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Original Research Article

Socioeconomic and Lifestyle Factors of Childhood Obesity Among School Students in the Metro City of Western India: A Cross-Sectional Study

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Abstract:

Introduction: An increase in the prevalence of obesity among young people is anticipated by the year 2030, making this a serious public health concern. Obesity risk is increased by a low socioeconomic level (SES) and by family problems. The issue is perpetuated by traumatic experiences in early life and a lack of access to healthy foods. The problem is made much worse by urbanisation, technology, and sedentary lives, especially in India.

Aims and objectives: This cross-sectional study examines the relationship between childhood obesity and socioeconomic and personal characteristics in a large city in Western India.

Methods: a cross-sectional study of students by employing a randomised sampling technique that considered both school type and proportional allocation. This method collected data regarding demographics, eating patterns, and junk food consumption with the use of tool semi-structured survey administered during a single visit.

Results: 309 students from various religious and educational backgrounds are shown in Table 1. Table 2 presents gender-specific anthropometric and BMI results. Table 3 compares BMI to religious affiliation, parental education, occupation, and junk food consumption at different schools. Table 4 shows that private schools, Muslims & Christian religion and parents with professional or commercial backgrounds are likelier to have children with abnormal BMIs. Parent's education, occupation, and junk food intake had no significant relationships.

Conclusion: The study demonstrates that private schools have a major childhood obesity problem. Again, this study is limited by its cross-sectional methodology, Indian BMI classification, lack of physical activity and sexual maturity assessments.

Keywords: lifestyle, childhood, socio-economic, obesity.

Introduction

Undoubtedly, Obesity is one of the most significant public health problems of our day. Unbelievable modelling research in the USA predicts that by 2030, 55–60% of today's youth will be obese. Although incidence rates have often slowed down or reversed in communities with greater socioeconomic levels (SES), there are few clear signs that this overall growing trend will be stopped in the not-too-distant future,

particularly among low SES groups [1]. As more people grow fat and inactive, the adverse effects on society and individuals will only worsen their exposure to it lasts longer. Due to adaptations, including decreased energy expenditure and a rise in hormones that enhance hunger, obesity has proven resistant to standard treatments. Therefore, prevention is a crucial method that theoretically reduces population contact with common risk factors. It is crucial to identify these risk variables and to have a better understanding of how they interact. It is crucial to understand how these risk variables interact [2].

According to research, Obesity in children is highly predictive of obesity in adults and represents a pivotal age range in developing these conditions. Therefore, early preventative initiatives and better knowledge of risk factors in infancy as well as early childhood are clearly priorities. A growing body of research supports the theory that childhood adversity raises the risk of adult obesity [3]. Two in kids who experienced neglect or abuse, adult obesity rates clearly increased, according to two recent meta-analyses. According to the body weight set-point theory, childhood hardship can also impact the regulation of the amount of fatty tissue upward. over improved safety as well as survival and cause redistributions of peripheral fat to more excellent visceral locations due to psychological factors such as low self-worth, poor mental health, ongoing stress, ongoing inflammation, traumatic experiences, and increased appetite [4].

Socioeconomic Adversity

In nations that have adopted Western lifestyles, One of the significant risk factors for developing obesity plus many other dangerous health conditions, including diabetes, cancer, and mental health, is having bad socioeconomic situation issues. Low SES has several significant side effects, some of which are particularly relevant to obesity [5]. These include mental health (depression, anxiety), a lack of confidence and self-worth, feeling disempowered, tension, worry, negative belief systems, and negative emotions (rage, indifference, hopelessness, annoyance, guilt, and so on). Another indicator of low SES is financial hardship; it reduces access to nutrient-rich food and subtly promotes unsafe lifestyle choices such as eating improperly and frequently with lots of calories, getting sedentary, and having fewer opportunities over opportunities over healthy development and growth like education. Another sign of low SES is inadequate educational attainment or the capacity for critical thought, both enhancing susceptibility to harmful food marketing [6].

Family Dysfunction

Being a parent and starting a family are significant life changes that significantly increase expectations and duties, not only in terms of finances but also in terms of serving as the main catalyst for children's social, mental, and emotional development. During some of a child's most important developmental phases, the ideal social, psychological, or emotional nurture may be interrupted. It is generally known that children raised under these conditions are considerably more likely to have various detrimental health consequences related to the development of obesity, including mental health issues, addiction, and chronic inflammation]7]. Once stress, Since instability and emotional turmoil are imprinted in a person from an early age, they will naturally turn to the brain's reward system, with minimal help from cognitive processes, to alleviate these uncomfortable situations. owing to its high-calorie content, junk food possesses hedonic properties, making it an easy way to self-medicate through hedonic binge eating, which forms strong habits due to the amygdala and hippocampus changes. Therefore, children from discordant households are more prone to swiftly establish healthy but eventually dysfunctional eating habits where they

routinely consume high in energy junk food for emotional and stress-related relief and enjoyment than children from in-tune homes [8].

The two main causes of the rising prevalence of kid obesity are thought to be an energy-efficient yet inactive lifestyle or consuming high-calorie meals with questionable nutritional value. Overweight children are more inclined to remain that way as adults and are more prone to have chronic health conditions and illnesses as adults. 10% of people worldwide, including those aged 5 to 17, are overweight; nevertheless, regional differences in this frequency exist [9]. Numerous research revealed that throughout Asia and African sub-Saharan countries' prevalence of overweight and obesity was less than 2.3%. However, during the past three decades, Asia's continued economic expansion and rising economic stability have exacerbated the shifting lifestyles that have contributed to dietary problems and the emergence of chronic illness. Although juvenile obesity was formerly thought to be an issue that only existed in high-income nations, there is no clear evidence that this is changing in nations with low and medium incomes. Moreover, many people with low and moderate incomes in nations' metropolitan areas have greater obesity prevalence rates [10]. India is going through a rapid economic transformation and a nutritional transition linked to a shift in people's eating habits or levels of exercise, especially among the youth. Today's youth are disproportionately exposed to obesogenic environments. Children of all socioeconomic strata are now strongly dependent on highly processed, calorie-dense, affordable, and easily accessible meals that are low in nutrients due to recent urbanisation and globalisation [11]. The introduction of food ordering apps, more significant academic pressure having little to no time for outdoor pursuits, spending more time on screens and "pocket money," and parents' hectic work schedules all contribute to the problem's severity. Numerous Indian studies have noted a rise in the number of obese people, from 5.5% to 17%. Those from metropolitan regions were shown to have a greater obesity prevalence is higher than those in rural regions. The gap in the incidence of obesity among kids living in urban regions can be primarily attributed to changes in urban residents' lifestyles, particularly those of youngsters [12].

Methods

Study design

A cross-sectional study was conducted on 309 private and government sector school students. The total number of secondary school pupils (classes 8–10) enrolled in each school was compiled in a list. The schools were first divided into government, private aided, and private unaided institutions. The schools were chosen for each stratified group using simple random selection, and the kids were chosen using a proportionate allocation method based on the total number of students in each stratum.

Data was gathered throughout the course of one visit. A semi-structured survey was used. Students used an anonymous self-administered questionnaire to self-report their sociodemographic characteristics, dietary habits, and frequency of junk food consumption. Anthropometric characteristics were measured once the questionnaire had been finished. Measurements of height, weight, and BMI were made.

Inclusion and exclusion criteria

For the study, the total number of students in grades 8 through 10 was considered. Nevertheless, students who weren't in class that day were not included in the study. Schools were chosen until each group's minimum number of necessary students was reached.

Statistical analysis

The study used SPSS 25 for practical statistical analysis. The continuous data has been written in mean ± standard deviation, while the discrete data has been presented as frequency and its respective percentage. The study employed ANOVA as the statistical tool for its analysis. The level of significance was considered to be $P<0.05$.

Ethical approval

Each patient was explained about the study process, and consent was obtained from each of them. The Ethical Committee of the concerned hospital has approved the study process.

Results

The distribution of the study participants' characteristics is shown in Table 1. Out of the 309 participants, 35.6% attended unaided/private schools, 36.2% attended aided schools, and 29.8% attended government institutions. The proportions of boys and girls were practically equal. Only 11.9% of those who participated identified as Muslims, whereas around two-thirds of those surveyed identified as Hindus. The majority of the parents had completed their secondary schooling. 39.5% of fathers had unskilled labour, and more than two-thirds of women were homemakers, according to the parents' occupations. The majority of those who participated had a mixed or non-vegetarian diet. 15.6% consumed junk frequently (table 1).

Table 1: Baseline characteristics of participants

Variables	Number, percentage (%)
Type of school	
Aided	112 (36.2)
unaided /private	110 (35.6)
Government	92 (29.8)
Gender	
Female	152 (49.2)
Male	157 (50.8)
Religion	
Christian	72 (23.3)
Hindu	200 (64.7)
Muslim	37 (11.9)
Education of father	
Primary	102 (33.0)
Secondary	103 (33.3)
Higher secondary and above	76 (24.6)
Illiterate	28 (9.1)
Education of mother	
Primary	102 (33.0)
Secondary	103 (33.3)
Higher secondary and above	74 (23.9)
Illiterate	30 (9.7)
Occupation of father	
Skilled	76 (24.6)
Unskilled	122 (39.5)

Professional	54 (17.4)
Business	25 (8.0)
Unemployed	32 (10.3)
Occupation of mother	
Skilled	10 (3.2)
Unskilled	76 (24.6)
Professional	212 (68.6)
Business	3 (0.9)
Unemployed	8 (2.6)
Dietary habits	
non-vegetarian/mixed	300 (97.0)
Vegetarian	9 (2.9)
Frequency of junk food consumption	
No consumption	22 (7.1)
Frequently	240 (77.7)
Occasionally	47 (15.2)

Table 2 provides a summary of the anthropometric results and the distribution of study participants' BMI categories by gender. The age range of the participants was 12 to 16 years (mean SD, 13.98 1.02). Boys were found to have higher mean ages (14.23 1.02 vs 13.78 1.09), weights (42.67 11.43 vs 42.09 9.12), and heights (156.34 11.10 vs 153.09 7.14) than girls. Girls had higher mean BMIs (18.06 3.45 vs. 17.89 3.34 kg/m2) than did boys. Age, weight, height, and BMI are anthropometric measurements that significantly differ by gender (p 0.05). Boys were more likely to be overweight or obese than girls, with prevalence rates of 12.7% and 4.4% for boys and 9.2% and 5.3% for girls, respectively. 10.3% and 5.5% of children nationwide were determined to be overweight or obese, respectively (table 2).

Table 2: BMI categories and anthropometric measurements by gender

	Males (157)	**Females (152)**	**Total (309)**	**p-value**
Outcome measures (mean ± SD)				
Age	14.23 ± 1.02	13.78 ± 1.09	13.98 ± 1.02	0.005
Weight	42.67 ± 11.43	42.09 ± 9.12	42.23 ± 10.67	0.034
Height	156.34 ± 11.10	153.09 ± 7.14	155.11 ± 9.89	<0.001
BMI	17.89 ± 3.34	18.06 ± 3.45	17.89 ± 3.45	0.033
BMI categories N (%)				
Normal	130 (82.8)	130 (85.5)	260 (84.1)	0.438
Overweight	20 (12.7)	14 (9.2)	32 (10.3)	
Obese	7 (4.45)	8 (5.3)	17 (5.5)	

Bivariate analysis of independent variables with high BMI are shown in Table 3. Students in various types of schools had significantly differing prevalence of increased BMI. Elevated BMI was substantially correlated with religion, both parents' education, occupation, and frequency of junk food consumption. However, dietary practices were not included in the multivariate analysis since they were not substantially linked to an elevated BMI. Despite there being no statistical link between gender and high BMI, logistic regression analysis took gender into account.

Table 3: Bivariate analysis of several variables with respect to normal and elevated BMI

Variables	Normal BMI N (%)	Elevated BMI N (%)	p-value
Type of school			<0.001
Aided	105 (93.7)	7 (6.2)_	
unaided /private	78 (70.9)	22 (20)	
Government	85 (92.3)	7 (7.6)	
Gender			0.322
Female	130 (85.5)	22 (14.5)	
Male	128 (81.5)	29 (18.5)	
Religion			<0.001
Christian	54 (75)	28 (38.9)	
Hindu	175 (87.5)	25 (12.5)	
Muslim	27 (72.9)	10 (27.0)	
Education of father			<0.001
Primary	92 (90.2)	10 (9.8)	
Secondary	85 (82.5)	18 (17.5)	
Higher secondary and above	56 (73.7)	20 (26.3)	
Illiterate	23 (82.1)	5 (17.6)	
Education of mother			<0.001
Primary	92 (90.21)	10 (9.8)	
Secondary	85 (82.5)	18 (17.5)	
Higher secondary and above	56 (75.7)	28 (37.8)	
Illiterate	26 (86.7)	4 (13.3)	
Occupation of father			<0.001
Skilled	62 (81.6)	14 (18.4)	
Unskilled	110 (90.2)	12 (9.8)	
Professional	38 (70.3)	16 (29.6)	
Business	17 (68)	8 (32)	
Unemployed	29 (90.6)	3 (9.4)	
Occupation of mother			<0.001
Skilled	8 (80)	2 (20)	
Unskilled	72 (94.7)	4 (5.2)	
Professional	156 (73.6)	56 (26.4)	
Business	2 (66.7)	1 (33.3)	
Unemployed	6 (75)	2 (25)	
Dietary habits			0.296
non-vegetarian/mixed	249 (83)	51 (17)	
Vegetarian	7 (77.7)	2 (22.2)	
Frequency of junk food consumption			0.033
No consumption	20 (90)	2 (9)	
Frequently	212 (88.3)	28 (11.7)	
Occasionally	37 (78.7)	10 (21.3)	

Table 4 displays the results of the multivariate logistic regression analysis that looked at the correlations between elevated BMI and factors like religion, the types of schools attended, level of education attained by the mother and father, gender, occupation of the mother and father, and frequency of junk food consumption. Adjusted odds ratios (AOR) and matching 95% confidence intervals

(CI) were reported. Compared to pupils at government institutions, kids in private schools had a higher likelihood of having an abnormal BMI. Compared to Hindu pupils, Muslim and Christian students were more likely to have a higher BMI. Compared to unemployed fathers, those with professional and business vocations had a higher chance of having an elevated BMI. There were no discernible correlations between mother's work, father's education, or how often she ate junk food.

Table 4: Multivariate logistic regression analysis of independent variable and BMI elevation

Variables	Adjusted OR (95% CI)	p-value
Type of school		
Aided	1.23 (0.78 -2.09)	0.58
unaided /private	2.98 (1.67 - 5.56)	0.001
Government	1	
Gender		
Female	0.98 (0.65 - 1.34)	0.33
Male	1	
Religion		
Christian	1.67 (1.09 - 2.45)	0.02
Hindu	1	
Muslim	2.35 (1.45 - 3.76)	0.001
Education of father		
Primary	0.87 (0.43 - 1.87)	0.56
Secondary	0.78 (0,41 - 1.87)	0.53
Higher secondary and above	0.85 (0.37 - 1.98)	0.68
Illiterate	1	
Education of mother		
Primary	0.98 (0.42 - 2.23)	0.85
Secondary	1.23 (0.56 - 2.65)	0.79
Higher secondary and above	0.96 (0.41 - 2.32)	0.91
Illiterate	1	
Occupation of father		
Skilled	1.45 (0.63 - 3.12)	0.47
Unskilled	1.40 (0.61 - 1.02)	0.5
Professional	2.54 (1.07 - 6.34)	0.06
Business	2.56 (1.09 - 5.76)	0.04
Unemployed	1	
Occupation of mother		
Skilled	0.89 (0.34 - 2.54)	0.81
Unskilled	0.65 (0.36 - 1.17)	0.14
Professional	1.09 (0.62 - 1.92)	0.98
Business	1.89 (0.35 - 9.98)	0.52
Unemployed	1	
Frequency of junk food consumption		
No consumption	1	
Frequently	1.45 (0.65 - 2.98)	0.47
Occasionally	1.22 (0.67 - 2.56)	0.62
Hosmer and leneshow test		0.484

Discussion

The latest information on kid obesity rates comes from India. The global dietary shift and lifestyle changes significantly contribute to the obesity pandemic. Intake of junk food, sweets, soft drinks, and milk has grown while the intake of fruits, green vegetables, and milk has decreased. These eating habits and a decline in physical activity will cause obesity in children. To research among school children the lifestyle elements linked to childhood obesity. Cross-sectional research of high school pupils in Mumbai's public and private schools was planned [13]. Children in the 5th and 6th grades (10 and 11 years old) served as the sample frame for the investigation of childhood obesity. Information was gathered on past eating patterns, physical activity, regular outdoor games, and spending time in front of a computer or television. The nutritional state was evaluated using the following factors: height, weight, and BMI [14]. It was shown that 81.89% of students who were overweight or obese and 63.93% of students who were average weight had not drunk carbonated beverages during the previous 30 days, with the difference being statistically significant. It was shown that 66.67% of students who were overweight or obese and 49.73% of average weight consumed sweets twice daily, with the difference being statistically significant. Risk factors for being overweight or obese include consuming fast food or quick meals, carbonated soft drinks, and many sweets. While excessive TV watching and computer gaming, or little physical exercise, were also linked to becoming overweight or obese [15].

Throughout China, where obesity is on the rise, little study has been done to examine the causes of childhood obesity and overweight. Chinese kids in primary school who participated in the study were examined for their connections between lifestyle variables and overweight or obesity. A cross-sectional study was done with 2400 kids from 11 elementary schools, ranging in age from 6 to 12 [16]. With the help of their parents, kids filled out a questionnaire at home. Self-reported weight and height, screen time, exercise, methods of transportation to and from school, and eating habits were all included in the study. To study the elements connected to overweight or obesity, multilevel models were used. Children in China who are in school need to be targeted for obesity prevention because screen time was independently linked to childhood obesity [17].

In industrialised countries, the rise in childhood overweight & obesity has become into a significant public health problem. Public health action requires preventive measures, but additional risk factor research is needed until evidence-based initiatives are created and successfully targeted. They looked into the links between dietary practices, recreational activities, parental involvement, educational institutions, and children's overweight and obesity risk factors. Important potential Parents and schools are responsible for providing public health initiatives to minimise childhood overweight and obesity. Public health programmes should prioritise children and schools in low-income communities to reduce future socioeconomic inequities in health [18].

Having serious ramifications for worldwide public health, childhood obesity is a big issue. The percentage of overweight or obese children in Saudi Arabia has grown dramatically in the last 20 years, prompting concerns about the burden's health and psychological implications. The research sought to identify the various Saudi Arabian indicators of risk for childhood obesity. 492 schoolchildren (246 children, ages 5 to 9, who are fat or overweight, and 246 youngsters who maintain a healthy weight participated in a case-control research [19]. Parental & child Risk variables for child obesity were assessed

utilising features, behavioural norms, screen usage, and other activities. valid & reliable instruments. To prevent juvenile overweight and obesity in this demographic, the primary emphasis of efforts should be the early identification and confrontation of risk factors. Parental traits, parental knowledge of the severity of the burden obesity causes, and behavioural habits like frequent eating, screen time, and exercise are just a few examples of these risk factors [20].

Due to the epidemic-like nature of obesity and overweight, It is important to compare national childhood obesity statistics & overweight using an internationally accepted. In an investigation, they looked at how common obesity and overweight are, how they are related to socioeconomic status (SES), along with how risk variables, including nutrition, exercise, sports, evening naps, bad eating practise such as consuming junk food and chocolate, dining outside, and so on, affect SES on the weekends. A family past with diabetes and obesity affects these conditions [21]. 5664 students from varied SES backgrounds who were in school between the ages of 12 and 18 participated in the study. Using a revised body mass index as a benchmark, obesity and overweight have been considered. A pre-tested questionnaire was used to identify SES and lifestyle characteristics. Our findings indicate that socioeconomic factors and health significantly correlate development levels and the incidence of overweight and obesity [22].

Research on a few protective variables that help children maintain a healthy weight and these factors are fragile in lower socioeconomic communities across different ethnic groups. A study aimed to evaluate their relationships with child overweight/obesity across Jewish & Arab demographic groupings in Israel's incidence of biological, behavioural, and psychological variables for children overweight/obesity [23]. The research adds to the body of knowledge regarding the risk factors for obesity in children from low socioeconomic status populations and protective factors for a healthy weight. We discovered differences between the two population groups along with some notable shared characteristics. The Arab group had fewer variables, which may mean some of the measurements were less appropriate. It is essential to look into cultural and other influences that affect diet, activity, & weight but were not considered in the current study [23].

A research conducted in Israel is the first to assess a comprehensive set of both risk-reducing and preventative factors for overweight/obesity in preschool children across each population group. There is proof that adolescents and children under the age of 5 are more likely to be overweight age as well as the recommendation that kids with obesity ought to be monitored by low-income preschoolers because of their greater risk highlight the significance of employing our data as a foundation for subsequent research in Israel's North in addition to other regions of the nation [24]. The findings may be necessary for understanding factors that contribute to overweight and obesity among low SES people with a variety of ethnic backgrounds in other nations as well. Our results support demands for increasing protective variables rather than concentrating solely on lowering risk factors in intervention programmes for low-income populations. Although the most critical risk variables for obesity were clearly maternal BMI and birth weight, both of which are notoriously difficult to change. In both groups, mother self-efficacy is a significant protective factor, particularly given that it may be modifiable. We think it should be a significant part of interventions and other elements in both groups. Jewish and Arab mothers and children may have different relationships among protective and risk variables, which might help create intervention programmes that are more

culturally suitable for each demographic [25].

Depending on the stage of nutritional transformation in a nation, there are different socioeconomic disparities in the frequency of childhood obesity. The study aimed to pinpoint the socioeconomic variables that influence the differences in obesity prevalence among Chinese elementary school students who live in urban locations. The socioeconomic gradients of overweight children in this country are the opposite of the tendencies found in countries that were later in the global obesity pandemic. This offers a chance to take action and stop the emergence of societal injustices that will probably result from future economic growth. The obese gender disparity is significant and deserves additional research [26].

Conclusion

The study has demonstrated a significant problem of childhood obesity among students at private schools who are at greater risk than public school students. It is important to emphasise prevention efforts that focus on this demographic age group. Schools should make physical activity and nutritious diet the norm for their students. Furthermore, this research has certain limitations, such as classifying BMI based on international reference standards when applied to an Indian population and adolescents' levels of physical activity were ignored in the study. These limitations highlight the need for further research to demonstrate causal association.

References

1. Ward ZJ, Long MW, Resch SC, Giles CM, Cradock AL, Gortmaker SL. Simulation of growth trajectories of childhood obesity into adulthood. N Engl J Med. 2017;377(22):2145–53.
2. Stamatakis E, Wardle J, Cole TJ. Childhood obesity and overweight prevalence trends in England: evidence for growing socioeconomic disparities. Int J Obes. 2010;34(1):41–7.
3. Chung A, Backholer K, Wong E, Palermo C, Keating C, Peeters A. Trends in child and adolescent obesity prevalence in economically advanced countries according to socioeconomic position: a systematic review. Obes Rev. 2016;17(3):276–95. This systematic review on obesity trends globally found clear indications of a growing influence of low socioeconomic status on obesity development.
4. Cunningham SA, Kramer MR, Narayan KM. Incidence of childhood obesity in the United States. N Engl J Med. 2014;370(5):403– 11. This study highlights the very important time period between birth and 5 years as a critical role in the development of obesity.
5. Gautam S, Jeong HS. Childhood Obesity and Its Associated Factors among School Children in Udupi, Karnataka, India. J Lifestyle Med. 2019 Jan;9(1):27-35. doi: 10.15280/jlm.2019.9.1.27. Epub 2019 Jan 31. PMID: 30918831; PMCID: PMC6425906.
6. Gupta N, Goel K, Shah P, Misra A. Childhood obesity in developing countries: Epidemiology, determinants, and prevention. Endocr Rev. 2012;33:48–70.
7. Bhardwaj S, Misra A, Khurana L, Gulati S, Shah P, Vikram NK. Childhood obesity in Asian Indians: A burgeoning cause of insulin resistance, diabetes and sub-clinical inflammation. Asia Pac J Clin Nutr. 2008;17(S1):172–5.
8. Bhargava Vyasa. Obesity in India -The Omnipresent Influence Research. J Pharmacol Pharmacodyn. 2013;5:220–6.
9. Jain Taran S, Ojha S, Kosta S, Kumar R. Prevalence of obesity in school children and its association with

parental obesity in central India. Int J Child Adolesc Health. 2016;9:377–85.
10. Kavita HS, Ashok NC. Prevalence of obesity among primary school children and its association with parental obesity and socio- economic status. Medica Innovatica. 2013;2:26–31.
11. Pathak S, Modi P, Labana U, Khimyani P, Joshi A, Jadeja R, et al. Prevalence of obesity among urban and rural school going adolescents of Vadodara, India: A comparative study. Int J Contemp Pediatr. 2018;5:1355–9.
12. Premanath M, Basavanagowdappa H, Shekar MA, Vikram SB, Narayanappa D. Mysore childhood obesity study. Indian Pediatr. 2010;47:171–3.
13. Burkhalter TM, Hillman CH. A narrative review of physical activity, nutrition, and obesity to cognition and scholastic performance across the human lifespan. Adv Nutr. 2011;2:201S–6S.
14. WHO Regional Office for Europe. Do surgical interventions to treat obesity in children and adolescents have long- versus short-term advantages and are they cost-effective? In: HEN synthesis report. Denmark: World Health Organization; 2012. p. 1–2.
15. De Onis M, Blossner M, Borghi E. Global prevalence and trends of overweight and obesity among preschool children. Am J Clin Nutr. 2010;92:1257–64.
16. Tang J, Chen SK, Luo JS, Fan X, Feng Y. Epidemiologic status and influencing factors of obesity in children and adolescents. CJCHC. 2011;19:1014–7.
17. Al-Hazzaa HM. The public health burden of physical inactivity in Saudi Arabia. J Family Community Med. 2004;11(2):45–51.
18. Sahoo K, Sahoo B, Choudhury AK, Sofi NY, Kumar R, Bhadoria AS. Childhood obesity: causes and consequences. J Family Med Prim Care. 2015;4(2):187–92.
19. Goyal RK, Shah VN, Saboo BD, et al. Prevalence of overweight and obesity in Indian adolescent school going children: its relationship with socioeconomic status and associated lifestyle factors. The Journal of the Association of Physicians of India. 2010 Mar;58:151-158. PMID: 20848812.
20. GBD 2015 obesity collaborators. health effects of overweight and obesity in 195 countries over 25 years. N Engl J Med. (2017) 377:13–27. doi: 10.1056/NEJMoa1614362.
21. Rudolf MCJ. The obese child. Arch Dis Child Educ Pract. (2004) 89:57–62. doi: 10.1136/adc.2004.059824.
22. Cunningham SA, Kramer MR, Narayan KM. Incidence of childhood obesity in the United States. N Engl J Med. (2014) 370:1660–1. doi: 10.1056/NEJMc1402397.
23. Ebbeling CB, Pawlak DB, Ludwig DS. Childhood obesity: public-health crisis, common sense cure. Lancet. 2002;360(9331):473–82.
24. Ji CY, Chen TJ. Empirical changes in the prevalence of overweight and obesity among Chinese students from 1985 to 2010 and corresponding preventive strategies. Biomed Environ Sci. 2013;26(1):1–12.
25. Wang Y, Lobstein T. Worldwide trends in childhood overweight and obesity. Int J Pediatr Obes. 2006;1(1):11–25.
26. Ji CY, Cheng TO. Prevalence and geographic distribution of childhood obesity in China in 2005. Int J Cardiol. 2008;131(1):1–8.