Open Access

ISSN: 2617-0817 E-ISSN: 2789-5912

Original Article

Obesity prevalence among school going children - A cross-sectional Study in a tertiary care hospital

DOI: dx.doi.org

Bahauddin[1*], Mohammad Thoufiqul Islam[2], Mohamed Ziaur Rahman[3], Rifath Nawrin Ovi[4], Farhana Hussain Sadia[5], Arunima Datta[6]

Received: 24 Jan 2024
Accepted: 26 Jan 2024
Published: 28 Feb 2024

Published by:
Sher-E-Bangla Medical College, Barishal, Bangladesh

*Corresponding Author

ABSTRACT

Background*: Childhood obesity is a major concern in Bangladesh, as in many parts of the world. With socio-economic transition and rapid urbanization in recent years, the prevalence of childhood obesity in Bangladesh is expected to rise. This study was designed to see the prevalence and risk factors of childhood obesity among school children in Sylhet.* ***Methods****: A cross-sectional study was conducted among students of class six to ten of four rural high schools. Demographic and anthropometric data were collected and BMI was calculated. The students were categorized as underweight, normal weight and overweight and obese based on International Obesity Task Force (IOTF) cutoff values. Logistic regression analysis was done to see the association of various factors with childhood obesity. P value of ≤ 0.05 was taken a significant.* ***Results****: Total 587 students were included in this study. Age varied from 10 to 18 years. Among them 10.9% and 3.6% were found to be overweight and obese respectively. Obesity was significantly higher among girls than boys (17.7% versus 11.1%). Low level (2 hours/day) screen time and consumption of fast food were found to be associated with childhood obesity. Breakfast skipping, mode of transport to school and sleep duration were not found as significant risk factors of obesity.* ***Conclusion****: Prevalence of overweight and obesity is high among rural school children in Sylhet. Obesity is higher among girls. Fast food, high screen time and less physical activity are important factors of childhood obesity.*

Keywords: *Prevalence, Obesity, Children, Bangladesh*

(The Planet 2024; 8(1): 291-296)

1. *Assistant Professor, Department of Physiology, Sunamganj Medical College, Sunamganj, Bangladesh*
2. *Assistant Professor, Department of Cardiology, Sunamganj Medical College, Sunamganj, Bangladesh*
3. *Senior Consultant, Department of Medicine, Sylhet MAG Osmani Medical College Hospital, Sylhet, Bangladesh*
4. *Assistant Professor, Department of Physiology, Jalalabad Ragib Rabeya Medical College, Sylhet, Bangladesh*
5. *Lecturer, Department of Physiology, Sunamganj Medical College, Sunamganj, Bangladesh*
6. *Lecturer, Department of Physiology, Sunamganj Medical College, Sunamganj, Bangladesh*

INTRODUCTION

Obesity is defined as an excess of body fat. In clinical and epidemiological studies, body mass index (BMI) is widely used to measure body fat. Age and gender specific BMI cut offs are used to define childhood obesity because children's body composition varies as they grow. [1,2] According to International Obesity Task Force (IOTF) criteria, for children 2 to 18 years, a BMI for-age ≥25 kg/m2 is defined as childhood overweight and a BMI for-age ≥30 kg/m2 as childhood obesity. [3] The general term childhood obesity includes both childhood overweight and obesity. Childhood obesity is increasing rapidly worldwide both in developed and developing countries. In 2013, the Global Burden of Disease estimated that 32.8% of boys and 22.6% of girls in developed countries were overweight or obese. During the same period, the prevalence increased from 8.15% to 12.9% in boys and from 8.4% to 13.4% in girls in developing countries. [4] The rising trends in children's and adolescents' BMI have plateaued in many high-income countries, albeit at high levels, but have accelerated in parts of Asia.[5] Trends in mean BMI have recently flattened in northwestern Europe for boys, and central and Andean Latin America for girls. By contrast, the rise in BMI has accelerated in east and south Asia for both sexes, and in the Southeast Asia for boys. Global age-standardized prevalence of obesity increased from 0.7% in 1975 to 5.6% in 2016 in girls, and from 0.9% in 1975 to 7.8% in 2016 in boys. [5] In sub-Saharan Africa where countries are still developing, there is growing evidence of increasing overweight and obesity among school children. [6, 7] Lack of physical activity, high level of screen time (watching TV and playing e-games), lack of sleep, breakfast skipping, high intake of sugar-sweetened beverages is associated with obesity among children. [8, 9] Studies from developed and developing countries have linked higher SES to obesity prevalence. In developing countries, nutritional transition and lifestyle changes associated with rapid urbanization, globalization and

ISSN: 2617-0817 E-ISSN: 2789-5912

industrialization are major contributing factors towards unhealthy lifestyles. [8,10] Due to economic transition to a middle-income country and rapid urbanization, unhealthy food habits and physical inactivity, childhood obesity is also increasing in Bangladesh. The psychological consequences of childhood obesity include social stigmatization, subject to bullying, poor body image, low self-esteem, stress, depression and anxiety, poor academic performance and diminished quality of life. [11] Obese children are more likely to become obese adults and more likely at risk of obesity-associated diseases including dyslipidemia, hypertension, ischemic heart disease, type 2 diabetes mellitus (T2DM), steatohepatitis, gall stone diseases, osteoarthritis, obstructive sleep apnea and metabolic syndrome. [11] More important, childhood obesity is associated with premature onset of obesity associated complications; particularly type 2 diabetes mellitus and ischemic heart disease. [12] It is associated with overall increased adult mortality. [13] Childhood obesity is preventable but difficult to cure. A good understanding of the current obesity status may help to address this growing public health concern. In view of the above consideration, this study was aimed at finding out the prevalence of, and factors contributing to childhood obesity in Sylhet.

METHODS & MATERIALS

Study design: This was a cross-sectional descriptive study.

Study period: The study was carried out during the period July 2018 to June 2019.

Study place: This study was conducted in the Department of physiology, Sylhet MAG Osmani Medical College, Sylhet, Bangladesh.

Study population: The study population consisted of 10-18 years old school children attending secondary schools in Jaintapur Upazila, a rural area located in the northeast part of Sylhet district of Bangladesh.

Sampling technique: A multistage stratified systematic random sampling was used. Out of 11 upzilas of Sylhet district, one was selected randomly by lottery. Thereafter, from a list of secondary schools obtained from the upzila Secondary Education Office, Jaintapur, Sylhet, four schools were selected randomly by lottery. Samples were collected from each class (class 6 to class 10). In each class, sampling was stratified on gender, so that girls could be sampled separately from boys.

Enrollment criteria

Inclusion criteria:

In each school, all apparently healthy school children between l0 and 18 years were considered eligible.

Exclusion criteria:

Exclusion criteria were known medical conditions, like diabetes, hypothyroid etc. None of the student was, however, excluded from the study.

Sample size: A minimum sample size of 246 was estimated based on the overweight/obesity prevalence of 20% in Bangladesh [14] using the formula for prevalence studies: n=z 2 pq/d2. [15] This was multiplied by design effect [15] for cluster sampling of 2 [16] to give a sample of 492. A sample of 587 deemed sufficient.

Sample size calculation:

Formula for sample size for prevalence studies

$n = z^2 pq/d^2$

= 492

*Design effect for childhood obesity is 2. [16]

Independent variables: The independent variables of the study were grouped under three headings: sociodemographic variables, physical activity and sedentary behaviors and dietary behaviors. The socio-demographic variables were: age, gander (girls and boys), parental education level, socio-economic status (SES), which in turn, was calculated based on three variables such as education of the head of family, occupation of the head of the family and total monthly income of the family. The physical activity and sedentary behavior related variables included physical activity, modes of transport to and from school, screen time and sleep duration. Dietary behavior related variables were: fast food consumption, breakfast skipping and buying foods at school. Kuppuswamy Socio-economic Scale updated for the year 2019 was used to calculate the SES of the family of the school child.[17] The scale has included three parameters and each parameter is further classified into subgroups. The three parameters are education of the head of the family, occupation of the head of the family and total monthly income of the family. Scores have been allocated to each subgroup. Scores obtained in each parameter are added up to get the final scores. Scores of the Kuppuswamy socio-economic scale rage from 3 to 29. It classified families into five groups: upper class, upper middle class, lower middle class, upper lower class and lower class. For the purpose of analysis, we classified the families into upper class, middle class (merging upper middle class and lower middle class) and lower class (merging upper lower class and lower class), obtaining Kuppuswamy scores 26-27, 11-25 and 3-10 respectively.

The dependent variables: The dependent variables of the study were height, weight, BMI, total blood cholesterol, and random blood glucose. BMI was used to calculate the body weight status of the children. According to International Obesity Task force (IOTF) criteria, the body weight status of the children was classified as underweight (thinness), normal weight, overweight and obesity. [3] For the purpose of analysis, we collapsed underweight and normal weight into one variable non-obese and overweight and obesity into one variable, obese.

Statistical Analysis: Data analyses were done using statistical package for social science (SPSS) version 24.0. Normality of distribution of continuous variables (age, height weight, BMI, blood cholesterol and glucose levels) was assessed by using histogram. All the continuous variables were found to have normal distribution. Mean and standard deviation were calculated for continuous variable. Frequency and percentage were calculated for categorical variables. Chi-square test was conducted to test the significance of difference of categorical variables: gender, dietary behavior, physical activity and sedentary behavior among obese and nonobese school children. Because some cells in the cross table had counts <5, Fisher's Exact test was done for comparison of SES and parental education among obese and non-obese children.

ISSN: 2617-0817 E-ISSN: 2789-5912

Student's independent t-test was performed to test the significance of difference of continuous variables blood cholesterol and blood glucose among obese and non-obese children. Multiple logistic regression analysis was done to identify the factors (predictors) associated with childhood obesity in Sylhet. Variables that correlated (p=0.05) in bivariate analysis were included in the model. Significance level was set at p = 0.05, 95% confidence limits.

RESULTS

A total of 587 students of class six to class ten from four secondary schools were enrolled in the study. Among the 587 enrolled students 300 (51.1%) were girls and 287 (48.9%) were boys. The age of the children ranged from 10 to 18 years, with mean (±SD) age of 14.2 (±1.76) years. The mean (±SD) age of the girls was 14.07 (±1.62) years, and of the boys was 14.52 (±1.86) years. The socio-economic status of school children was classified as lower, middle and upper according to Kuppuswamy socio-economic scale updated for the year 2019 (Appendix 5). Most of the students (n=467; 79.5%) belonged to lower socio-economic class. One fifth of the students (n=119, 20.30%) came from middle class. Only are student (0.2%) belonged to upper class. The pattern of the educational level of the mothers and fathers was almost similar, with the exception that more fathers were graduate than mothers, 28 (4.8%) versus 4(0.7%). The educational level achieved by most of the parents was primary school certificate (PSC), by nearly half of the parents.

Table – I: Age distribution of the school children

Gender			Mean age (±SD) years
	Frequency	Percentage	
Girls	300	51.1	14.07±1.72
Boys	287	48.9	14.52±1.86

Table – II: Physical activity and mode of transport to school

Indicator	Frequency	Percentage
Physical activity level Low (<30 min/d)	206	35.1
Medium (30 min-<1 h/d)	61	10.4
High(≥1h)	320	54.3
Mode of transport of school Active School transport (Walking/cycling)	423	72.1
Non active School transport	64	27.9

Total number of students =587 Mean screen (±SD) time was 1.11 (±1.07) h/d. About one third students spent ≥2 h/d on the screen (Table 15). Mean (±SD) sleep duration of the students was 7.3 (±1.33) h/d. 57.8% students slept <8 h/d and 42.2% slept ≥8 h/d (Table11).

Table – III: Dietary behaviors of the school children

Variable[1]	Frequency	Percentage
Fast food consumption		
Yes	157	26.7
No	430	73.3
Breakfasts kipping		
Yes	57	9.7
No	530	90.3
Buying foods at school		
Yes	365	61.7
No	225	38.3

Total number students=587; 1. Fast food: Mass-produced, ready- to-eat foods served promptly after ordering, like, sandwich, burgers, hot dog, fried chicken, French fries, etc. yes=3 times/week; c. no=3 times/week;

Dietary behaviors of the school children in the study included the following variables: fast food consumption, breakfast skipping and buying foods at school. Responses related to all these variables were dichotomized as 'yes' (≥3 times/week) or 'no' (<3 times/week), detailed in the methodology. Table 16 summarizes the dietary behaviors of the school children. Fast food was consumed by about one fifth of the school children (26.7%; n=157). Only on tenth of the students (9.7%; n=57) skipped breakfast. More than half of students (61.7%; n=365) bought foods at school (Table 3).

ISSN: 2617-0817 E-ISSN: 2789-5912

Table – IV: Anthropometric characteristics of the school children in Sylhet

Variable	Overall	Girls	Boys
Weight mean (±SD) (kg)	43.63 (±10.65)	41.9(±9.78)	45.43(±11.239)
Height (m)	1.53 (0.09)	1.49(±0.06)	1.57(±0.11)
BMI	18.4 (±3.61)	18.6(±3.89)	18.1(±3.28)

Anthropometric characteristics included in this study were measurement of body weight and height, and computation of BMI from the body weight and height. The results are presented in Table 4. The mean (±SD) weight of the school children was 43.63 (±10.65) kg and the weight range was 21 to 83 kg. Mean (±SD) weights of the girls and boys were respectively 41.9 (±9.78) kg and 45.43 (±11.23) kg. The mean (±SD) height of the school children was 1.53 (±0.09) meters and the height range was 1.15 to 1.75 meters. The mean (±SD) height of the girls was 1.49 (±0.06) meters and of boys was 1.57 (±0.11) meters. The mean (±SD) BMI was 18.40 (±3.61) and the BMI range was 11.03 to 31.63. The mean BMIs of girls and boys were almost similar, 18.61 and 18.18.

Table – V: Body weight status of school children in Sylhet

	Overall(n=587)		Girls(n=300)		Boys(n=287)	
Bodyweight status[1]	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Under weight	76	12.9	36	12	40	13.9
Normal weight	426	72.6	211	70.3	215	74.3
Over weight	64	10.9	40	13.3	24	8.49
Obesity	21	3.6	13	4.3	8	2.8

The body weight status of the school children was classified as underweight (thinness), normal weight, overweight and obesity according to International Obesity Task Force (IOTF) cutoff values of 17 kg/m2, 25 kg/m2 and 30 kg/m 2 respectively (detailed in methodology). The overall overweight (BMI≥25 kg/m^2) and obesity (BMI≥30 kg/m2) prevalence were 10.9% and 3.6% respectively. Overall normal weight (BMI 17-25 kg/m2) was 72.6% and underweight or thinness (BMI <17 kg/m^2) was 12.9%. Girls were found to be more overweight (13.3% versus 8.4%) and more obese (4.3% versus 2.8%) than boys. But the prevalence of normal weight and underweight were almost equal in girls and boys (Table 5). Therefore, for the purpose analysis, the school children were reclassified as obese (collapsing overweight and obese) and non-obese (collapsing underweight and normal weight).

Table – VI: Prevalence of obese and non-obese among school children in Sylhet

	Overall		Girls		Boys	
Variables[1]	Frequency	%	Frequency	%	Frequency	%
Obese	95	14.5	53	17.7	32	11.1
None-obese	502	85.5	247	82.3	245	88.9

Among the studied school children 14.5% (n=85) were found to be obese and 85.5% (n=502) were found to be non-obese. More girls (17.7%) than boys (11.1%) were obese (Table 6). Distribution of obesity as a function of gender, physical activity level, screen time and fast food consumption among school children in Sylhet Gender and obesity prevalence. Among the girls, 17.7% (n=53) were obese; whereas, 11.1% (n=32) of the boys were found to be obese. More girls were found to be obese (17.7%) than boys (11.1%). This gender difference was found statistically significant (p=0.026). Statistically significant association was also found between childhood obesity and belonging of the children to middle and higher SES (p=0.000). No significant difference of parental educational levels between obese and nonobese children was found.

DISCUSSION

This study assessed the prevalence of obesity and the socio-economic and behavioral (physical activity- and diet-related) risk factors (predictors) associated with it among school children in Sylhet. The overall prevalence of obesity among school children in Sylhet was found to be 14.5%; overweight was 10.9% and obesity was 3.6%. Additionally, the prevalence of underweight (thinness) was found 12.9%. Socio-demographic and physical activity- and diet-related behavioral risk factors found to be associated with childhood obesity among school children in Sylhet were female gender, higher SES, low level of physical activity, high screen time and fast-food consumption. But the major predictors were: low physical activity level, high screen time and fast-food consumption. Obese children had higher metabolic co-morbidities. Total blood cholesterol and blood glucose levels were significantly higher in the obese than in the non-obese children. Approximately one in every four children (25.58%) has high normal (170-200 mg/d) blood cholesterol level. In this study, overall prevalence of overweight/obesity among school children was found 14.5%, supporting results from previous studies in Sylhet. In a study conducted in 2014 Saha

ISSN: 2617-0817 E-ISSN: 2789-5912

et al [19] reported childhood overweight/obesity 14.2% in the urban area of Sylhet. Another study also from urban area of Sylhet found childhood overweight/obesity 18.6%. The participants in these two studies were younger, 10-14 years and 5-14 years respectively. The prevalence childhood overweight/obesity is also consistent with the findings of a nationwide cross-sectional study. [16] Study form other South Asian counties showed similar rates of overweight/obesity. A study from Sri Lanka reported childhood overweight/obesity 14.9% (Karuppiah and Markandu 2018).[20] In the present study underweight was found 12.9%. It was 17.6% in the research by Bulbul & Hoque (2014).[16] The prevalence of underweight was found to be decreasing. The observed trend in the prevalence of childhood obesity and underweight is mostly consistent with the economic transition and urbanization in the region. We found higher prevalence of overweight/obesity in the girls compared with boys. Higher prevalence of obesity in girls has been reported in numerous studies. Ullah et al. (2014) [9] reported a higher prevalence of overweight/obesity in the girls. But this finding deferred from that of Bulbul & Hoque (2014).[16] The gender difference in the overweight/obesity prevalence may be due to potential differences in the energy needs between boys and girls, in the timing of sexual maturation, and in the level of physical activity. Religious beliefs and traditional customs in this region are that adolescent girls should not play outdoor games with boys in the play ground. In the present study, we found that most of the girls did not take part in outdoor games. This may be a risk factor for childhood obesity. Positive association was found between overweight/obesity and higher SES, finding supportive of results from previous studies.[19] Thus, affluent children may resort to a relatively inactive life style. Physical activity ≥1 h/d more than twice a week has a significant independent inverse relationship with overweigh and obesity. The association of physical activity with overweight/obesity accords with previous studies (Ahmed et al. 2016).[21] Mushtaq et al [10] also found significant association of physical inactivity with childhood obesity. In the present study, we found higher prevalence of obesity among children with screen time >2h/d. This is consistent with previous studies. Result from a systematic review of 232 studies involving school children of 5 to 17 years suggested that watching TV >2 h/d was associated with higher prevalence of childhood obesity. [22] Peck et al (2015) [23] reported that viewing as little as 1 h of TV daily was associated higher chance of overweight/obesity in children. Similarly, results from a recent meta-analysis of 14 cross sectional studies and 4 reports involving 106,169 children suggested that increased TV watching was associated with a higher risk of childhood obesity. [24] Several potential mechanisms have been postulated to explain the link between screen time and 99 obesity. These include limited available time to engage in outdoor games leading to overall reduced physical activity and increased energy intake via snacking while watching TV. Unlike other studies [25, 26] no association was found with overweight/obesity and mode of transport to school. Many previous studies found significant association of shorter sleep duration with childhood obesity [27,28]. We found significant association between consumption of fast food and childhood obesity, which is consistent with other studies. [19] Due to aggressive advertising practices, relatively low cost of energy-dense foods and improved purchasing power, children are consuming foods high in saturated fat and refined carbohydrates, diets low in polyunsaturated fatty acids, and sweetened carbonated beverages. [11] These foods are calorie-dense but micronutrien-poor and may be responsible for childhood obesity. Breakfast skipping was not found to be associated with obesity in this study, unlike others. [10,8] This may be due to the fact that only a negligible number of participants in the study were found to skip breakfast. Regression analysis-major predictors of childhood obesity from regression analysis, we found female gender, low level of physical activity, consumption of fast food and high screen time to be important predictors of childhood obesity.

RECOMMENDATION

The following recommendation can be made First, large-scale nationwide survey should be conducted for an in-depth analysis of the prevalence and factors influencing overweight and obesity among school children. Further longitudinal studies involving these factors are warranted to establish the temporal nature and causality of their association among both girls and boys. Second, a national strategy for diet and physical activity should be developed and a preventive program should be initiated, considering the dietary behaviors, physical activity and sedentary life style associated with childhood obesity and the socio-demographic factors affecting these. Countrywide awareness programs to spread healthy message on good nutrition and healthy dietary habits should be initiated. Legislative measures on unhealthy food marketing and aggressive advertisement of these foods may be taken. Third, at the family level, the parents should play a role model in practicing healthy life styles and healthy dietary habits. Family based and culturally relevant behavioral intervention should be implemented. Watching TV and playing video games may represent an important area of intervention targeting obesity prevention in children. At the home level, parents could consider restricting time spent on the screen among school children. Finally, physical activity and nutrition education should be included in the school curriculum. Cheap and healthy foods may be made available in school canteen. Intervention strategies need to take consideration of gender differences and cultural perception.

CONCLUSION

Prevalence of overweight and obesity is high among rural school children in Sylhet. Obesity is higher among girls. Fast food, high screen time and less physical activity are important factors of childhood obesity.

Strength and Limitations of the Study

The key strength of the present study is the representativeness of the sample with inclusion of samples from four schools of a rural area of Sylhet. The findings can be generalized to children in rural area of Bangladesh and other South Asian countries. The results can also be generalized to

other low- and middle-income countries throughout the world, sharing the same environmental factors with the study sample. I would like to acknowledge a number of limitations of the study. Firstly, the study design was cross-sectional; therefore, inference of causality could not be made. Secondly, the use of self reported rather than objectively measured ambulation on physical activity and sedentary behavior is likely to have been subjected to recall bias and measurement errors. The self reported data on parental education level, family income and children's dietary behavior may have its inherent characteristics including social desirability and misreporting. Finally, data on an important compounder, parental BMI was not calculated. Despite these limitations, the data collection was reliable and reflected what has been reported in the literatures on the issue of childhood obesity.

Conflict of Interest: None.
Source of Fund: Nil

REFERENCES

1. *Hammer, L.D., Kraemer, H.C., Wilson, D.M., Ritter, P.L. and Dornbusch, S.M., Standardized percentile curves of body mass index for children and adolescents, American Journal of Diseases of Child, 145, pp. 259-263.*
2. *Pietrobelli, A., Faith, M.S., Allison, D.B., Gallagher, D., Chiumello, G. and Heymsfield, S.B. 1998, Body mass index as a measure of adiposity among children and adolescence: A validation study, Journal of pediatrics, 132, pp. 204-210.*
3. *Cole, T.J., Flegal, K.M., Nicholls, D. and Jaction, A.A. 2007, Body mass index cut offs to define thinness in children and adolescents: international survey, BMJ, 335, pp. 194-201.*
4. *Marie Ng, Fleming T, Robinson M, Thomson B, Greatz N, Margono C. et al. 2014, Global, regional and national prevalence of overweight and obesity in chilrden and adults 1980-2013: A systematic analysis, Lancet, 384. pp. 766-81.*
5. *NDC Risk Factor Collaboration, 2017, Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975-2016: a pooled analysis of 2416 population-based measurement studies in 128.9 million children, adolescents, and adults, Lancet, vol.390, pp. 2627-42.*
6. *Muthuri, S.K., Francis, C.E., Wachira, L-J.M., LeBlanc, A.G., Sampson, M. and Onywera, M.K. et al. 2014, Evidence of overweight/obesity transition among school-aged children and youth in Sub-Saharan Africa: A systematic review, PLoS ONE, 9(3), pp. e92846-71*
7. *Negash, A., Agyemang, C., Matsha, T., Peer, N., Erasmus, R.T. and Kengne, A.P. 2017, Differential prevalence and associations of overweight and obesity by gender and population group among school learners in South Africa: a cross-sectional study, BMC Obesity, 4(29), pp. 1-8.*
8. *Adom, T., Viliers, A.D., Puoane, T. and Kengne A.P. 2019, Prevalence and correlates of overweight and obesity among school children in an urban district in Ghana, BMC Obesity, 6, pp. 14-24.*
9. *Ullah, M.O., Hasan, M.A., Rahman, M.M., Chowdhury, A.H., Das, N.C., Uddin, M.J. and Uddin, M.T. 2014, Obesity of primary school children: A cross sectional study in Bangladesh, International Journal of Scientific and Engineering Research, 5(12), pp. 263-270.*
10. *Mushtaq, M.U., Gull, S., Mushtaq, K., Shahid, U., Shad, M. A. and Akram, J. 2011, Dietary behaviors, physical activity and sedentary life style associated with overweight and obesity, and their socio-demographic correlates, among Pakistani primary school children, International Journal of Behavioral Nutrition and Physical Activity, 8, pp. 130-142.*
11. *Gupta, N., Goel, K., Shah, P. and Misra, A. 2012, Childhood obesity in developing countries: Epidemiology, determinants, and prevention,. Endocrine Reviews, 33(1), pp. 48-70.*
12. *Ghosh, A. 2014, Explaining overweight and obesity in children and adolescents of Asian Indian origin: the Calcutta childhood obesity study, Indian J Public Health, 58, pp. 125-8.*
13. *Must, A. and Strauss, R.S. 1999, Risk and Consequences of Childhood and adolescent Obesity, International Journal of Obesity, 23 (suppl 2), pp. S2-S11.*
14. *Rauniyar, B.K., Jahan, S., Sultana, S., Hasan, M., Rahman, M.A. and Akter, Y. 2018, Prevalence of obesity is rising among primary school children in Dhaka city of Bangladesh, Diabetes Obes Int J, 3(3), pp. 1-6.*
15. *Naing, L., Winn, T. and Rusli, B. N. 2006, Practical issues in calculating sample size inprevalence studies, Archives of Orofacial Sciences, vol.1, pp. 9-14.*
16. *Bulbul, T. and Hoque, M. 2014, Prevalence of childhood obesity and overweight in Bangladesh: Findings from a countrywide epidemiological study, BMC Pediatr, 14, pp. 86- 92.*
17. *Saleem, S.M. 2019, 'Modified Kuppuswamy sociodemographic scale updated for the year 2019, Indian Journal of Forensic and Community Medicine, 6(10).*
18. *Kwiterovich, P.O. 2008, Recognition and management of dyslipidemia in children and Adolescents, J Clin Endocrinol Metab, 93(11), pp. 4200-4209. 109*
19. *Saha, M., Adhikary, D.K., Parvin, I., Sharma, U.R., Akhter, F. and Majumder, M. 2018, 'Obesity and its risk factor among school children in Sylhet, Bangladesh', J Nepal Health Res Counc, 16(3)9, pp. 205-8.*
20. *Karuppiah, D. and Markandu, M 2018, Prevalence of obesity, overweight and central obesity among adolescent girls in national school in Batticaloa district, Sri Lanka, Sri Lanka Journal of Diabetes, Endocrinology and Metabolism, 8(1), pp. 17-22.*
21. *Ahmed, M., Shah, K. and Kshirsagar, V.Y. 2016, Prevalence and risk factors for obesity in urban and rural school going children of Karad taluka, Maharashtra, India, Int J Contemp Pediatrics, 3(4), pp. 1389-1393.*
22. *Trembly, M.S., Leblanc, A.G., Kho, M.E., Saunders, T.J., Larouche, R., Colley, R.C. et al. 2011, Systematic review of sedentary behavior and health indicators in school-age children and youth, International Journal of Behavioral Nutrition and Physical Activity, 8, pp. 98-118.*
23. *Peck, T., Scharf, R.J., Conaway, M.R. and DeBoer, M.D. 2015, Viewing as little as 1 hour of TV daily is associated with higher chance in BMI between kindergarten and first grade, Obesity, 32(8), pp. 1680-1686.*
24. *Zhang, G., Wu, L., Zhou, L., Lu, W. and Mao, C. 2015, Television watching and risk of childhood obesity: a meta-analysis, European Journal of Public Health, 26(1), pp.13-18.*
25. *Denstel, K.D., Broyles, S.T., Larouche, R., Sermiento, O.L., Barreira, T.V., Chaput, J.P. et al. 2015, Active school transport and weekday physical activity in 9-11-year-old children from 12 countries, International Journal of Obesity Supplements, 5, pp. S 100-106.*
26. *Sarmiento, O.L., Denstel, K.D., Broyles, S.T., Larouche, R., Barreira, T.V., Chaput, J.P. et al. 2015,'Relationship between active school transport and adiposity indicators in school-age children from low-middle- and high-income countries, International Journal of Obesity Supplements, 5, pp. S107-S114.*
27. *Cain, N. and Gradisar, M. 2010, Electronic media use and sleep in school-aged children and adolescents: A review, Sleep Medicine, 11, pp. 735-742*
28. *Chaput, J.P. and Trembly, A. 2012, Insufficient Sleep as a Contributor to weight gain: An Update, Curr Obes Res,1, pp. 245-256.*