Original Article

Prevalence of Overweight and Obesity among the School-Going Children (6-12 Years) of Urban and Rural Areas in Bangladesh

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Abstract

Introduction: Childhood obesity becomes an epidemic worldwide which is escalating as a major health burden in developed as well as in developing countries. The obesity in childhood appears to be an increased risk of subsequent metabolic, systemic and psycho-social morbidities. The transitions in the dietary habit and sedentary lifestyle are the major risk factors along with some genetic involvement. Prevalence survey is necessary to know about the present incidence and the trend to combat childhood overweight and obesity.

Objectives: Aim of this study is to assess overweight and obesity among urban and rural school-going children of 6-12 years old.

Materials & Methods: A prospective observational study was carried out from March 2013 to May 2014 by the Department of Pediatrics, Bangabandhu Sheikh Mujib Medical University, Dhaka and subjects were from two schools of rural and urban areas of Bangladesh. Total 365 children aged between 6-12 years were included. Weight and height of all available students were measured, BMI was calculated and nutritional status was measured by using CDC growth chart.

Results: Proportion of overweight and obesity among all selected students were 35 (9.6%) and 40 (11%) respectively. In Rural area 5 (2.6%) and 3 (1.5%) children were overweight and obese respectively whereas in Urban area, 30 (17.6%) and 37 (21.8%) children were overweight and obese respectively. The proportions were significantly higher than in rural area.

Conclusion: Overweight and obesity are in high proportion among urban school going children.

Keywords: Overweight; Obesity; Underweight; Urban; Rural; School-going children; BMI

Introduction

Globally, the prevalence of overweight and obesity in children has increased, and this has become a critical public health concern [1]. In countries experiencing rapid economic growth, particularly in developing nations, the increasing prevalence of youth overweight and obesity poses significant obstacles to healthcare systems [2,3]. Recent statistics show a worrying increase in developing nations as well, although it has traditionally been more common in developed nations [4].

Across the globe, the prevalence of childhood overweight and obesity is on the rise, albeit with considerable variation among nations [5,6]. The International Obesity Task Force (IOTF) has reported a decade-long upward trajectory in obesity rates among children worldwide [7]. Developed regions such as North America and Western Europe have shown the highest rates of obesity, while middle- and low-income countries are experiencing significantly higher rates [8]. Highlighting this shift, a 2013 World Health Organization (WHO) report revealed that over 40 million children under five years old were overweight in 2011, with the majority residing in developing nations [9]. Additionally, another WHO report indicated that approximately 35 million of these overweight children lived in developing countries [10]. Consequently, obesity is no longer confined to

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affluent nations but is spreading swiftly in low- and middle-income countries [8,11].

The WHO has prioritized investigating the global health implications stemming from economic and nutritional transitions, particularly in developing nations experiencing economic growth and improved living standards [12]. This shift has seen a transition from under-nutrition to over-nutrition, evident in the rising trend of childhood overweight and obesity, often referred to as the 'Double Burden of Malnutrition' [13]. This phenomenon is now observable among school-aged children, with rural areas historically focused on under-nutrition now facing the dual challenge of over-nutrition as well [14,15].

The root causes of overweight and obesity primarily stem from energy imbalances, driven by factors such as excessive calorie intake, insufficient physical activity, high socioeconomic status, urbanization, cultural norms, and the marketing tactics of processed food companies [3,16,17] In Bangladesh, nearly 40% of children under five suffer from inadequate nutrition [18]. However, rapid urbanization, dwindling recreational spaces, increased disposable income, and widespread access to sedentary technology are contributing to a rise in childhood overweight and obesity, particularly among affluent families in urban areas like Dhaka [19]. The nation is presently encountering the two fold burden of malnutrition, with both under-nutrition and childhood overweight/obesity prevalent. Childhood overweight and obesity represent a significant public health concern in urban cities of Bangladesh because overweight or obese children have a higher risk of becoming overweight or obese adults [20,21]. Additionally, overweight adults face increased mortality and morbidity risks associated with obesity-related chronic diseases, further straining the already challenged well-being framework in Bangladesh [22,23].

Given the divergent demographic characteristics of urban and rural children in Bangladesh, it is imperative to assess the prevalence of childhood overweight and obesity in both settings to gain a comprehensive understanding of the national landscape regarding this public health concern.

Materials & Methods

This prospective observational study was conducted between March 2013 to May 2014, which were enrolled total 365 school going children (6-12 years) from two purposively selected schools in Bangladesh having co-education system; 195 students were collected from an English medium school in urban area of Dhaka city and 170 students were from a rural Bangla medium school in Faridpur district and analyzed in the department of Pediatrics, Bangabandhu Sheikh Mujib Medical University (BSMMU). All students of selected age groups of both schools who were present during the allocated period of study were included and children who were suffering from chronic illnesses e.g. genetic syndrome, endocrine disorder, eating disorders and those who were taking systemic steroid for long time for any reason, were excluded from the study. Height and weight of selected children were measured and BMI was calculated. Obtained BMI for age and sex was categorized into individual nutritional status by plotting on CDC BMI for age and sex percentile chart. BMI for age and sex, between ≥85th to <95th percentile was defined as overweight, ≥95th percentile was defined as obesity and <5th percentile was under weight.

Prior to the commencement of this study the research protocol was approved by the Institutional Review Board (IRB) of BSMMU; written informed consent was taken from school authorities and verbal consent was taken from students and/or guardians.

All data were demonstrated as mean ± SD or n (%) where appropriate. Proportion of overweight and obesity were presented as percentage. Z test and Student's t test were used for group comparison. All comparisons were made two-sided and a p-≤0.05 (2-tailed) considered as significant. Data were analyzed using SPSS version 16.

Results

A total of 365 students from two purposively selected schools were studied. Among them, 170 (46.6%) students were from urban area and 195 (53.4%) were from rural area. Among total students, boys were 198 (54.2%) and girls were 167 (45.8%) and boys-girls ratio was 1.2 : 1.

The studied students of both urban and rural schools were in different age groups ranging from 6 years to 12 years. Studied children were well distributed in all age groups with some preponderance in 11-12 year age group in both urban and rural students (Table 1).

Amongst all studied children, proportion of overweight and obesity was 35 (9.6%) and 40 (11%) respectively; whereas, proportion of underweight was 57 (15.6%) (Figure 1).

Table-1: Age Distribution of Studied Students According to Place of Residence

Age in years	Urban (n=170) n (%)	Rural (n=195) n (%)	Both urban & rural N = 365 (%)
6 - 7	21 (12.3)	30 (15.4)	51 (14)
7 - 8	26 (15.3)	24 (12.3)	50 (13.7)
8 - 9	32 (18.8)	11 (5.6)	43 (11.8)
9 - 10	28 (16.5)	31 (15.9)	59 (16.2)
10 - 11	27 (15.9)	29 (14.9)	56 (15.3)
11 – 12	36 (21.2)	70 (35.9)	106 (29)
Total	170 (46.6)	195 (53.4)	365 (100)
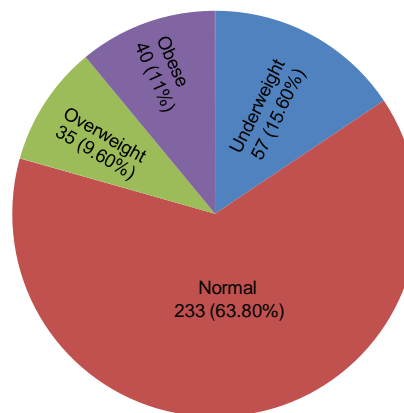
Figure-1: Nutritional status of students as per BMI for Age and Sex (N=365)

Table-3: Distribution of Nutritional Status (by BMI for Age and Sex) of Urban Students as per Age and Sex (n=170)

Age in years	Underweight (n = 13)		Normal (n = 90)		Overweight (n = 30)		Obese (n = 37)	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
6 - 7	1	1	6	3	4	1	4	1
7 - 8	2	2	3	4	1	3	5	6
8 - 9	3	0	8	9	2	1	7	2
9 - 10	3	0	9	7	1	1	4	3
10 - 11	0	0	2	12	4	6	3	0
11 – 12	1	0	16	11	1	5	1	1
Total	10	3	44	46	13	17	24	13

Table-4: Distribution of Nutritional Status (by BMI for Age and Sex) of Rural Students as per Age and Sex (n=195)

Age in years	Underweight (n = 44)		Normal (n = 143)		Overweight (n = 5)		Obese (n = 3)	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
6 - 7	5	2	11	11	0	1	0	0
7 - 8	4	3	12	5	0	0	0	0
8 - 9	3	3	5	0	0	0	0	0
9 - 10	3	2	12	11	1	0	0	2
10 - 11	2	2	14	9	0	1	1	0
11 – 12	6	9	27	26	1	1	0	0
Total	23	21	81	62	2	3	1	2

The numbers of overweight and obese students in different age group were almost similar in urban students (Table-3) as well as in rural studied students (Table-4)

Table-5: Comparison of Nutritional Status (by BMI for Age and Sex) between Urban and Rural Students

Nutritional Status	Urban (n = 170) n (%)		Rural (n = 195) n (%)		p value*
Underweight	13	(7.6)	44	(22.6)	0.001
Normal	90	(52.9)	143	(73.3)	0.001
Overweight	30	(17.6)	5	(2.6)	0.001
Obese	37	(21.8)	3	(1.5)	0.001

*Z test was done to measure the level of significance.

The corresponding proportion of overweight and obesity was 30 (17.6%) and 37 (21.8%)in urban children and 5 (2.6%) and 3 (1.5%) in rural children. This difference was statistically significant (p=0.001). Among urban studied children, proportion of obesity37 (21.8%) was very high than overweight 30 (17.6%). However, underweight was found in significantly higher proportion in rural studied children 44 (22.6%), compared to urban children 13 (7.6%).

Table-6: Comparison of Nutritional Status (by BMI for Age and Sex) between Boys and Girls

Nutritional Status	Boys (n = 198) n (%)		Girls (n = 167) n (%)		P value*
Underweight	33	(16.7)	24	(14.4)	0.549
Normal	125	(63.1)	108	(64.7)	0.749
Overweight	15	(7.6)	20	(12)	0.156
Obese	25	(12.6)	15	(9)	0.271

*Z test was done to measure the level of significance.

While nutritional status (as per BMI) of boys and girls of total studied children were compared, no significant difference was found **(Table-6).**

Table-7: Comparison of Nutritional Status (by BMI for Age and Sex) between Urban and Rural Boys

Nutritional Status	Urban boys (n = 91) n (%)		Rural boys (n=107) n (%)		p value*
Underweight	10	(11)	23	(21.5)	0.048
Normal	44	(48.3)	81	(75.7)	0.001
Overweight	13	(14.3)	2	(1.9)	0.001
Obese	24	(26.4)	1	(0.9)	0.001

*Z test was done to measure the level of significant.

However, proportions of overweight and obesity were more in urban boys 13 (14.3%) and 24 (26.4%) respectively than rural boys 2 (1.9%)and 1 (0.9%) respectively) which is statistically significant (p = 0.001 in obese) (Table-7). Among boys, proportion of underweight was found significantly higher in rural areas 23 (21.5%), compared to urban areas 10 (11%) (p = 0.048).

Table-8: Comparison of Nutritional Status (by BMI for Age and Sex) between Urban and Rural Girls

Nutritional Status	Urban girls (n = 79) n (%)		Rural girls (n = 88) n (%)		p value*
Underweight	3	(3.8)	21	(23.9)	0.001
Normal	46	(58.2)	62	(70.4)	0.099
Overweight	17	(21.5)	3	(3.4)	0.001
Obese	13	(16.5)	2	(2.3)	0.001

*Z test was done to measure the level of significant.

Similar dominance of proportion of overweight and obesity were found in urban girls 17 (21.5% overweight and 13 (16.5%) obese over rural girls (3 (3.4%) overweight and 2 (2.3%) obese) (p = 0.001). Among girls, proportion of underweight was found significantly higher in rural areas 21 (23.9%), compared to urban areas 3 (3.8%) and the difference was also significant between urban and rural girls (p=0.001). **(Table-8)**

Discussion

Childhood obesity is one of the most widespread medical problems with a rapidly increasing prevalence in both rural and urban areas of both developed and developing countries as well [3]. The BMI for age and sex is a widely used method to determine and classify overweight and obesity. Repeated prevalence study helps to understand present prevalence as well as trend of childhood overweight and obesity in the society. This may help in decision making in respect to establish alternative strategy. Current study is an exploratory study and has been conducted among children aged 6-12 years from two purposively selected schools of two socio-economic backgrounds. School children were selected as they are easy to collect and they are more vulnerable. Among 365 students of current study, 170 (46.6%) were from urban and 195 (53.4%) were from rural schools.

In present study, 30 (17.6%) children were estimated as overweight and 37 (21.8%) were obese in urban area. The proportion of overweight and obesity was found very high, as urban group of studied children were selected from an English-medium school of Dhaka city, where students were from affluent society. A total of 67 (39.4%) children of urban school were either obese or overweight, which is almost similar to another study conducted in same city in 2006, where estimated proportion of either obese or overweight children was 41.5%[24]. Proportion of obesity (17.6%). This may suggest that a true population shift in weight distribution has occurred. Intervention programs must therefore aim to target all students, with the broad goal of shifting the BMI curve back toward a healthier distribution. Higher frequency of obesity (24%) over overweight (19%) was also reported amongst New York elementary school children[25]. This among urban children in present study 37 (21.8%) is much higher than overweight children 30 similarity suggests that the trend of nutritional status is gaining similarity with most affluent parts of world.

In present study, corresponding frequency of overweight and obese children in rural area were 5 (2.6%) and 3 (1.5%) respectively. A study among school children in the Union Territory of Puducherry, India found more or less similar findings (overweight 4.4%, obese 2.1%)[26]. The proportion of underweight in rural area in present study was as much as 44 (22.6%,) whereas in urban area it was 13 (7.6%) only. The difference suggests that, double burden of both underweight and overweight children exist in same country. This may suggest that the target of intervention needs to be different in urban and rural area as in urban population the problem is more of over nutrition and in rural area it is under-nutrition.

In this study, combined proportion of overweight and obesity was found significantly higher in urban boys 13 (14.3%)(40.7%) and girls 17 (21.5%)(38%) than in rural boys 2 (1.9%)(2.8%) and girls 2 (2.3%)(5.7%). A cross-sectional study, conducted in the National Capital Territory of Delhi, India, including 5-18 year aged students of all schools, also found enormous dissimilarity of overweight and obesity prevalence in between high income and low income group of students, where prevalence of overweight and obesity in boys of high income and low income group was 21.2% and 2.4% respectively and in girls of high income and low income group was 22.1% and 2.8% respectively[27]. This difference

may be multi-factorial which includes difference in socio-economic condition, life style, availability of food, dietary habit, sedentary activity etc. Multiple strategies to combat this difference are needed.

Conclusion

This study has identified a significant prevalence of overweight and obesity among urban school-going children aged 6-12 years. Both male and female individuals are equally impacted. Undernutrition is more prevalent among rural school pupils, impacting both males and females.

References

1. GBD Obesity Collaborators. Health Effects of Overweight and Obesity in 195 Countries over 25 Years. N. Engl. J. Med. 2017;6: (1):13–27. doi: 10.1056/NEJMoa1614362. Epub 2017 Jun 12.

2. Corvalán, C.; Garmendia, M.L.; Jones-Smith, J.; Lutter, C.K.; Miranda, J.J.; Pedraza, L.S.; Popkin, B.M.; Ramirez-Zea, M.; Salvo, D.; Stein, A.D. Nutrition Status of Children in Latin America. Obes. Rev. 2017; 18 (52):7–18.

3. McPherson, K. Reducing the global prevalence of overweight and obesity. Lancet. 2014 August 30; 384 (9945): 728–730. :doi.org/10.1016/S0140- 6736(14) 60767-4

4. Subas Neupane , K C Prakash , David Teye Doku. Overweight and obesity among women: analysis of demographic and health survey data from 32 Sub-Saharan African Countries. BMC Public Health. 2016 ;13:16-30. doi: 10.1186/s12889-016-2698-5.

5. Doycheva I, Watt KD, Rifai G, et al. Increasing burden of chronic liver disease among adolescents and young adults in the USA: a silent epidemic. Dig Dis Sci. 2017;62(5):1373–1380. doi:10.1007/s10620-017-4492-3

6. Wang JJ, Gao Y, Lau PWC. Prevalence of overweight in Hong Kong Chinese children: its associations with family, early-life development and behaviors-related factors. J Exerc Sci Fit. 2017;15(2):89–95. doi:10. 1016/j.jesf.2017.10.001

7. Gille D, Bütikofer U, Chollet M, et al. Nutrition behavior of the middle-aged and elderly: compliance with dietary recommendations of the food pyramid. Clin Nutr. 2016;35(3):638–644. doi:10.1016/j.clnu.2015.04.002

8. Sahoo K, Sahoo B, Choudhury A, Sofi N, Kumar R, Bhadoria A. Childhood obesity: causes and

consequences. J Fam Med Prim Care. 2015;4(2): 187–192. doi: 10.4103/2249-4863.154628

9. Monteiro CA, Cannon GJ. The role of the transnational ultra-processed food industry in the pandemic of obesity and its associated diseases: problems and solutions. World Nutr. 2019;10(1) :89-99. doi:10.26596/wn.201910189-99

10. Liu D, Fang HY, Zhao LY, Yu DM, Long JM, Zhao WH. Study on the relationship between family-related factors and obesity of children and adolescents aged 6–17 years. Zhonghua Liu Xing Bing Xue Za Zhi. 2018;39(6) 720-723. doi:10.3760/cma.jissn.0254-6450.2018.06.005

11. Abd Elmoaty AA, Imam MHR. Effect of low calories diet to decrease weight of obesity. J Home Econ. 2015;25(1): 179-194. doi:10.21608/ mkas. 2015. 171288

12. Pyper E, Harrington D, Manson H. The impact of different types of parental support behaviours on child physical activity, healthy eating, and screen time: a cross-sectional study. BMC Public Health. 2016;16(1): 568. doi:10.1186/s12889-016-3245-0

13. Oninla SO, Owa JA, Onayade AA, Taiwo O. Comparative study nutritional Status of urban and rural Nigerian school children. J Trop Pediat . 2007; 53(1): 39-43. DOI:10.1093/tropej/fml051

14. Popkin B, Ng SW. The Nutrition Transition in High and Low-Income Countries: What are the Policy Lessons? Agricultural Economics. 2007;37(1): 199-211. DOI:10.1111/j.1574- 0862.2007. 00245.x

15. Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of Obesity in the United States, 2009–2010. NCHS Data Brief. 2012 ;82:1-8.

16. May, A.L.; Freedman, D.; Sherry, B.; Blanck, H.M.; Centers for Disease Control and Prevention. Obesity— United States, 1999-2010 MMWR Surveill Summ. 2013, 62 (3): 120–128.

17. Koirala, M.; Khatri, R.; Khanal, V.; Amatya, A. Prevalence and factors associated with childhood overweight/obesity of private school children in

18. Ahmed T, Ahmed AMS: Reducing the burden of malnutrition in Bangladesh. BMJ 2009; 339:4490.

19. Ahmed SMM, Islam MS, Razzaque A, Ahmed T. Socioeconomic differentials of childhood obesity among school children in the context of affluent society of Dhaka City. In 11th Annual Scientific Conference (ASCON). Dhaka, Bangaldesh: icddr,b 2007; 129.

20. Singh AS, Mulder C, Twisk JW, van Mechelen W, Chinapaw MJ. Tracking of childhood overweight into adulthood: a systematic review of the literature. Obes Rev 2008; 9 (5):474-488. doi: 10.1111/j.1467-789X.2008.00475.x. Epub 2008 Mar 5

21. Whitaker RC, Wright JA, Pepe MS, Seidel KD, Dietz WH. Predicting obesity in young adulthood from childhood and parental obesity. N Engl J Med 1997 Sep; 337 (13):869–73. doi: 10.1056/NEJM 19970 9253371301

22. Bangladesh Bureau of Statistics: Statistical Pocket book of Bangaldesh 2007.Dhaka Bangladesh: Bangladesh Bureau of Statistics; 2007.

23. Mirelman A, Koehlmoos TP, Niessen L. Risk-attributable burden of chronic disease and cost of prevention in Bangladesh. Global heart 2012;7(7): 61–66. DOI:10.1016/j.gheart.2012.01.006

24. Mohsin F, Tayyeb S, Baki A, et al. Prevalence of obesity among affluent school children in Dhaka. Mymensingh Med J . 2010 ; 19(4): 549-54.

25. Thorpe LE, List DG, Marx T, et al. Childhood Obesity in New York City Elementary School Students. Am J Public Health. 2004; 94(9): 1496-1500.

26. Mahajan PB, Purty AJ, Singh Z, 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(1): 45-50.

27. Kaur S, Sachdev HPS, Dwivedi SN, et al. Prevalence of overweight and obesity amongst school children in Delhi, India. Asia Pac J Clin Nutr. 2008; 17(4): 592-596