of childhood obesity among school children aged 6 to 12 years in union territory of Puducherry. *Indian J Community Med* 2011;36:45-50.
- Jacob KS. Prevalence of obesity and overweight among school going children in rural areas of Ernakulam district, Kerala State India. *Int J Sci Study* 2014;2:16-9.
- Warrach JH, Javed F, Faraz-ul-Haq M, Khawaja BF, Saleem S. Prevalence of obesity in school-going children of Karachi. *PLoS One* 2009;4:E4816.
- Piryani S, Baral KP, Pradhan B, Poudyal AK, Piryani RM. Overweight and its associated risk factors among urban school adolescents in Nepal: A cross-sectional study. *BMJ Open* 2016;6:e010335.
- Sahoo K, Sahoo B, Choudhury AK, Sofi NY, Kumar R, Bhadoria AS. Childhood obesity: Causes and consequences. *J Family Med Prim Care* 2015;4:187-92.
- Osei-Assibey G, Dick S, Macdiarmid J, Semple S, Reilly JJ, Ellaway A, *et al.* The influence of the food environment on overweight and obesity in young children: A systematic review. *BMJ Open* 2012;2. pii: e001538.
- Das KS, Chisti JM, Huq S, Malek AM, Vanderlee L, Salam AM, *et al.* Changing trend of overweight and obesity and their associated factors in an urban population of Bangladesh. *Food Nutr* 2013;4:678-89.
- NIPORT, ICDDR, B, MEASURE Evaluation. Bangladesh Urban Health Survey 2013. National Institute of Population Research and Training, MEASURE Evaluation. International Centre for Diarrhoeal Disease Research, Bangladesh; 2015. Available from: <https://www.measureevaluation.org/resources/publications/tr-15-117>. [Last accessed on 2020 Apr 09].
- Bishwajit G. Nutrition transition in South Asia: The emergence of non-communicable chronic diseases. *F1000Res* 2015;4:8.
- Saha S, Zahid KM, Rasheed S. The study of the level of knowledge, attitude, practices (KAP) as well as the effects of school environment on the nutritional status of children (7-12) coming from affluent families in the Dhaka city in Bangladesh. *Bangladesh J Nutr* 2012;24-25:31-48.
- Rathnayake KM, Roopasingam T, Wickramasinghe VP. Nutritional and behavioral determinants of adolescent obesity: A case-control study in Sri Lanka. *BMC Public Health* 2014;14:1291.
- Ng M, Fleming T, Robinson M, Thomson B, Graetz N, Margono C, *et al.* Global, regional, and national prevalence of overweight and obesity in children and adults during 1980-2013: A systematic analysis for the Global Burden of Disease Study 2013. *Lancet* 2014;384:766-81.
- Siddiqy RM. Urban environment and major challenges in sustainable development: Experience from Dhaka city in Bangladesh. *South East Asia J Public Health* 2017;7:12-6.