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CHILDHOOD OBESITY AND ITS RISK FACTORS: A REVIEW ARTICLE

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ABSTRACT

Obesity is a complex issue that affects children across all age groups. Childhood obesity has become a major global epidemic that imposes a substantial social and health burden worldwide. An estimated 4.0 million deaths and 120 million disability-adjusted life years (DALYs) in 2015 were attributable to an excess body mass index (BMI) globally. The global estimation by WHO showed that, in 2019, an estimated 38.2 million children under the age of 5 years were overweight or obese. CDC report of 2017-2018 revealed that the prevalence of obesity was 19.3% and affected about 14.4 million children and adolescents. Obesity prevalence was 13.4% among 2 to 5-year-olds, 20.3% among 6 to 11-year-olds, and 21.2% among 12 to 19-year-olds. Some studies have found that BMI is 25–40% heritable. The genetic factor accounts for less than 5% of cases of childhood obesity. Dietary factors such as fast food consumption, sugary beverages, snack foods, portion size, skipping breakfasts have been studied extensively for its possible contributions to the rising rates of childhood obesity. Each additional hour of television per day increased the prevalence of obesity by 2%. Studies have shown that having an overweight mother and living in a single parent household are associated with overweight and childhood obesity. In India, we are still struggling with the burden of malnutrition but the issue of over-nutrition cannot be ignored. India should also formulate a national policy and partner with the private sector to end the childhood obesity epidemic.

Key words: Obesity, overweight, childhood, prevalence, risk factors, BMI.

INTRODUCTION

Childhood obesity is one of the most serious public health challenges of the 21st century. The problem is global and is steadily affecting many low and middle income countries, particularly in urban settings. The prevalence has increased at an alarming rate. Globally in 2010, the number of overweight children under the age of five is estimated to be over 42 million. Close to 35 million of these are living in developing countries. [1]

Obesity is a complex issue that affects children across all age groups. One-third of children and adolescents in the United States are classified as either overweight or obese. There is no single element causing this epidemic, but obesity is due to complex interactions between biological, developmental, behavioural, genetic, and environmental factors. [2]

Childhood obesity has become a major global epidemic that imposes a substantial social and health burden worldwide. An estimated 4.0 million deaths and 120 million disability-adjusted life years (DALYs) in 2015 were attributable to an excess body mass index (BMI) globally. Obesity in childhood is a special concern, given its life course impact by causing the development of multiple chronic conditions. [3]

Childhood obesity is a complex health issue. It occurs when a child is well above the normal or healthy weight for his or her age and height. The causes of excess weight gain in young people are similar to those in adults, including behaviour and genetics. Obesity is also influenced by a person's community as it can affect the ability to make healthy choices.

Behaviours that influence excess weight gain include eating high-calorie, low-nutrient foods and beverages, medication use and sleep routines. Not getting enough physical activity

and spending too much time on sedentary activities such as watching television or other screen devices can lead to weight gain. [4]

Childhood obesity has reached epidemic levels in developed as well as in developing countries. Overweight and obesity in childhood are known to have significant impact on both physical and psychological health. Overweight and obese children are likely to stay obese into adulthood and more likely to develop non-communicable diseases like diabetes and cardiovascular diseases at a younger age. [5]

Dr. Saratchandra, Senior Consultant Cardiologist, Indo-US Hospitals said that obesity is associated with higher rates of death driven by comorbidities such as type 2 diabetes mellitus (T2DM), dyslipidemia, hypertension, obstructive sleep apnea (OSA), certain types of cancer, steatohepatitis, gastroesophageal reflux, arthritis, polycystic ovary syndrome (PCOS), and infertility.

Dr. NG Sastry, senior consultant, Indo-US Hospitals said that Indians have a strong genetic pool and therefore we need to be extra careful to maintain the right body weight from the beginning to keep diabetes at bay effectively

Studies also indicated that people who modify their lifestyle to be healthy have seen a 55% reduction in diabetes, while those who were managed just with medication saw a 30% to 35% reduction in diabetes. [6]

Childhood obesity is now an epidemic in India. With 14.4 million obese children, India has the second-highest number of obese children in the world, next to China. The prevalence of overweight and obesity in children is 15%. In private schools catering to upper-income families, the incidence has shot up to 35-40%, indicating a worrying upward trend. [7]

According to the ICMR-INDIAB study 2015, the prevalence rate of obesity varies from 11.8 % to 31.3%, and central obesity from 16.9%36.3%. A total of 5% of the Indian population is morbidly obese, (>30 Body Mass Index). [6]

PREVALENCE

The global estimation by WHO showed that, in 2019, an estimated 38.2 million children under the age of 5 years were overweight or obese. Once considered a high-income country problem, overweight and obesity are now on the rise in low- and middle-income countries, particularly in urban settings. In Africa, the number of overweight children under 5 has increased by nearly 24% percent since 2000. Almost half of the children under 5 who were overweight or obese in 2019 lived in Asia. Over 340 million children and adolescents aged 5-19 were overweight or obese in 2016.

The prevalence of overweight and obesity among children and adolescents aged 5-19 has risen dramatically from just 4% in 1975 to just over 18% in 2016. The rise has occurred similarly among both boys and girls: in 2016 18% of girls and 19% of boys were overweight. While just under 1% of children and adolescents aged 5-19 were obese in 1975, more 124 million children and adolescents (6% of girls and 8% of boys) were obese in 2016.

Overweight and obesity are linked to more deaths worldwide than underweight. Globally there are more people who are obese than underweight – this occurs in every region except parts of sub-Saharan Africa and Asia. [8]

CDC report of 2017-2018 revealed that the prevalence of obesity was 19.3% and affected about 14.4 million children and adolescents. Obesity prevalence was 13.4% among 2 to 5-year-olds, 20.3% among 6 to 11-year-olds, and 21.2% among 12 to 19-year-olds. Childhood

obesity is also more common among certain populations. Obesity prevalence was 25.6% among Hispanic children, 24.2% among non-Hispanic Black children, 16.1% among non-Hispanic White children, and 8.7% among non-Hispanic Asian children. [9]

The data from the National Health and Nutrition Examination Survey showed that the prevalence of obesity among US children and adolescents was 18.5% in 2015-2016. Overall, the prevalence of obesity among adolescents (12-19 years; 20.6%) and school-aged children (6-11 years; 18.4%) was higher than among preschool-aged children (2-5 years; 13.9%). School-aged boys (20.4%) had a higher prevalence of obesity than preschool-aged boys (14.3%). Adolescent girls (20.9%) had a higher prevalence of obesity than preschool-aged girls. [5]

A cross-sectional survey was conducted from May to October of 2017 among children aged 6–13 years old in grades 1–5 studying in private schools of Lalitpur district in Nepal. The study found that out of 575 students, 107 (18.6%) were overweight and 41 (7.1%) were obese. Among 328 male children, 62 (19.0%) were overweight and 35 (10.6%) were obese. Likewise, among 247 female children, 45 (18.2%) were overweight and 6 (2.4%) were obese. Male children (aOR = 2.21, 95% CI: 1.38–3.53), children of mothers with a high school (aOR = 3.13, 95% CI: 1.39–7.12) or university level of education (aOR = 3.09, 95% CI: 1.23–7.70) and children of mothers in a professional field (aOR = 1.34, 95% CI: 1.02–4.05) had a greater likelihood of being overweight/obese. Likewise, students consuming energy-dense less nutrient food (aOR = 2.92, 95% CI: 1.66–5.12), lacking active travel to and from school (aOR = 2.38, 95% CI: 1.12–4.79) and those having sedentary behaviours (aOR = 3.01, 95% CI: 1.20–7.29) were likely to be overweight/obese. [10]

In 2018, an article was published which reported data on the prevalence of childhood obesity obtained through the National Food and Physical Activity Survey (IAN AF 2015–2016). The data revealed that 23% of the children evaluated were under 10 years old and 11% were adolescents. Of children under the age of 10 years, 17.4% were overweight and 7.7% were obese. It also showed that the prevalence of childhood obesity increased with age: 15.3% of children aged 8 years had obesity in 2018/2019, while 10.8% of 6-year-old children were obese. Girls had a higher prevalence of overweight (including obesity) than boys – in girls 29.5% were overweight and 10.6% were obese. [11]

Another study was conducted in an affluent school of Hyderabad in January 2018 among students of classes 4–10. Among 544 students, 24.6% were obese and 35.8% were overweight. Using the CDC criteria, the prevalence of obesity and overweight was 15.4% and 26.1%, respectively. The mean BMI in the obese group was 25.6 ± 3.5 kg/m^2 and in the overweight group was 21.1 ± 1.9 kg/m^2. The prevalence of obesity and overweight was more in girls (obesity 32.8% versus 17.3% and overweight 44.5% versus 28.1%, respectively). The highest prevalence of childhood obesity was seen in the 8–10 years age group. [12]

Singh PD et al, in June 2020 stated in their study that the overall prevalence of overweight and obesity in the selected government and private schools in Chandigarh found to be 9.9% and 14.0%, respectively. The prevalence of overweight (adult equivalent of 23) was 10.3% in boys and 9.4% in girls and that of obesity (adult equivalent of 27) was found to be 13.3% and 14.7%, respectively, in boys and girls. [13]

RISK FACTORS

It is widely accepted that increase in obesity results from an imbalance between energy intake and output. However, there is increasing evidence indicating that an individual's genetic

background is important in determining obesity risk. Research has made important contributions to the factors associated with childhood obesity.

Genetics: Studies showed that genetics are one of the biggest factors examined as a cause of obesity. Some studies have found that BMI is 25–40% heritable. However, genetic susceptibility often needs to be coupled with contributing environmental and behavioural factors in order to affect weight. The genetic factor accounts for less than 5% of cases of childhood obesity. Therefore, while genetics can play a role in the development of obesity, it is not the cause of the dramatic increase in childhood obesity. [5]

An article analysed that the FTO gene showed that the odds ratio for overweight/obesity was elevated by 40% among children carrying the AA-allele as compared to the TT-allele. Similar positive associations were found for waist circumference, waist-to-height ratio and the sum of skinfold thicknesses. [14]

Dietary factors: Dietary factors such as fast food consumption, sugary beverages, snack foods, portion size etc. have been studied extensively for its possible contributions to the rising rates of childhood obesity.

Increased fast food consumption has been linked with obesity in the recent years. Many families, especially those with two parents working outside the home, opt for these places as they are often favoured by their children and are both convenient and inexpensive. Foods served at fast food restaurants tend to contain a high number of calories with low nutritional values. Though many studies have shown weight gain with regular consumption of fast food, it is difficult to establish a causal relationship between fast food and obesity.

Different studies found that consumption of sugary beverages increases BMI by small amounts over the years. Sugary drinks are another factor that has been examined as a potential contributing factor to childhood obesity. Many studies have examined the link between sugary drink consumption and weight and it has been continually found to be a contributing factor to being overweight. Sugary drinks are less filling than food and can be consumed quicker, which results in a higher caloric intake.

Another factor that has been highlighted as a possible contributing factor of childhood obesity is the consumption of snack foods. Snack foods include foods such as chips, baked goods, and candy. Many studies have been conducted to examine whether these foods have contributed to the increase in childhood obesity. While snacking has been shown to increase overall caloric intake, no studies have been able to find a link between snacking and overweight.

Portion sizes have increased drastically in the past decade. Consuming large portions, in addition to frequent snacking on highly caloric foods, contribute to an excessive caloric intake. This energy imbalance can cause weight gain, and consequently obesity. [5]

The eating habits of the parents are often shared by the children. One recent survey discovered that roughly 32% of fathers and 12% of mothers skipped breakfast on a regular basis. When compared against the child's eating habits, it was found that when either parent skipped breakfast, the child is more likely to skip breakfast as well. This observation was compounded when both parents skipped breakfast, resulting in the child being far more likely to skip breakfast than in either of the other scenarios (odds ratio of 2.38 to 5.33 when compared to children whose parents don't skip breakfast). Once the children's BMIs were

calculated and compared against their breakfast-eating habits, it was determined that children who skip breakfast were at increased risk of having excess weight or obesity (odds ratio of 2.16) compared to those who do not skip breakfast. [15]

Activity level: Television viewing among young children and adolescents has increased dramatically in recent years. Each additional hour of television per day increased the prevalence of obesity by 2%. Research which indicates the number of hours children spend watching TV correlates with their consumption of the most advertised goods, including sweetened cereals, sweets, sweetened beverages, and salty snacks. Regulation of marketing for unhealthy foods is recommended, as is media advocacy to promote healthy eating. [5]

Lissner et al. investigated the association between daily TV time and the presence of a TV/video/DVD in the child's bedroom and overweight /obesity by estimating odds ratios adjusted for sex, age and parental education. Both, having a TV in the child's bedroom and consumption daily TV time of more than 60 minutes showed a positive association with the weight status of children in all countries. [14]

Environmental factors: Approximately 55% of global increases in BMI can be attributed to rising BMI in rural areas, and this may be as high as 80% in low and middle-income countries. Rural areas are associated with 1.36 higher odds of obesity compared to urban areas; however, mediation analysis shows that individual educational attainment, neighbourhood median household income, and neighbourhood-built environment features reduce these odds by 94% and render the relationship statistically insignificant. Rural areas tend to have farther distances between residences and supermarkets, clinical settings, and recreational opportunities, which may be impacting the ability to practice healthy behaviours that prevent obesity.

Historically, evidence has suggested that fast food restaurant density is associated with obesity prevalence. A state-level analysis of fast food restaurant density and the number of residents per restaurant accounted for 6% of the variance in state obesity prevalence. Individual-level factors can interact with built environmental factors (like fast food restaurant density) to increase the odds of obesity. [16]

A study conducted by Anderson PM and Butcher KE showed that 53% of parents drove their children to school. Of these parents, 66% said they drove their children to school since their homes were too far away from the school. Other reasons parents gave for driving their children to school included no safe walking route, fear of child predators and out of convenience for the child. Children who live in unsafe areas or who do not have access to safe, well-lit walking routes have fewer opportunities to be physically active. [5]

Socio-cultural factors: Socio-cultural factors have also been found to influence the development of obesity in children as the children imitates adults. Our society tends to use food as a reward, as a means to control others, and as part of socializing. These uses of food can encourage the development of unhealthy relationships with food, thereby increasing the risk of developing obesity. [5]

People in some communities have limited resources and limited access to supermarkets. As a result, they might buy convenience foods that don't spoil quickly, such as

frozen meals, crackers and cookies. Also, people who live in lower income neighbourhoods might not have access to a safe place to exercise. [17]

Family factors: Family habits, whether they are sedentary or physically active, influence the child. Studies have shown that having an overweight mother and living in a single parent household are associated with overweight and childhood obesity. The types of food available in the house and the food preferences of family members can influence the foods that children eat. In addition, family mealtimes can influence the type of food consumed and the amount thereof. [5]

Ahrens W. And Pigeot I. observed a clear gradient of an increasing prevalence of overweight/obese children ranging from a prevalence of 17.1% among those sitting always with their family to a prevalence of 36.2% among those who reported to never/rarely sit together with their family during meals. [14]

Certain medications: Some drugs can increase the risk of developing obesity. They include prednisone, lithium, amitriptyline, paroxetine (Paxil), gabapentin (Neurontin, Gralise, Horizant) and propranolol (Inderal, Hemangeol). [17]

Solmi F. and Morris S. investigated the association between overweight and obesity, and medication use in children aged 5–11 years. They found that, overall, 12.2% of children used prescribed medications regularly, although children who were obese had a higher probability of using at least one regular medication and a higher number of medications compared with children of normal BMI. They also found that overweight and obese children were more likely to use medications for respiratory, endocrine and central nervous system diseases, which are potentially related to obesity. [18]

PREVENTION

The most important strategies for preventing obesity are healthy eating behaviours, regular physical activity, and reduced sedentary activity (such as watching television and videotapes, and playing computer games). [19]

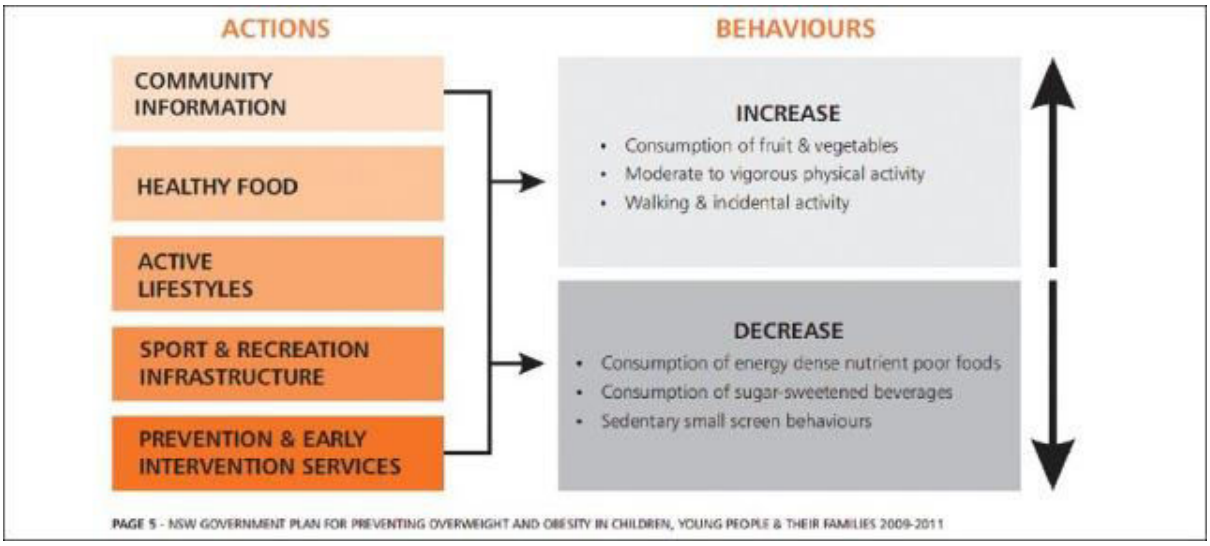

Figure 1: New South Wales (NSW) Government plan for preventing overweight and obesity in children, young people and their families 2009–2011

Figure 1 shows the action points and desired behaviours at the community level to prevent emergence of overweight and obesity. *"*Good for Kids, Good for Life Program*"* is a large scale 5-year obesity prevention trial being run in the Hunter New England Area Health Service. The program seeks to prevent overweight and obesity in children in the region and to build evidence for policy and practice related to the prevention of childhood overweight and obesity in NSW. The Good for Kids, Good for Life Program interventions focus on the six key areas of schools, childcare services, community organizations, health, media, and aboriginal communities. NSW health department plans to extend social marketing activities focusing on the five key consumer messages; be active 1 hour each day; drink water; turn off the TV; eat more fruit and vegetables; and eat fewer snacks. This will provide contextual information about obesity causes and prevention strategies, and be targeted to key segments of the population.

In India, we are still struggling with the burden of malnutrition but the issue of over-nutrition cannot be ignored. India should also formulate a national policy and partner with the private sector to end the childhood obesity epidemic. Effective policies and tools to guide healthy eating and active living are within our grasp. Some of the specific recommendations are as follows.

Surveillance:

- Periodic monitoring of nutritional and obesity status of children including adults.
- To create a database for childhood obesity at various regions to start with and then may be at state level.
- Initiate community-based research to document burden of obesity and associated risk factor and monitor these trends over time.
- Maintain a nationwide database on secular trends in obesity and associated co-morbidities.

Health education:

- For all children and their families, routine health care should include obesity-focused education.
- Nutrition and physical advice through audio-visual media and culturally conducive methods.
- Endorsement of healthy lifestyle by prominent people and local champions.
- For children who are overweight or obese, a series of clinical counseling interventions in the primary care setting is suggested.
- Educational materials are available from a variety of sources to facilitate the counseling. These materials have much in common and have not been directly compared; it is reasonable for providers to select materials with messaging that is best suited to their community.

Community mobilization:

- Organization and participation in health walks and healthy food festivals.
- Information about nutrition to parents (particularly mothers).
- Children-specific nutrition information and workshops for newly married women.
- Safe walk/bicycle routes to school.
- To establish a therapeutic relationship and enhance effectiveness, the communication and interventions should be supportive rather than blaming, and family-centered, rather than focused on the child alone.
- Long-term changes in behaviours that are related to obesity risk should be emphasized, rather than diets and exercise prescriptions, which tend to set short-term goals.

Early infancy and perinatal period:

- Balanced nutrition to pregnant mothers.
- Encourage exclusive breastfeeding.
- Avoidance of catch-up obesity in children.
- Maintenance of correct growth velocity under guidance of physicians.
- Avoid excess nutrition to stunted children.

School-based interventions:

- High importance on physical activity.
- Making healthier choice available and banning un-healthy food in cafeteria, (sweetened beverages and energy-dense junk food). Teachers can play a vital role in this initiative.
- Training of teachers regarding nutrition education.
- Incorporation of more knowledge about nutrition and physical activity and nutrition related diseases in school curriculum.

Home-based interventions:

- Key goals to address are the common diet-related problems encountered in children, set firm limits on television and other media early in the child's life, and establish habits of frequent physical activity.
- TV/computer time to be restricted to maximum 2 hours/day.
- Mandatory 60 minutes of physical activity daily to be supervised by parents.
- Restriction on eating out at weekends and restricting availability of junk foods at home.

Policy formulation:

- Creation of national task force for obesity.
- Decrease in taxes and prices of fruits and vegetables.
- Proper Food labelling practices and quality monitoring.
- More playgrounds, parks and walking and bicycle tracks.
- Restriction on advertisement of commercial foods on television at prime time and during children's programs and ban on unfair nutrition claims for commercial products.
- Encourage trans-national food companies to manufacture healthy snacks.
- Prohibition of promotional gifts with junk foods.
- Ban on monetary sponsorship of youth festivals by cola companies. [20]

CONCLUSION

In the recent days Childhood obesity became a major public health crisis nationally as well as internationally. The prevalence of childhood obesity has increased over few years. This global problem can be slowed, if the society focuses on the risk factors. Moreover, if parents enforce a healthier lifestyle at home, many obesity problems could be avoided. In many countries there are effective interventions and government policies for prevention and control of childhood obesity which the developing countries like India can adopt. However, further research needs to examine the most effective strategies of intervention, prevention, and treatment of obesity. These strategies should be culture specific, ethnical, and consider the socio-economical aspects of the targeting population.

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