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Childhood obesity: Causes, comorbidities, prevention, and management

Ulfat Amin Bhat

Abstract

In both industrialized and developing nations, childhood obesity has reached epidemic proportions, causing a variety of medical disorders that raise the risk of morbidity and hasten mortality. Obesity is a serious public health issue and is a complex disorder involving biological, developmental, environmental, behavioral, and hereditary components. Numerous research investigations have been carried out to determine what linkages and risk factors enhance the likelihood that a kid may present with obesity as a result of the rise in the incidence of obesity among youngsters. The integration of diet, workouts, biological changes, and psychological variables is important in the control and prevention of childhood obesity; therefore, all researchers concur that prevention is the key strategy for controlling the current problem. However, a comprehensive view of all the health conditions linked to obesity remains a mystery. This strategy could backfire because of the psychological problems with bodily habitus that may come along with puberty. Bulimia nervosa, binge-eating disorder, and night-eating syndrome are all conditions that can develop in teens as a result of unhealthful eating behaviors. Others who overshoot their objective of "being healthy" and limit their food may develop anorexia nervosa.

Keywords:

Childhood obesity, consequences, epidemiology, lifestyle

Introduction

besity in children is a complicated public health issue that affects the majority of industrialized countries globally. It is influenced by genetic factors, physiology, personality characteristics, and lifestyle factors. Additionally, poor nutrition and physical inactivity are the primary causes of preventable teen mortality, chronic diseases, and the financial burden on health that results from them.^[1,2] Few treatments have shown long-lasting effects or been adopted at such a scale to have a substantial public health impact, despite the obvious need to avoid childhood obesity and to intervene early to avert unhealthy weight gain in the later phases of growth.^[3]

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In urban and semi-urban India, childhood and teenage obesity is on the rise. The problem is more than just an esthetic one; it is a disorder that causes significant mortality and morbidity, limited mobility, and the disruption of everyday activities.^[4] Nearly half of the obese kids become obese teenagers, and almost all of them become obese adults. They thus have a higher chance of developing asthma, cancer, osteoarthritis, liver, and renal disease. As juvenile obesity becomes more prevalent and lasts longer, its health cost will increase in the coming decades.^[5] The National Family Health Survey (NFHS-5) survey report states that 3.4% of kids are obese. For those between the ages of 5 and 19 years, the rates are much higher and growing.^[6]

According to the extensive National Nutritional Survey, there will be 17 million

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Ms. Ulfat Amin Bhat, Faculty Syed Mantaqui College of Nursing & Medical Technology, Islamic University of Science and Technology, Awantipora, Jammu and Kashmir, India. E-mail: cuteulfat@gmail. com overweight children in this age range in 2016, 18 million in 2018, and 27 million in 2030.^[7] Weight reduction can reverse a lot of the morbidity, which is linked to visceral fat rather than peripheral fat. However, it may be highly stressful to treat established obesity because sustained weight reduction is hard to attain and weight loss quickly returns. The whole family has to participate in the weight reduction process; if members of the family are resistant to changing their behavior, the child should not be made to make severe adjustments on their own.^[4,8]

The objective of management is to achieve and sustain stable weight loss to the greatest extent feasible, not to reach the optimum body weight, which may be nearly impossible. Loss is challenging; thus prevention is essential. Pediatricians must be on the lookout for obesity and work to lessen its negative effects on individuals who are already fat.

Definitions and Epidemiology

The most used method for measuring obesity is body mass index (BMI; weight in kg × height in m²). Obesity in adults is defined as a BMI of 25 kg/m^2 , morbid obesity as a BMI of 40, and superobesity as a BMI of 60. It is challenging to classify children because of the significant influence that age, gender, pubertal status, and race/ ethnicity have on the development. BMI, which is modified based on norms depending on the child's age and gender, is calculated using the child's height and weight to assess childhood obesity. The "overweight" range for age and gender is defined as BMI between the 85th and 94th percentiles, whereas the "obesity" range is defined as BMI above the 95th percentile.^[9]

When compared with people who maintain a healthy weight, those who are obese during childhood or adolescence are five times more likely to be fat in adulthood.^[10] Severe obesity, when compared with obesity, is substantially associated with increased cardiovascular risk, adult obesity, and early mortality.[11] Youth from economically disadvantaged backgrounds are more prone to develop obesity than their counterparts from high socioeconomic backgrounds. Children aged 2-19 years who lived in the lowest income group between 2011 and 2014 had an obesity rate of 18.9%, whereas youngsters in the highest income group had an obesity rate of 10.9%.^[12] Children of disadvantaged backgrounds who are ethnically diverse are more likely than other children^[13] to experience obesity, which is further aggravated by an inadequate access to health care that can stop unhealthy weight gain and its consequences.^[13-15]

Except in portions of Sub-Saharan Africa and Asia, being obese is associated with more fatalities than being underweight. According to World Health Organization

Table 1: Country report card of India from Atlas of childhood obesity^[16]

-	
Latest survey: % infants overweight	2.4%
2016: % boys aged 5–9 years with obesity	3.7%
2016: % girls aged 5–9 years with obesity	2.6%
2016: % boys aged 10–19 years with obesity	1.8%
2016: % girls aged 10–19 years with obesity	1.1%
Future predictions for 2030	
Percentage of children aged 5–9 years with obesity	10.8%
Percentage of children aged 10–19 years with obesity	6.2%
Number of children aged 5–9 years with obesity	12,692,004
Number of children aged 10–19 years with obesity	14,789,136
Number of children aged 5–19 years with obesity	27,481,141





(WHO) worldwide estimates from 2016, over 13% of the adult population worldwide (11% of men and 15% of women) were obese, with the figure virtually doubling between 1976 and 2016 [Figure 1].^[7,16,17]

India is expected to have more than 20 million by 2025 and more than 27 million obese children by 2030, accounting for one in every 10 children worldwide (UNICEF'S World Obesity Atlas for 2022) [Table 1].^[16] It is rated 99th out of 183 countries in terms of obesity resilience, and the financial effects of obesity are anticipated to rise from \$23 billion in 2009 to \$479 billion by 2060. According to the WHO, excess body fat increases the risk of noncommunicable diseases such as 13 types of cancer, type 2 diabetes, heart problems, and lung conditions, all of which lead to premature death. Obesity was responsible for 2.8 million deaths worldwide last year.

In recent years, India has risen to the top five countries in terms of adult obesity. According to one estimate from 2016, 135 million Indians are overweight or obese, and the number is growing.^[16,18,19]

Causes

Obesity in children and adolescents is caused by a variety of circumstances. These can be separated into different categories: genetic, environmental, psychological, sociocultural, behavioral, and family factors [Figure 2].^[20]



Figure 2: Causes of childhood obesity; Source: Family Health Survey (4-5), Image drawn by Author.

- Genetics: One of the main things being researched as an obesity cause is genetics. According to certain research, 25%–40% of BMI is inherited.^[21] To have an impact on weight, however, genetic predisposition frequently has to be combined with supportive environmental and behavioral variables.^[22] Less than 5% of occurrences of childhood obesity are caused by genetics.^[18] Parents' genes influence genetics, which commonly causes offspring to become overweight.^[23]
- 2. Environmental factors: Environmental aspects including school rules, demography, and parental job obligations also have an impact on eating and exercise patterns. The risk of obesity in children can be significantly increased by commercial drivers of poor nutrition. Over the past seven decades, various sectors of the food industry have contributed to the global pandemic of obesity, from unethical marketing of breast milk substitutes for infant feeding to aggressive promotion of high-calorie, lownutritive value foods and beverages targeting children and adolescents.^[21] Exposure to advertising and consumption of unhealthy foods are strongly correlated. In addition to billboards and conventional broadcast media (radio and television), new media (internet advertising, text messaging, social media manipulation, and video games), collaborations with toy companies, the animation film, and video game industries, as well as celebrity endorsements, are causing consumers to crave addictive, highly processed foods and sugary drinks.^[24]
- 3. Psychological factors: These include different factors like the following:
 - Anxiety and depression: But there is more to this link than meets the eye; sadness may both contribute to and result from obesity.^[25] Moreover, compared with nonobese controls, a clinical sample of obese teenagers showed a greater lifetime prevalence of anxiety disorders,^[26] despite the fact that some research finds no connection between elevated BMI and elevated anxiety symptoms.^[27,28] Therefore, it is possible that there are two sides to the link between fat and anxiety, which makes it far from clear.

- Binge-eating disorder: Specially in females, communities with adolescent obesity seem to frequently display characteristics connected to eating disorders.^[29] Numerous research has revealed a greater frequency of eating-related pathologies in obese children and young people, including anorexia nervosa, bulimia nervosa, and impulse control.^[18,30]
- Body dissatisfaction: At all ages, males report higher levels of body satisfaction than females, according to research.^[31] The fact that thinness is the sole culturally defined goal for women, whereas being both slim and strong for men may be a reflection of the westernized cultural values of beauty. In other words, for females, there is a linear link between body dissatisfaction and increasing BMI, but, for boys, there appears to be a U-shaped association, suggesting that boys with BMIs at the low and high extremes have significant levels of body dissatisfaction.^[18,32]
- Low self-esteem: In terms of self-esteem, research findings contrasting children who are overweight or obese with those who are of a healthy weight have been conflicting.^[33,34] Obese children have worse self-esteem, according to certain research, but not all of them.^[28,35,36] There is a general consensus in the research that the global method to measuring self-esteem in children who are overweight or obese is inaccurate because these kids appear to be most vulnerable in the physical and social facets of self-esteem.^[34]
- 4. Sociocultural factors: Additionally, it has been shown that sociocultural variables have an impact on how obesity develops. Food is frequently used in our culture as a reward, a tool for social control, and as a way of reward.^[37] These practices with food increase the chance of becoming obese by promoting the formation of unfavorable connections with food.
- 5. Family factors: The rise in obesity incidence has also been linked to familial factors. Children's eating choices might be influenced by the sorts of food that are available in the home and by family members' food preferences. Additionally, the type and quantity of food consumed might be influenced by family mealtimes. Last but not least, the kid is influenced by the family's behaviors, whether they involve physical activity or not.^[34] According to studies, living in a single-parent family and having an overweight mother are linked to childhood obesity and overweight.^[38]
- 6. Behavioral factors: Food consumption and the consumption of sugar-sweetened drinks with high-calorie counts but poor-nutrient content, which are easily accessible to youngsters, are behavioral variables. Obesity has been linked to it in particular food consumption.^[39] Obesity is also influenced by a lack of exercise. A lot of time is spent by kids utilizing technology, including computers, video games, television, and mobile phones. Children between the ages of 8 and 18 years spend 7.5 h a day on average using electronic devices, which prevents them from engaging in active play and physical activity.^[18,40]

Prevention

Because childhood fat cells persist into adulthood and contribute to illness, it is crucial to prevent childhood





Figure 3: Prevention of childhood obesity Source: Family Health Survey (4-5), Image drawn by Author.

obesity. The occurrence of childhood obesity can be avoided by using the following measures [Figure 3]:

- Diet: Avoid eating large meals often and skipping meals; "grazing" is preferable to "gorging." Low-fat, high-carb, highglycemic index (GI) meals (such as polished rice, potatoes, packaged cereals, bread, and other maida products) induce strong insulin spikes that encourage weight gain; therefore, it is important to start slowly and avoid overrestricting fat consumption.^[31] Never should food restrictions be seen as a form of punishment. Purchase low-fat milk or products, and keep cooking fat levels low. Avoid fried meals, sodas, and junk food. Encourage the consumption of water, whole dals, fruits, and salads. No meal to be skipped and check the calories in packaged goods.^[41,42]
- 2. Sedentary lifestyle: Television and electronic games are not recommended for children under the age of two. A sedentary lifestyle, particularly hours wasted in front of screens (TV, video games, laptops, mobile phones, etc.), should be limited to fewer than 2h per day in children over the age of 2. There is evidence that overeating occurs throughout these hours of screen use, which has an impact on metabolic health. Stop placing a screen in the bedroom and limit the number of displays in your house.^[24]
- 3. Prenatal care: Women must conceive at a healthy body weight and manage their weight growth with a healthy lifestyle. Independent of maternal hyperglycemia, significant weight gain during pregnancy is related to fetal macrosomia. Normal women should gain 11.5–16 kg during pregnancy, overweight women 7–11.5 kg, and obese women 5–9 kg. Tobacco use throughout pregnancy and postnatally is restricted because it increases the child's chance of becoming overweight at 7 years of age regardless of birth weight.^[43,44]
- 4. Quality sleep: The lesser the sleep pattern, the greater the possibilities of obesity due to neuroendocrine and metabolic imbalances. To ensure enough sleep, parents should encourage appropriate sleep hygiene behaviors in their children, such as turning off all "screens"/lights 30 min before bedtime.^[45]
- 5. Healthy life style: In children, 1h of moderate-to-intense regular exercise is recommended,^[8] although regular physical exercise can help improve aerobic fitness (important for metabolic health). Physical activity levels



Figure 4: Clinical comorbidities Source: Family Health Survey (4-5), Image drawn by Author.

may be increased beginning at the age of 2–3 years by active play, walking, and using a tricycle, and after 5–6 years by increasing sports involvement 2/3 times per week. Table 2 shows a list of physical activities that focus on musculoskeletal strengthening and aerobic workouts.^[46-49]

Clinical Comorbidities

Childhood obesity can have a substantial detrimental effect like Figure 4 on a child's physical well-being, emotional and social well-being, and self-esteem. Additionally, it is linked to a child's poorer quality of life and poor academic achievement.^[1]

- 1. Health outcome: Numerous medical disorders have been connected to childhood obesity. Fatty liver disease, cardiovascular disease, type 2 diabetes, mood disorders, asthma, high cholesterol, sleep apnea, cholelithiasis, glucose intolerance and insulin resistance, skin disorders, menstrual irregularities, impaired balance, and orthopedic issues are just a few of the conditions that fall under this category.^[50,51] Many of the aforementioned health issues were formerly exclusively encountered in adults but are now very common in obese youngsters. Even while the majority of the physical health problems linked to childhood obesity are treatable and can go away once a kid or teenager achieves a healthy weight, some of them persist into adulthood and cause harm. Some of these medical disorders have the potential to be fatal in the worst scenarios. Diabetes, sleep apnea, and cardiovascular disease are three of the more prevalent health issues linked to childhood obesity.[51,52]
- 2. Social and emotional effects: Children's and adolescents' social and emotional well-being are impacted by childhood obesity, in addition to the myriad medical issues it is linked to. One of the most stigmatizing and lowest socially desirable conditions in childhood has been called obesity.^[18,53] Children who are overweight or obese are frequently made fun of or ridiculed for their weight. They also experience a wide range of additional difficulties, such as discrimination, unfavorable stereotypes, and social marginalization.^[51] Children less than 2-years-old have been observed to discriminate against fat people.^[53] Children

	Moderate physical activities	Vigorous physical activities	Musculoskeletal strengthening	
Preschooler	 Playing at the park 	• The effort is the sole difference between moderate and high intensity. Combat sports energizing dancing	• The effort is the sole difference • The tug of war	The tug of war
	Bicycle or tricycle		 Tree climbing or rope climbing 	
	 Walking, jogging, skipping, leaping, dancing, 		• Yoga	
	swimming, catching, throwing, and kicking are all examples of physical activities		 Jumping, skipping, and running 	
School-going children	Walking quickly			
	Riding a bicycle			
	 Baseball and softball swimming 			
Adolescents	Walking quickly			
	Riding a bicycle			
	 Baseball and softball swimming 			
	Cleaning the house, such as sweeping, dusting, etc.	2.		

Table 2: List of physical activities

who are obese are frequently rejected from activities, especially those that are competitive and call for physical exertion. Children who are overweight frequently find it challenging to engage in physical activity because they move more slowly than their classmates and frequently experience shortness of breath.^[20] These detrimental social issues can have an impact on a child's academic achievement as well as their self-esteem, confidence, and body image and can have very devastating effects on children. The social repercussions of obesity may make maintaining a healthy weight challenging. Children who are overweight often seek refuge in familiar settings, such as their families, where they may turn to food for solace in order to shield themselves from criticism and hostility. Additionally, kids who are overweight typically have fewer friends than kids of normal weight, which leads to less playtime and social engagement and more time spent doing sedentary activities.^[5,42] As previously indicated, children who are overweight or obese frequently find it more difficult to engage in physical exercise because they experience breathing difficulties and frequently struggle to keep up with their friends. As a result, weight gain is unavoidably caused because more calories are consumed than are expended each day.

3. Academic outcome: Students' involvement in sports and other physical activities has diminished as a result of the growing pressure of academic competition. This is especially true for girls who have been sedentary throughout their school days. Numerous Indian research reveals that women are more likely than men to develop metabolic syndrome and obesity. It has been discovered that childhood obesity has a deleterious impact on academic achievement. According to a study, children who are overweight or obese are four times more likely than their peers of a similar weight to report experiencing issues at school.^[36] Additionally, they are more likely to leave school more frequently, especially if they have a chronic illness such as diabetes or asthma, which might impair their ability to learn.^[54,55]

Management

The treatment for pathological obesity relies on the underlying cause, such as the treatment of Cushing syndrome, replacement of thyroxine in hypothyroidism,



Figure 5: Management of childhood obesity Source: Family Health Survey (4-5), Image drawn by Author.

or growth hormone in growth hormone disorder. Exogenous obesity necessitates both weight loss and loss maintenance. The entire family has to be encouraged to adopt long-term dietary and exercise improvements. Small, long-lasting adjustments are more beneficial than radical, transient ones. Only in life-saving circumstances, such as excessive obesity, severe sleep apnea, or cardiac symptoms (Pickwickian syndrome), an extremely lowcalorie diet be considered. It should be recommended to use behavioral modification strategies together with dietary changes and increased activity [Figure 5].^[18,56,57]

1. Diet therapy: One of the greatest strategies to help the youngster reach a healthy weight is to improve the family's eating and activity routines. Standard diet treatment limits calories while keeping a normal, balanced pattern: fewer than 25% of total calories should come from fat, 20% from protein, and the remaining 55% should come from complex carbs with appropriate fiber and minerals. Even in cases of extreme obesity, calorie restriction should be modest, to lose 0.5kg per week while providing enough protein intake of 0.8-1 g/kg per day. Nutritional deficiencies (such as those in iron, calcium, vitamin D, etc.) are remedied, and if needed, limited continuing supplementation is given, promoting the consumption of low GI foods, such as fruits, salads, whole grains, brown rice, whole legumes, low-fat dairy, and modest amounts of nuts, while discouraging the consumption of unhealthy and "diet foods." It is best to stay

away from diet sodas, sugar-free sweets, chocolates, baked chips, and other foods because they frequently contain a lot of calories.^[10,18]

- 2. Community level assistance: Community-level influences have an important role in molding the environment around children and adolescents. As a result, community-based treatments should be promoted, and healthcare workers should be vocal supporters of preventative initiatives. The Indian government has started the "Fit India Movement" to drive changes in behavior and promote physical fitness, as well as create a shared platform for individuals to exchange information and disseminate awareness through targeted initiatives.^[58] Many campaigns have been launched as a part of this nationwide movement, such as school fitness certification, the Fit India mobile application, quizzes, fitness protocols and guidelines for people of various ages, the Fit India dashboard, and a platform for people to share their positive fitness stories. Healthcare practitioners must advocate for and support public policy measures such as providing parks and open spaces for physical activity, offering incentives for healthier alternatives, and penalizing unhealthy packed snacks and meals. They should be conversant with regional and national food-assistance programs, such as the Integrated Child Development Service (ICDS) Program, the Special Nutrition Program, and mid-day meal schemes, among others.[59]
- 3. Parenting styles: Healthcare practitioners are wellpositioned to advise parents on successful parenting practices for influencing their children's reasonable and good behavior choices. While authoritative parenting encourages better eating, authoritative and permissive approaches have been associated with a higher incidence of juvenile obesity.^[60] Parents should create tiny goals for their children and re-evaluate them on a regular basis. Restrictive feeding behaviors are linked to a higher risk of eating without hunger or obesity and should be avoided.[34,61] To foster receptiveness and enable children to develop a liking for more nutritious foods, parents should be encouraged to try strategies such as routine service of meals, providing very well snacks and along with rejected foods, use of better and healthier seasonings (e.g., salads, fruit slices), instituting food intake with enjoyment, and so on. Positive feedback, such as compliments or awards when goals are completed, is essential. At the very same time, food should never be used as a reward, and bad behaviors should be handled with care.[62]
- 4. Health education: Health education is an integral part of preventive interventions. During immunization or disease contact, health workers must be involved directly in the education programs of parents. They should inspire and educate parents on good food alternatives for their offspring, meal preparation, the value of aerobic exercise, and strategies to foster a healthy atmosphere. They must promote a family-centered approach and encourage support to families to live healthier lives and serve as role models for their children. Counseling must be targeted to the child's age and development while also taking into account the family's cultural, economical, and psychological aspects.^[47] This relationship should be bilateral and compassionate, and parents should avoid passing judgment on their child's weight. Motivational interviewing approaches are useful in

promoting positive behavior changes and good physiciancaregiver communication.^[63]

- 5. Healthy life style: All forms of exercise boost energy expenditure, which is necessary for a healthy lifestyle and weight loss. Other advantages include improved lipid profiles, blood pressure, and insulin levels; lower hunger; and a higher metabolic rate. Less irritability, acne, and hirsutism are also less common (while calorie restriction alone causes decreased metabolic rate). Make sure active games are regarded as enjoyable for compliance (walking with friends, swimming, dancing, and sports).^[64] Exercise that has minimal impact and is moderate in intensity for 30 min per day, 5 days per week, should be recommended at first; afterward, the duration and intensity of exercise should be raised to roughly an hour per day. Less than 2h a day of screen time has been advised.^[59]
- 6. Behavior modification and social support: These are critical, especially maintaining diaries of food intake, activity, and screen time and motivational techniques such as small, zero calories, awards (hug, stationery, or sports item, star on a chart). Reasonable, clear goals must be set by the family and health personnel working together. Occasional treats should be given so that frustration and dysfunctional behavior do not occur. Unhealthy family habits and disparagement of the child should be discouraged. Initially, a monthly review with reinforcement may be necessary. Weight cycling patterns are undesirable because each weight loss or gain cycle causes metabolic and psychological changes, which make subsequent weight loss more difficult.^[49,65,66]

Conclusions

The most effective strategy for combating the obesity pandemic appears to be prevention; education on healthy eating and active lifestyle is the cornerstone of all therapeutic programs. A multidimensional, multiphase strategy including the community, school, and family may be more successful than one-component initiatives. Community-based initiatives should encourage children to lead healthy lifestyles, promote healthy food options, and raise awareness of the need for increased physical activity.

If people focus on the causes, it may be possible to curb the growth of the kid obesity problem. Several factors contribute to childhood obesity, some of which are more important than others. Moreover, many obesity-related issues may be prevented if parents pushed for a better lifestyle at home. Children's home-based instruction in nutrition, exercise, and good eating will ultimately translate to other facets of their lives. This will have the most impact on how kids decide what to eat at school, in fast food restaurants, and whether or not to exercise. By concentrating on these reasons, children obesity may eventually decline and society as a whole may become healthier.

Authors' contributions

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Ethical statement

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Conflicts of interest

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Data availability statement

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